S. HRG. 107–315

CLEAN AIR ACT OVERSIGHT ISSUES

HEARINGS

BEFORE THE

SUBCOMMITTEE ON CLEAN AIR, WETLANDS, PRIVATE PROPERTY, AND NUCLEAR SAFETY

AND THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED SEVENTH CONGRESS

FIRST SESSION

MARCH 21, 2001
APRIL 5, 2001
APRIL 27, 2001—SALEM, NH
MAY 2, 2001
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[1]NOTE: During the first session of the 107th Congress, the committee roster appeared in the *Congressional Record* on January 25, 2001. The subcommittee memberships were determined at an organizational meeting held on February 28, 2001.

On June 6, 2001, the majority of the Senate changed from Republican to Democrat when Senator James M. Jeffords, of Vermont, changed party affiliation from Republican to Independent. Senator Harry Reid, of Nevada, assumed the chairmanship of the committee. On July 10, 2001, Senator Jeffords was appointed as chairman of the committee by the Democratic Leader. At a business meeting held on July 25, 2001, two subcommittees were renamed and new subcommittee assignments were made.

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CLEAN AIR ACT OVERSIGHT ISSUES

WEDNESDAY, MARCH 21, 2001

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON CLEAN AIR, WETLANDS, PRIVATE PROPERTY, AND NUCLEAR SAFETY,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:10 a.m. in room 406, Senate Dirksen Building, Hon. George V. Voinovich (chairman of the subcommittee) presiding.

ENVIRONMENTAL REGULATIONS AND THE NATION'S ENERGY POLICY

Present: Senators Voinovich, Lieberman, Clinton, Corzine, Inhofe, Crapo, Carper, and Smith [ex officio].

Senator VOINOVICH. Good morning. The hearing will come to order. I have a statement I want to put in the record.

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Today's hearing is on the interaction between our environmental regulations and our nation's energy policy. This is our first subcommittee hearing this year, and I'd like to welcome our ranking member, Senator Joe Lieberman. I look forward to working with him in Congress and in this committee.

Few would disagree that we are in the midst of an energy crisis in this nation, one that is having a tremendous influence over the state of our economy and affecting the quality of life of the American people. The impact of this energy crisis is, and will continue to be, of such a magnitude that I believe what this committee does this year could have more sway over what happens to our economy and the citizens of the United States than at any other time in recent memory.

All we need do is look at what is happening in the State of California and it is apparent how urgently we need to enact a national energy policy. Brownouts, rolling blackouts, lost business—all have brought chaos to this nation's largest State and largest economy. Not only is California's energy crisis impacting California; it reaches nationwide and across the globe.

Since the beginning of the 107th Congress, I have been holding a series of public meetings across the State of Ohio where I have asked individuals and business owners to relay their experiences as to how our energy crisis is impacting them.

Last month in Cleveland I held a meeting with Catholic Charities, Lutheran Housing, and the Salvation Army, as well as senior citizens, low-income parents, and handicapped individuals. The Catholic Diocese said the number of helpline calls in 2000 was up 96 percent from 1999 and 194 percent from 1998 to 2000.

The Salvation Army, first 7 weeks this year, 559 families seeking assistance with energy costs; last year, 330.

For the least of our brothers and sisters, the choice comes down to paying for heat or paying for food, and because of this many are having to rely on hunger centers for their meals.

A few weeks ago I met with business leaders in Cincinnati. They weren't big businesses. They were small ones. Each of them relayed how energy costs were impacting their particular business.

Mr. Joe Maas, who owns JTM Provisions Company, a food service company, indicated that JTM will pay $200,000 more this year than last year for gas and electric, a 100 percent increase for the business.

H.J. Benken Florists, owned by Mr. Michael Benken, is a family owned business. He reports that energy costs for many California-based companies that provide flowers to Mr. Benken's shop have increased as high as 600 percent. As a matter of fact, he said that most roses are now grown in Ecuador or other Latin American countries where energy prices are lower.

We read the Wall Street Journal and New York Times, business section and I would suspect that some of the predictions that the profits aren't reaching what they suspected them to have a lot to do with their energy costs.

Many Americans live paycheck to paycheck, and when they have to allocate more of their paycheck for energy costs and make a choice to meet the mortgage payments, pay their bills, or cut back on other spending, usually they cut back on spending, and since consumer spending makes up 68 percent of our gross domestic product, America's competitiveness is negatively impacted.

This hearing is the first in a series of hearings examining our energy and environmental policies. To that end, I am working closely with Senator Murkowski on his National Energy Security Act. In fact, I am the fourth original cosponsor of this legislation.

It is my intention to examine the various environmental issues surrounding our energy policy in our subcommittee in order to prepare for action by the Senate on the Murkowski energy bill.

If you were to listen to the media, you'd think that the only thing in the bill is oil drilling in ANWR. It is much more than that. The bill is a comprehensive package of proposals and it includes general provisions to protect energy supply and security; it encourages clean coal technology, allowing us to use our 250-year supply; it supports domestic oil and gas exploration; it promotes energy conservation and efficiency; it encourages alternative fuels and renewable energy supplies for homes, businesses, and cars; and it provides continued assistance under the Low Income Energy Assistance Program, or LIHEAP program.

Today's hearing will begin with a broad perspective on the energy end environmental issues, followed by a closer look at utility-related issues. Our next hearing will look more specifically at oil and gas issues. We will then have a hearing on global climate

change—which I think is going to be very interesting and hopefully we can get the best and the brightest to come in and talk about that—and nuclear issues and the Smith multi-emissions strategy.

This year the subcommittee will also conduct general oversight hearings on the Clean Air Act, budget oversight, indoor air, and other issues. I promise it will be a very, very busy year.

As I mentioned, I think these hearings will have a dramatic impact on our economy. I don't know what the economic situation is in the rest of our States and in our nation, but I've got to tell you in Ohio that we're in recession. We are. How deep that recession will be will largely be determined on what we do to harmonize our energy and environmental needs.

I went through—and I think I shared this with Senator Lieberman—I went through, as mayor of Cleveland, the recession of 1981 and 1982. I don't want to go through that again. We've got to take some action here to turn people's attitude around.

The energy crisis has several causes, all of which are important: a lack of national energy policy for almost 30 years—and I want to say this, this is not a Republican or Democratic issue, as far as I am concerned. My party is as guilty as the other party in terms of putting energy policy together.

Faulty deregulation law—where deregulation has worked in other States, it has failed in California. It's working in Ohio. This has placed a drag on California's economy, as well as the rest of America, and they still haven't dealt with resolving their energy problems.

It is an interesting thing to me, as a government official, that so often when a problem arises that what we do is we point to somebody else, instead of stepping forward and saying, "mea culpa." Some of it is because of me, and there are things that I need to do to help the situation.

Third, environmental policies which have contributed to a lack of fuel diversity and difficulties in siting new generation facilities, pipelines, and transmission lines. These policies have gotten much worse over the last 8 years, particularly in terms of fossil fuel.

Fourth, we are too reliant on foreign sources of oil. In January the OPEC nations cut back on production by 1.5 billion barrels. That was January 17. Just this past weekend OPEC announced they are decreasing production by another one billion barrels per day. The Saudis have said, "Don't worry about it. We'll keep it around $28. Well, I'm not putting that in the bank.

I think that we are going to be held hostage to the Middle East, and I think that's another issue that we ought to look at. The Middle East is—I spent time in Egypt and I spent 3 days in Israel, and the situation there to me is more critical and I'd submit—and I have been going to Israel and visiting that part of the world for 20 years. We have some real difficult problems over there, and that may well have an impact on us.

In 1973 we had 35 percent reliance. Today it is 56 percent. It is projected by 2020 to be 65 percent.

The other thing is the inappropriate demonizing of nuclear power. The U.S. industry uses this safely and other countries use it safely. It's clean, and we need to deal with the waste issue and move on with building new reactors.

On fuel diversity, current environmental laws have created greater dependence on natural gas. Of currently planned new electric generation, 90 percent is natural gas fired. Thirty-one peaking plants are planned in Ohio. We just built 13 new 1,000-megawatt peaking plants, all fueled by natural gas.

The problem is natural gas production is down. It has dropped 3.7 percent from the fourth quarter of 1999, and the price of it has gone right through the roof.

We need to determine the necessary changes in environmental laws for increased energy production from clean coal technologies, increased nuclear generation, new refining capacity.

Refining capacity—we could get oil tomorrow. We don't have the refineries. We haven't built a new refinery in this country in 25 years. We had 231 in 1983. We have 155 in 2000.

I think Secretary of Energy Spencer Abraham gave an excellent speech on Monday to the U.S. Chamber of Commerce laying out our current energy situation. I don't know whether my colleagues read that or not, but it is, I think, one of the most comprehensive reviews of where we are in terms of our energy policy, and I'm going to include that in the record and again urge people to read that.

As we begin today's hearing, I'd like to pose three questions for the panelists to consider:

- To what extent has the Clean Air Act affected fuel choice and reduced fuel diversification?
- To what extent has the Clean Air Act made it more difficult to site and operate energy facilities such as power plants, refineries, E&P facilities, transmission lines, and pipelines?
- What is the appropriate method for harmonizing our nation's environmental laws with our energy needs? How can policymakers better reconcile the sometimes conflicting policy objectives?

I'd be curious to hear the answers put forth by today's panelists, and I thank the witnesses for coming here to appear before us. I really appreciate Senator Lieberman being here and Senator Corzine. I will ask now Senator Lieberman for his opening statement.

[The prepared statement of Senator Voinovich follows:]

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Today's hearing is on the interaction of our environmental regulations and the nation's energy policy. This is the first subcommittee hearing of the year and I would like to welcome our ranking member Senator Joe Lieberman. Senator Lieberman and I have worked well together in the past couple of years on a wide variety of issues here in the Environment and Public Works Committee and also in the Governmental Affairs Committee. I look forward to another 2 years of productivity working with him in this Congress.

Few would disagree that we are in the midst of an energy crisis in this nation, one that is having a tremendous influence over the state of our economy and affecting the quality of life of the American people. The impact of this energy crisis is, and will continue to be, of such a magnitude that I believe what this committee does this year could have more sway over what happens to our economy and the citizens of the United States than at any other time in recent memory.

All we need do is look at what is happening in the State of California and it is apparent how urgently we need to enact a national energy policy. Brownouts, rolling blackouts, lost business—all have brought chaos to this nation's largest State and

largest economy. Not only is California's energy crisis impacting California, it reaches nationwide and across the globe.

California's problem—as large as it is—is just one of the many energy problems faced by communities, cities and States across the nation.

Since the beginning of the 107th Congress, I've been holding a series of public meetings across the State of Ohio where I have asked individuals and business owners to relay their experiences as to how our energy crisis is impacting them.

Last month in Cleveland, I held a meeting with Catholic Charities, Lutheran Housing and the Salvation Army as well as senior citizens, low income parents and handicapped individuals. I heard many heart-rending stories about the struggles that they were going through just to be able to afford their monthly energy bills.

I was told that because of soaring energy costs, the dependency on charitable organizations has risen dramatically.

The Catholic Diocese said that in the year 2000, their helpline received 3,400 calls for basic needs; items such as food, utilities, mortgage or rent. The number of calls the Diocese received went up 96 percent from 1999 to 2000, and 194 percent from 1998 to 2000.

In the first 7 weeks of 2001, the Salvation Army in Cleveland had 559 families seeking assistance with energy costs. In comparison, for all of 2000, the Salvation Army helped 330 families.

For the least of our brothers and sisters, the choice sometimes comes down to paying for heat or paying for food, and because of this, many are having to rely on hunger centers for their meals. As more people come into these programs, the more it is taking a toll on the various philanthropic organizations to keep up with the demand.

A few weeks ago, I met with business leaders in Cincinnati, each of whom relayed how energy costs were impacting their particular businesses.

For instance, Mr. Joe Maas, who owns JTM Provisions Company, a company which produces products for the food service industry, indicated that JTM will pay $200,000 more this year than last for gas and electric—a 100 percent increase. High energy prices have also increased the prices of JTM's raw ingredients, such as tomato paste, which Mr. Maas buys from California producers. The price of this ingredient alone has increased $2,000 per load due to higher shipping and processing costs.

Another example is H.J. Benken Florists owned by Mr. Michael Benken. This family owned business reports that energy costs for many California-based companies that provide flowers to Mr. Benken's shop have increased as high as 600 percent. Energy prices have increased so dramatically in California that most roses are now grown in Ecuador or other Latin American countries where energy prices are lower. Mr. Benken also stressed that his products—flowers—are luxury items, so consumers will simply forgo buying them if their prices skyrocket, as they have.

In December, Mr. Benken's heating bill was $15,000, just $200 more than the previous December. However, that was to heat less than a third of the space: Mr. Benken typically heats 20,000 square feet of greenhouse space. This year, he is heating just 6,000 square feet.

The "horror stories" that I had heard from business owners in Ohio were confirmed on a national scale when I addressed the Board of Directors meeting of the National Association of Manufacturers last month. Manufacturers from all over America complained bitterly over the high price of energy they were experiencing.

Many expressed how they couldn't immediately pass these incredible increases in energy costs because they knew their customers couldn't afford it. This has led them to cut costs elsewhere by deferring maintenance, freezing their hiring and even considering lay-offs.

Federal Reserve Chairman, Alan Greenspan, has indicated that businesses don't have the same capital to invest, since more of it is being used to pay energy bills.

Indeed, at my meeting in Cleveland, a businessman by the name of Jim Krimmel told me that the price he paid for gas had increased from $87,000 in January of 2000 to just over $197,000 in January 2001; even though this year, he was using less gas. By his calculations, Mr. Krimmel indicated that he will pay $1.5 million for gas in 2001—an $867,000 increase over the price he paid just 2 years ago.

I believe the high cost of energy is a major contributing factor to our current economic downturn, affecting both businesses and individual consumers. Many Americans live paycheck to paycheck, and when they have to allocate more of their paycheck for energy costs, they make a choice to either meet their mortgage payments, pay their bills or cut back on other spending. Usually, they cut back on spending, and since consumer spending makes up 68 percent of our Gross Domestic Product, America's competitiveness is negatively impacted.

Another aspect of our energy crisis that we must address is the uncertainty over a large portion of our crude oil supply.

The United States is more dependent on foreign oil today than at any other time in our history. I trust that my colleagues remember the Arab Oil Embargo of 1973, when costs went up, gas shortages were everywhere and people sat in long lines to get gas. At that time, the U.S. relied on 35 percent foreign oil to meet our domestic needs. In the year 2000, our reliance on foreign oil averaged some 56 percent. By the year 2020, it is projected to hit 65 percent at our current rate of consumption.

Our dependence on foreign oil is both a national security issue and an economic issue, and a major reason why a lack of an energy policy should be of great concern to all Americans.

In addition, we should be extremely concerned about how our environmental policies have impacted our ability to meet our energy needs here in America. That is the purpose of today's hearing.

This hearing is the first in a series of hearings examining our energy and environmental policies. My goal as subcommittee chairman is to harmonize our Federal clean air regulations with our nation's energy needs. I want a clean environment and cost-effective reliable sources of energy that will allow continued economic growth. To that end, I am working closely with Senator Murkowski on his National Energy Security Act, S. 388. In fact I am the fourth original cosponsor of his legislation, right behind the Majority Leader.

If you were to listen to the media, you'd think that Senator Murkowski's bill was just about oil drilling in ANWR. It's much more than that. This bill is a comprehensive package of proposals:

- It includes general provisions to protect energy supply and security;
- It encourages clean coal technology—(allowing us to use our 250-year supply);
- It supports domestic oil and gas exploration; it promotes energy conservation and efficiency;
- It encourages alternative fuels and renewable energy supplies for homes, businesses and cars;
- It provides continued assistance under the Low Income Home Energy Assistance Program (LIHEAP).

It is my intention to examine the various environmental issues surrounding our energy policy in the Clean Air Subcommittee in order to prepare for action by the Senate on the Murkowski Energy Bill.

Today's hearing will begin with a broad perspective on America's energy and environmental issues followed by a closer look at utility related issues. Our next hearing will look more specifically at oil and-gas issues. We will then have hearings on Global Climate Change, Nuclear Issues, and Chairman Smith's Multi-Emissions Strategy.

This year, the subcommittee will also conduct general oversight hearings on the Clean Air Act, Budget Oversight on the Office of Air and Radiation of the EPA and Wetlands Of lice of the Army Corps of Engineers, Indoor Air and a number of other issues. Needless to say, it will be a very busy year.

However, in today's hearing we are addressing the impact between our environmental and energy policies. As I indicated, I believe we are not only entering into a recession, but also an energy crisis; and our energy crisis will largely determine how deep of a recession, and how long it will last.

In my opinion, this energy crisis has several causes, all of which are important:

1) A lack of a national energy policy for almost 30 years.

2) A faulty deregulation law in California. Where deregulation has worked in other States, it has failed in California. As I said earlier, this has placed a drag on California's economy as well as the rest of America's—and they still have not dealt with their problem. California needs to take responsibility for its failed law because deregulation is working in other States.

3) Environmental policies which have contributed to a lack of fuel diversity and difficulties in siting new generation facilities, pipelines, and transmission lines. These policies have gotten much worse over the last 8 years, particularly with the previous Administration's "War On Fossil Fuel."

4) We are too reliant on foreign sources of oil. Just this past weekend, OPEC announced they are decreasing production by 1 million barrels per day—on top of the 1.5 million barrel per day reduction we faced in January. If we do nothing to shake our dependence on foreign oil, we are going to be held hostage to unstable and/or unfriendly regimes in the Middle East for years to come. It should not sit well with the members of this subcommittee that while our troops are bombing Saddam Hussein, he is selling us oil.

5) The inappropriate demonizing of nuclear power. The U.S. energy industry uses it safely and other countries use it safely as well. The two things we must do is address the waste issue and what to do with it and move forward with building new reactors. We have been discussing what to do with the nuclear repository in Yucca Mountain for some 15 years. It's time to make a final decision on whether or not Yucca Mountain is a viable site for nuclear waste. Either it is the right place to store our nuclear waste, or we should move on.

With respect to fuel diversity, our current environmental laws have helped create greater dependence on cleaner-burning natural gas. Ninety percent of currently planned new electric generation is from plants that will be natural gas-fired. Right now, there are 31 "peaking" plants planned in Ohio—plants which operate at peak times—and all of which would be natural gas-fired. The major problem with our growing reliance on natural gas is the fact that natural gas production is down. It has dropped 3.7 percent from the fourth quarter of 1999 and has driven the price of natural gas through the roof.

We need to determine the necessary changes in environmental laws for increased energy production. We need to look at the options that tend to get ignored because they are not "politically correct:" from clean coal technologies, to increased nuclear generation to new refining capacity. If we are unable or unwilling to do so, I believe that for the foreseeable future, we will only see more of the same of what is occurring in California right now, but on a nationwide scale.

As we begin today's hearing I would like to pose three questions for the panelists to consider:

Question 1. To what extent has the Clean Air Act affected fuel choice and reduced fuel diversification?

Question 2. To what extent has the Clean Air Act made it more difficult to site and operate energy facilities such as power plants, refineries, and E&P facilities, transmission lines, and pipelines?

Question 3. What is the appropriate method for harmonizing our nation's environmental laws with our energy needs? How can policymakers better reconcile the sometimes conflicting policy objectives?

I will indeed be curious to hear the answers put forth by today's panelists.

I thank the witnesses for appearing this morning, and I look forward to your testimony.

Senator LIEBERMAN. Mr. Chairma, thank you. I'm going to yield to Senator Inhofe, who I know has another committee he has to go to.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Thank you, Senator Lieberman.

All I want to do is insert a statement for the record, and I'd like to repeat what the chairman said. This is not a Republican/Democrat type of thing. We tried to get Ronald Reagan to adopt a comprehensive national energy policy. He didn't do it. I thought sure Bush would when he came in. He didn't do it. The Clinton Administration didn't do it. So it is overdue and certainly the regulations, the cost of regulations is a very significant part of our cost of energy.

Just the other day they released a report that if you regulate the CO_2 emissions from utilities, the cost would be somewhere between 60 and $115 billion a year—again costs go up.

I would ask unanimous consent that my statement be put in the record, and I thank Senator Lieberman for allowing me to do that.

Senator VOINOVICH. Without objection.

[The prepared statement of Senator Inhofe follows:]

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

In the last week, there has been an enormous amount of negative press about President Bush's decision to not support mandatory carbon reductions from utilities.

However, with a looming recession and rising energy prices, President Bush did the right thing.

When the price of gasoline went through the roof last summer, we all witnessed the Clinton Administration's incredibly irresponsible accusations that big oil companies were "colluding." Price spikes occurred last summer because of the large number of the Clinton Administration's poorly implemented environmental regulations and our dependence on foreign oil supplies.

The solution to the high prices is not found in cheap political gimmicks like releasing oil from the Strategic Petroleum Reserve. Rather, the solution relies on developing a strategic national energy policy and having highly effective and streamlined environmental regulations.

Currently, 56.6 percent of the U.S. oil needs are met by foreign sources. This presents a real energy and national security problem.

The military is equally dependent on foreign oil as the general public is. We must seek to encourage as great a domestically produced, diverse energy supply as possible—including nuclear, coal, oil, gas, and renewables.

When well thought out and reflecting consensus, environmental regulations can certainly provide benefits to the American people. But when regulations are rushed into effect without adequate thought, they are likely to do more harm than good.

Congress should not let the extreme environmental group's tyranny force the American people to pay sky high prices for fuel.

Over the years, I have witnessed the environmental movement fight any and all attempts to reform and streamline environmental regulations. We are dealing with this energy crisis largely because the environmental extremists dictated our nation's energy policy for the last 8 years. A consequence that they do not want to tell the American people is a byproduct of their efforts.

If you do not do it the environmentalists way, then we see all of the commercials detailing horror stories. Well, the energy crisis it a real life horror story. A horror story, which will only get worse. If we, as a nation, do not do something about it, it will affect every aspect of everyone's life. I want all of the American people to take notice!

Let's not forget. When the price of energy rises that means the less fortunate in our society must make a decision between keeping the heat and lights on or paying for other essential needs. I am hearing from school after school that heating bills are depleting the funds that usually go to supplies and books. Though we are seeing with the rolling blackouts in California right now that it does not matter how much money you have—because the energy just doesn't exist. There is a real human cost to the extreme environmental movement.

Last December, the Department of Energy's Energy Information Administration released a study on regulating CO_2 emissions from utilities. The study concluded that the mandatory regulation of CO_2 from utilities will cost $60–115 billion per year by 2005. The mandatory regulation of CO_2 would make the price and availability of energy a national crisis—at a scale that our nation has never before experienced. Environmental regulations are a large contributor to the energy crisis in California. Before we add to the current regulatory web, our nation should look at how we can implement our current environmental regulations—more effectively and efficiently.

As a Senator and grandfather, I want to ensure the cleanest environment for our nation. I am convinced that environmental regulations can be harmonized with energy policy. Our current situation demands it.

Unlike his predecessor, President Bush cannot continue to place layer after layer of regulations without any consideration of their energy implications. The environmental community does not have to answer to the American people when energy prices go through the roof or to worry about the national security implications of greater dependence on foreign energy sources. However, the President does.

Senator VOINOVICH. I'd like to thank you for being here, and, Senator Crapo, thank you for being here.

Senator INHOFE. One last thing. I always thought when Republicans took over we'd run things better in the Senate, and yet we have two significant committees taking place at the same time now, so I guess that didn't happen.

Senator LIEBERMAN. We're going to do better when we take over. [Laughter.]

Senator VOINOVICH. On that note, we'll hear from Senator Lieberman.

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. Thanks. Thanks, Mr. Chairman. Thanks very much for convening this hearing today and this series of hearings that you and I have agreed that we would do in this Subcommittee on Clean Air and particularly the interaction of our energy needs and our environmental goals.

These are complicated but urgent questions, and I think they can benefit from just the kind of open, balanced discussion that I hope we will have this morning, so I look forward to being part of this with you.

This is one of those areas where, you know, everybody in one sense is right, or, put another way, there are arguments on both sides, and the truth is that we have to find a way to both meet our energy needs and protect our environment, and we have to do it in a way that doesn't just respond to short-term pressures and problems but has long-term goals and values for our country involved.

It is not going to be easy, but I think we can do it, and we can do it if we share information in a mutually respectful and open-minded way, and particularly if we take advantage of the single-most significant new factor in our world today, which is technology, and the extraordinary new opportunities that technology gives us.

So we have an energy system now that is substantially dependent on a source of energy, fossil fuels, which we do not control, and it creates exactly the dependence that Senator Voinovich has talked about and undercuts our own security and our own national strength, no matter how strong we are in every other way—economically and militarily.

So I think, as we go forward, we have to acknowledge—and it is painful, because it represents change and dislocation—that, one, we should try to develop and use as much of our energy resources, natural energy resources, as we have within our country—fossil fuel sources—in an environmentally protective way, but that ultimately we have to look beyond fossil fuel. While we're looking beyond, we have to make much better use of efficiency, energy efficiency, and conservation, but the next chapter of our history will involve new sources of energy.

A while back—actually, it was at the time of the Kyoto meetings on climate change. I spent a few days after the meetings in Tokyo, and I had dinner one night with an executive of Toyota Motors, and we were talking future, and he said—because, obviously, the Japanese have their own problems about how much energy they control within their resources, which is not much, so they look for outside sources or new technologies. He said Toyota has made a judgment that vehicles will be powered in the future by fuel cells. He said, "That's my prediction to you."

Now, it may happen in 10 years, it may happen in 30 years. I think at the time he said it probably would happen in 20 years. But it is going to happen, and it is going to happen because the logic of it, the efficiency of it, the cleanliness of it, if you will, the economy of it is so overpowering that it's just going to be, and the question is who is going to do it first. In fact, the Japanese are in-

vesting extraordinary amount of money from within their government and their companies in fuel cell technology.

We're beginning to do that ourselves, although I think one result of hearings such as this might be to create a much bolder, more aggressive—I hesitate to use the metaphor. It is used probably too often, but it is not a bad one—a moon shot program focus for developing the energy sources through new technology of the next generation to make sure, for our own energy interests but also for our own economic interests, that we are at least a significant factor in the global marketplace for these new technologies, if not the dominant factor.

So the answer to the question is that somehow we've got to do what our constituents want us to do and our national interest suggests that we do and our national values compels us to do, which is to both meet our energy needs, to have a reliable, cost-efficient source of energy to power our economy, but also to protect our environment.

I mean, we have been dealing with this lately in this very interesting, complicated discussion, debate that we are having over the so-called effort to regulate the four pollutants from power plants. I mean, and this focuses it. Power plants produce power. They produce energy. We need energy. We need that power. Yet they are obviously also one of the major sources of air pollution in our country.

Let me just give you a few statistics. Power plants generate 24 percent of industrial nitrogen oxide emissions, 66 percent of industrial sulfur dioxide, 32 percent of mercury, and 40 percent of carbon dioxide emissions.

Remarkably, almost 80 percent of those emissions come from coal-fired power plants that were installed prior to 1977. Those pollutants contribute to serious environmental and public health problems such as smog, acid rain, climate change, and cause effects such as respiratory problems, contamination of fish and other wildlife, and even, according to some scientists, developmental abnormalities in our children.

So we have a shared interest in doing something about those, and the question is how to do it.

I was privileged last week to join with several colleagues, a bipartisan group of colleagues, including Senator Clinton, I'm proud to say, to introduce the Clean Power Act, which is a proposal that tries to build on the market-based ideas that were part of the Clean Air Act originally, the so-called "cap in trading system" to fix limits on emissions of these four pollutants.

I know they are controversial, particularly the carbon dioxide provision, which, as we know, the President supported and changed his mind on. We're going to argue about that, because I think that's a critical element in the problem of climate change that the public should and really wants us to do something about.

To me here is a real, live issue that brings together our need to have a reliable source of energy with our desire to protect the environment and our public health.

I just offer this anecdote as an example of how complicated these issues are. I sat last week with an executive of a utility company, a major utility company. This one happens to be supporting this

four-pollutant bill. While there is a tendency to say, "This four-pollutant bill is against the coal industry," this gentleman said to me that he expects that his utility and the ones that he is associated with will want to build coal-fired plants in the future, but they're not going to build them unless they have the regulatory certainty that he believes our four-pollutant bill will produce.

So I just present this—the irony that the bill is seen in some ways as anti-coal, over-regulatory by its critics, and here is a man in the utility industry saying he'd like to build some more coal-fired plants because he thinks he can do it in an environmentally protective way and still have a cost advantage, but he's not going to do it unless he knows what the regulatory environment is long term because that will help him plan and make an investment with some sense of confidence about what the future will hold.

These are critically important, as I say, complicated matters. They are not inherently partisan. They ought not to be partisan. I hope, Mr. Chairman, that, perhaps through the light that we will shed on them in this hearing and others that we will hold, we can find common ground to go forward and present not just for ourselves, but particularly for our children and grandchildren, a strong, reliable source of energy and a cleaner and healthier planet.

I thank you very much, Mr. Chairman. I look forward to these hearings. We've got two great witnesses here—Ms. McGinty and Ms. Stuntz—and others to follow, and I look forward to their testimony.

Senator VOINOVICH. Thank you, Senator Lieberman.

The subcommittee has been operating by the early bird rule, and Senator Corzine was next in line, and Senator Crapo was here, and, Senator Clinton, you are on.

OPENING STATEMENT OF HON. HILLARY RODHAM CLINTON, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator CLINTON. I'm the only bird left. Thank you so much, Mr. Chairman. I really want to commend both the chairman and Senator Lieberman for holding this hearing today and trying to get to the difficult questions that both the chairman and Senator Lieberman just referred to with respect to the interaction of environmental and energy policy. I'm delighted to have our witnesses here and I look forward to hearing from both of you, and I am particularly glad to see Ms. McGinty back from India and other far-flung adventures.

This hearing is exceptionally timely, perhaps more than anyone would have realized, given the events of the last week. Before I continue to speak about the substance of the hearing, itself, I'd like to just take a minute to express my extreme disappointment with another action taken by the new Administration yesterday.

You know, we've all heard about the President's charm offensive, but when it come to the environment and public health it sometimes appears as though his Administration is on a harm offensive. Yesterday it was arsenic and about face. We've seen the intention of this Administration to roll back an important new drinking water standard for arsenic, a known human carcinogen. The standard would have followed the recommendations of the National

Academy of Sciences. It would have brought us in line with standards elsewhere in the world. I think it is regrettable that we would turn our backs on an effort to update a standard which has not been revised in almost 60 years.

Rather than rolling back health standards, we should be rolling up our sleeves and investing in our nation's water infrastructure so that drinking water can be as clean and safe as possible.

I know that meeting our nation's water infrastructure needs is something we will be looking at in the committee, and I hope it will be an issue that we can address legislatively in this Congress, because when it comes to the environment and health, whether it is the air we breathe or the water we drink, there really shouldn't be any bigger or more important priority to us as representatives of people, and I feel the same way when it comes to the issue we are here today to discuss.

The answer to meeting our nation's energy challenges should not be to lower the bar with respect to air quality, but to look for ways that together we can make it cost effective and efficient for us to meet the appropriate standards.

The Federal Government should be working to help industry meet the bar by investing in research and development; by providing incentives for more energy-efficient appliances, homes, offices; providing incidents for the production and use of renewable energy sources and other clean sources of energy; and taking the additional steps necessary to ensure reliable and affordable power, whether it is by establishing regional transmission organizations or other measures.

Yesterday I met with a number of New York's winners of the EPA Energy Star Award, and I was so impressed with their individual stories. The energy conservation and efficiency achievements and actual monetary savings realized by these winners are on-the-ground proof that these kinds of efforts and investments actually do work and are one of the ways we can really bridge the dilemma that both the chairman and Senator Lieberman addressed.

For example, in Kingston, New York, in the school district there, a community located in the Hudson Valley, because of Federal and State incentives and assistance, the school district replaced windows, installed new boilers, made other energy-efficient upgrades, and ended up saving more than $395,000 last year—money that can be reinvested in education programs.

Verizon Company also in New York has made a commitment to buy energy-efficient products, communicate with employees, use more fuel cells, because they recognize, as you said, Senator Lieberman, that this is something that will save money and it is a technology that should be in wider use.

There are stories like that all over America, and yet I'm told that in the President's budget programs like this in both EPA and the Department of Energy will be either eliminated or severely cut back, which I think is exactly the wrong direction for us to be going in.

We ought to be taking a look at effective cost-saving programs that will help us deal with our energy needs in an environmentally sustainable way and investing in such programs, and that goes along with our major concern of this hearing of ensuring that peo-

ple in New York and across America have access to reliable and affordable power.

I ran into a friend of mine at breakfast yesterday, the recently retired chairman of Mobil Oil Company, Lou Noto, and I was talking with him and he said something which made a big impression on me. He said, "You know, we've got to do more in conservation." He said, "For every gallon of oil that I've brought up from the ground, 75 percent of its energy usage was wasted, 25 percent was what we eventually ended up using." He said, "You know, that's just not something we can keep doing." Well, we have to figure out a way how to avoid that.

Much of the concern in New York is divided between our efforts to stimulate economic development in upstate New York and not having access to affordable and reliable power at a cost that many businesses feel they can pay, because you may know that New York has the highest utility cost in the country. We used to be second to Hawaii, but we have surpassed that distinction. Downstate we have the highest of the high, and so that is a real challenge for New York City, about how we are going to be meeting the needs, particularly this summer. Now that New York City's population has topped eight million for the first time in history, more and more people are going to be placing demands, and we have to be ready to meet those demands.

I don't think our concern about meeting our demands for energy today should permit us to be short-sighted about our long-term energy and environmental needs over the coming decades.

I fully support Senator Lieberman's initiative, both with respect to four pollutants but also with his strong stand against drilling in the Arctic National Wildlife Refuge, which is not an answer either to our short-term or our long-term energy needs and postpones the moment of reality and reckoning that our country has to come up to face. We have to decide we're going to be more energy efficient. Yes, we have to produce more, but what we produce, as Lou told me yesterday, we have to use more efficiently and cost effectively.

So I'm very grateful that we are having this hearing, because we represent people, as all of us in this Body do, who need reliable and affordable power, but I also represent many people who are just as concerned that, you know, we've killed the lakes in the Adirondacks; that the Long Island Sound is, you know, not what it used to be; that if global warming comes to pass over the next 100 years, Long Island will become Short Island. You know, we have a lot of concerns that we have to confront.

So I think it is important that we are having this hearing and trying to sort out all of these issues and trying to get a good, solid basis in science and fact on which to build a consensus that cuts across partisan lines.

I just want to conclude by really recognizing the chairman's efforts, who I think has played a very important role.

I hope, Mr. Chairman, that you will take me up on my offer at an earlier hearing to come to Ohio and visit some of the plants and the people that you represent and that you will come and visit some of my folks in the Adirondacks and elsewhere, because we have to figure out how to really protect the interests of all of our people in a way that brings people together and solves our prob-

lems, and I really applaud the many efforts you have made over the years to do just that.

Senator VOINOVICH. Thank you.

Senator Crapo?

OPENING STATEMENT OF HON. MICHAEL D. CRAPO, U.S. SENATOR FROM THE STATE OF IDAHO

Senator CRAPO. Thank you very much, Mr. Chairman.

I also applaud your holding this and other hearings that you are going to hold.

I didn't come here with a prepared statement, but as I listened to the statements made by you and other Senators something strikes me, and that is that there is a very clear indication here that there is a broad bipartisan support for developing a national energy policy and for a lot of the elements that have to be in that energy policy.

I think that your statement, Mr. Chairman, very, very adequately laid out the scope of the issue that we have to address. Senator Lieberman and his focus on technology and making sure that we have a shared interest in problem solving plays right into what you were saying, Mr. Chairman, and I believe that ultimately we have already, as I've listened here, the basis for a good bipartisan approach to the issue.

Undoubtedly, as we develop our approach to a national energy policy, we are going to have to focus on conservation and on efficiencies and on renewables and other alternative sources of energy. We're going to have to look at the short-term needs and find out how to address the issues that Mr. Chairman has raised already with regard to our lack of development of supply alternatives, whether it be short-term or long-term alternatives.

I strongly agree with the chairman's highlighting of the fact that we have a significant source of power in this country that we have not utilized effectively—nuclear power. Admittedly, we have to address the waste stream issues, but when we can solve those issues—and I believe that with all the talk we have about technology and research and the American ingenuity that needs to be brought to effect on these issues that we will be able to resolve the waste stream issues with nuclear power, and when we do we are going to see that there will be a tremendous boon to our ability to generate self-sufficiency in the power arena.

So, with those comments I would just say I see that, with the statements that I've already heard here today, a broad area of consensus has already been outlined. I believe that this is a bipartisan issue where we have a strong commitment on all sides to make it work. There will be areas where there is disagreement, but from what I've heard today there's an awful lot more area of agreement, and hopefully we'll be able to work forward quickly to address both the short-and long-term needs.

Thank you.

Senator VOINOVICH. Thank you, Senator Crapo.

It is interesting that you mention nuclear power. I've looked at the source of energy in our respective States, and it is interesting that, Senator Lieberman, 73 percent of the power in your State is from nuclear, and Senator Corzine 70 percent. It looks like your

part of the country uses more nuclear power than the midwest and some other places in the country, and it has been—it is expensive. It's clean, and it is not as expensive as some other alternatives.

It is an area that I think—we also have the Nuclear Regulatory Commission under our jurisdiction, and I've met now with three of the commissioners, and they sincerely believe that with some changes we could move forward with more production with the current facilities that are available. There are people in this country today that are giving consideration to building more nuclear-generating plants.

The basic problem, of course, that we have is this whole issue that we've had since I was a county commissioner in Cuyahoga County, and that is: what do you do with the nuclear waste?

Senator CRAPO. Mr. Chairman?

Senator VOINOVICH. Yes?

Senator CRAPO. Could I just make one interesting point there. Senator Clinton pointed out how we apparently waste 75 percent of the power that comes from the oil that we take out of the ground in just getting it up and generating it into ultimate usage. I'm going to be a little bit off on these statistics, but I'm in the ball park. My understanding is that, with regard to the spent nuclear fuel, when those fuel rods come out only about 10 percent of the power in those fuel rods has been utilized, and that if they can figure out the technology to refine and reconcentrate those fuel rods, there's about 90 percent of the power left in them.

It's a tremendous—it's enough power to run the energy needs of this country for 100s of years in a lot of different areas, and so this focus we're talking about on research and development and technology I think can be utilized very effectively in nuclear power.

Senator VOINOVICH. Thank you.

We're very fortunate today to have two panelists that have had a lot to do with our energy and environment over the years, Ms. Linda Stuntz, former Deputy Secretary, Department of Energy, and Kate McGinty, former chairman of CEQ. We're pleased that you are both with us this morning.

Ms. Stuntz, we'll start with you. I think you are familiar with the rules of the committee that we'd like you to try to limit your testimony to 5 minutes. Your statements will be put into the record, and so if you can do that we'd very, very grateful to you.

Ms. Stuntz?

STATEMENT OF LINDA STUNTZ, FORMER DEPUTY SECRETARY, DEPARTMENT OF ENERGY

Ms. STUNTZ. Thank you, Mr. Chairman and members of the subcommittee. I'm very grateful for the opportunity to testify before you today on this extremely important and very timely issue of harmonizing the Clean Air Act and the nation's energy policy.

Some 12 years ago, before I was Deputy Secretary in the Department of Energy, I was something called Deputy Under Secretary for Policy, which meant I got the things to do that nobody else really wanted to do. One of those things—and it made an effect on me for my life, I will tell you—was to be the Department's point person on the development of the Clean Air Act Amendments of 1990, both within the Administration and in meetings here in the Senate. I re-

call many days spent around a conference table with then-Majority Leader Mitchell, working out a deal that was going to be done between the Senate and the Administration.

Senator Lieberman is laughing because he was a part of that process, as well. I recall his constructive participation in that process. I'm heartened this morning by what I've heard, because I think—not that it was perfect—but those amendments were important. They were a product of a bipartisan approach that included the Administration. It is never easy to deal with the Clean Air Act. I don't think you will be able to reauthorize it as it needs to be done without a similar approach, and so I think you are off to a good start. That experience certainly impressed upon me the importance and the difficulty of reconciling these competing objectives.

I will be brief this morning. At the risk of boring some of you who I'm sure know this, I did attach to my testimony some basic facts in hopes that it would be useful to you as you continue your inquiries on this matter. I won't review in detail our current energy consumption. I don't disagree with Senator Lieberman that in the future we all must inevitably evolve from a fossil-fuel-based economy to something else, whether it is hydrogen or nuclear. We are right now very much a fossil-fuel-based economy, and the charts I've showed you make that quite clear.

Figure two, I would point out, also talks about the trends. The trends you see are good in the sense that we use less oil now in our economy. We are less oil dependent than we used to be. That's primarily because we've backed it out of electricity, but we remain, of course, extremely dependent on it in transportation.

Coal is the single largest source of energy that we produce as a nation. Natural gas—interestingly, those in the room who are energy groupies will recall that in the early 1970's we actually produced more natural gas than we produce now. Even though there has been substantial attention to that, we have yet to obtain the level of production we had back then. There's a long, interesting story about why that occurred, and we can go into that if it is of interest.

In terms of the less-emitting energy—and I hesitate to say "emission free," because when the Energy Administration information calculates non-hydro renewables, it includes biomass and municipal solid waste. My friends in the environmental community frequently have issues with those factors, so non-hydro renewables and hydropower and nuclear together don't make up very much of the total. When we talk about Clean Air Act policy I think that has to be kept in mind.

Let me move to figure three, because that's where it gets interesting. We talk about where at least the Energy Information Administration thinks we're going in the future.

One of the things we know about this for sure is that it will be wrong, because we never do a very good job as a nation in predicting exactly what we will use and how much it will cost. But directionally I think it is important to look at what they see happening.

Our production of petroleum is going to continue to decline. Perhaps it will stabilize. Perhaps not. That depends upon price, that depends upon technology.

Coal is going to continue to increase to meet our needs, leveling off a little bit, but, nonetheless, remaining extremely important.

With respect to nuclear energy—and the Energy Information Administration has some, I believe, fairly pessimistic predictions about relicensing. I think there will be more relicensing of existing plants that could extend their lives and extend the contribution of that source. I think it is an important issue for this subcommittee to look into, because without that what you see is that hydro power continues to be static, could even decline. Non-hydro renewables increases slightly but not a lot, and we remain primarily a fossil fuel based economy.

This doesn't exclude, please, the importance of conservation. Republicans always get hit with this—that we don't care about conservation. In fact, the economy has grown substantially more energy efficient as it has adopted new technologies, and it will continue to do so. We need it all, I think, is the bottom line.

Let me just close by talking about what I see as the greatest challenge we face right now, and that's on the electric side. We didn't need California and a lot of other things, tightness in New York City this summer to tell this. If you look at figure four, it really shows you where the Government experts think we are headed with respect to the need for new capacity.

Right now, as was pointed out in the opening statement, I believe by the chairman, some 89 or 90 percent of that capacity is predicted to be natural gas. As I point out in my statement, I represent companies that drill for natural gas and build pipelines in the Gulf of Mexico. There are credible technological stories going on down there to produce gas from a mile of water and 7,000 feet beneath that. I have great optimism for their ability to do this.

Nonetheless, any time this nation in the past has decided that we know the fuel that is going to carry us through, whether it was nuclear too cheap to meter, coal, no more natural gas, synthetic fuels, whenever we have done that we have regretted it. It has been a costly mistake.

Therefore, I think this forecast should be troubling in terms of fuel diversity, in terms of security, and in terms of economics. As to the extent to which the Clean Air Act has driven this development, it unquestionably has been a factor. Perhaps we can discuss later the extent to which it has been a factor. I think that is debatable, but it clearly has been an issue in terms of the ability to build new coal plants, uncertainty about the requirements, and the importance of regulatory certainty for the future to make these large, long-life capital investments.

So let me close with that. I look forward to your questions and this important discussion.

Senator VOINOVICH. I thank you very much, Ms. Stuntz.

Ms. McGinty, thank you for being here.

STATEMENT OF KATHLEEN MCGINTY, FORMER CHAIR, COUNCIL ON ENVIRONMENTAL QUALITY

Ms. MCGINTY. Thank you, Mr. Chairman and members of the committee, for having me here to join you in this discussion today.

Let me, if I might, move right to my bottom line. When it comes to meeting our energy and environmental needs in this country, we face an enormous wealth of opportunities. Yet, instead of fostering these opportunities, leadership in Washington today seems bent on creating a climate of crisis and fear. The hyperbole being thrown around seems to me to bear little resemblance to reality.

So what is going on? Sadly, one can only surmise that the events of the day are being seized upon opportunistically to promote narrow special interests and sacrifice the broader public interest in the process.

To me, a glaring example of this pattern is the effort to use the California energy situation as an excuse, frankly, to sacrifice the Arctic National Wildlife Refuge. I can't build on Senator Clinton's comments here. The bottom line is, as we know, and as I think in an honest moment the Administration should admit, that opening the Arctic National Wildlife Refuge will do nothing to solve or even help what is a very tragic situation in California today.

With all due respect to the members of this committee, I suspect that for some, at any rate, this hearing is part of a similar strategy—namely, to seize upon current energy issues to push through policies that will roll back critical environment and public health protections.

With the change of Administration, special interests are seeing opportunity anew, I believe, and are grasping at any and all developments to justify short-sighted and self-interested campaigns.

To take the implicit premise of this hearing, did the Federal Clean Air Act cause what are inarguably tremendous problems now being suffered and experienced in California? Answer—no. You don't have to go to the Sierra Club to obtain that answer, just ask some of the major electricity generators operating in California in response to assertions by the White House and others that environmental regulations are holding back output. Generators have repeatedly said—and I quote—absolutely false.

What are the main drivers? They are economic and they have to do with honest, earnest, but inevitably flawed, as Linda just said, best guesses about markets. Power plants were not built in California in the early 1990's because there was an excess of power. Then came not new regulation but deregulation, which offers many benefits, but in the mid–1990's it brought with it some market uncertainty which further dampened interests in building further generating capacity.

Then the unanticipated happened—stronger economic growth than had been anticipated, stronger growth in electronic-based commerce than had been anticipated, and, perhaps a harbinger of climate change, the weather hit new extremes of hot and cold.

The result, instead of the excess which previously had been anticipated broadly, there was a dearth of supply.

Let's look nationally. Is the Federal Clean Air Act preventing increases in generation across the nation, as a whole? Again, I think that is a hard case to make. I'd say absolutely not.

Experts say that some 190,000 megawatts of new capacity is in the pipeline. Now, that's a full 25 percent increase in the nation's overall generating capacity. Of that, some 22,000 megawatts of this new capacity projected to come on line by 2020 is coal fired. If that amount of coal is being planned, clearly Clean Air Act requirements are not shutting down coal as an option.

Are environmental concerns completely irrelevant to the California story? No. But to the extent they play a role they do so largely related to local concerns, primarily on issues like the siting of plants, pipelines, and transmission lines.

Now, since local control and State's rights seems to be an article of faith among the Administration and some in Congress, I assume that there is no Federal effort intended here to reverse those local decisions and that those decisions might earn some modicum of respect here in this forum.

To me, this whole debate actually is a tremendous tragedy. Why? Quite simply, because I think our country is better than these false choices that are being presented. Americans are smarter. With inventiveness and ingenuity, we thankfully have moved beyond the tired, old rhetoric of it's jobs or the economy, it's the environment or the economy. We know that we can and must have both or we will have neither.

This principle was proved repeatedly during the Clinton/Gore Administration. While some of the most demanding environmental protections were put in place, the nation also enjoyed and experienced unsurpassed economic performance.

In the energy area, in particular, the record shows that this false conflict is, in fact, a false choice. According to numbers compiled by the Minerals Management Service in 1992, the last year of the first Bush Administration, domestic oil and gas drilling activity was at its lowest level since World War II.

By contrast, under the Clinton/Gore Administration natural gas production on Federal lands on shore increased 60 percent; oil production offshore, particularly in the Gulf of Mexico, is increased 65 percent; natural gas production, in especially the deep waters of the Gulf, increased nearly 80 percent in just the last 2 years. Even coal production was substantially higher in the last Administration than in the previous two.

I would note that all of that was accomplished even while the last Administration protected more lands than any Administration since Teddy Roosevelt.

While shoring up conventional sources of energy, the Clinton/Gore Administration also moved, however, aggressively to achieve better balance in our energy sources. Contrary to statements by the White House and congressional leadership——

Senator VOINOVICH. Ms. McGinty——

Ms. MCGINTY. I have about 3 minutes left, if the chairman would indulge me.

Senator VOINOVICH. We'll indulge you.

Ms. MCGINTY. Thank you, sir.

Contrary to some statements that have been made, when nearly 80 percent of our electricity is fossil fuel dependent, you cannot achieve better balance by simply increasing supplies of fossil fuels. To reduce risk, you have to diversity your portfolio, and that's what

we were working to do. Wind—we invested. It is now the largest-growing source of energy in the world. Geothermal—investments have reduced the cost by one-third. Photovoltaics—dramatic increase of shipments of that technology and efficiency, dramatic savings to consumers while moving forward in environmentally sound ways.

These achievements, while impressive, are not enough, and they represent actually only 12 percent of the increased investments of these environmentally and energy sound technologies that have been requested in the previous Administration.

It is particularly troubling to me in this regard to learn that the White House proposes to go in exactly the opposite direction from investing in a diverse, robust set of energy sources. Estimates are that the recently proposed budget will slash efficiency and renewables by some 30 to 40 percent. This policy simply can't be squared with a sincere effort to improve balance and energy and security and energy.

Last point—perhaps the most compelling example of bringing the environment and the economy together in the energy area is the multi-pollutant approach that Senator Lieberman had referred to. When former Vice President Gore first announced this policy in April, 2000, the statement was supported by everyone from the Sierra Club to some of our biggest coal-fired power generators, and, indeed, even President Bush later endorsed it.

Why? Because so many realized that, in fact, good energy policy is good environmental policy, and they realized that we need a comprehensive policy that protects the environment while, as Senator Lieberman said, offering certainty to business and operators out there.

That also means that climate must be in the mix. To fail to include climate, as the White House now proposes, is irresponsible because it virtually guarantees the supply problems we see today will be repeated because climate is one of the biggest drivers to energy on the horizon. Not including climate and giving regulatory certainty is a threat to reliability.

My hope is that this committee will chart a different course on these issues, that this committee will see that Americans have come together, business leaders and environmentalists, alike. They've moved beyond the false choices of the past, the choices that said you had to sacrifice your quality of life, you have to choose either environment or the economy.

This country is blessed with a wealth of opportunity to be a technological leader, to improve the health and well-being of our citizens, and to fuel our economy. That's the vision that we are presented with, and it is my hope that this committee can help lead the way to our securing that bright future. Thank you very much.

Senator VOINOVICH. Thank you, Ms. McGinty.

Because of the fact that you had so much more time than Ms. Stuntz, I'm going to allow Ms. Stuntz to have a little more time to maybe respond to some of the things that you've said in your testimony.

I'd like to say this, in all due respect. I'm hoping that these hearings that we have are not looking back and knocking the past Administration or the new Administration. I'm more interested in how

do we work together to move forward. I think that to have hearings where we are, you know—there's no question that this Administration has policies. The other one had policies in regard to this. But we are trying to work together to try and come up with some positive solutions to things, and I hope we don't let these things get back to just throwing daggers at the last 8 years or the last 30 years or what this new Administration—I'd rather keep it on a more positive note, if we can, because if we make it partisan, frankly, we'll do what we've done around here in my 2 years here—just keep throwing stones and end up getting nothing done.

Ms. Stuntz, I'd like to give you a few more minutes.

Ms. STUNTZ. Mr. Chairman, I appreciate that, but I really would rather engage in a discussion with you if you are interested, and perhaps you'll allow me some long-winded answers.

[Laughter.]

Ms. STUNTZ. That's what I'd like to do.

Senator VOINOVICH. Well, I'll start out the questioning, then.

Senator LIEBERMAN. We're unaccustomed to long-winded answers here.

[Laughter.]

Senator VOINOVICH. OK. We're going to try to limit the questioning to the 5-minutes, but to what extent has the Clean Air Act, in your opinion, made it more difficult to site and operate energy facilities such as power plants, refineries, E&P facilities, transmission lines, and pipelines? That's the first thing. I'd be interested also in your comments about where we are going with these numbers.

You hear that we can do a better job in energy, and we are doing a better job in conserving energy. We had a big program in Ohio, Green Lights, in all of our public buildings and our schools and so forth, but if you look at conserving energy and then you look at the other sources of energy that are available, you know, do these projections hold up?

Ms. STUNTZ. Well, I think EIA has done a pretty good job here. I think it sets up a challenge. Can we increase the nuclear piece? Can we do something about—I think, frankly, hydroelectric power, it's a crime. The two largest non-Federal projects happen to be in upstate New York—Niagara and St. Lawrence. They produce low-cost power. There are international implications. One has been in relicensing for 5 years. It is not close to being done. But out West there are many more—Senator Crapo knows well the problems that hydroelectric power encounters in trying to get relicensed. The process is broken. It needs to be fixed. That's just one small example.

So I report these numbers to you, not because I believe they can't be changed, but where we are going under current conservation policies, that's where we will be.

It is a challenge. It is also a reality check. I have a small disagreement with Katie. In today's Energy Daily, which I grabbed before I left the office, a Duke executive said, "Emission limits in California are going to cause it to shut down plants." That is the last thing California needs right now. This is NOx emission limits. The Governor is not going to allow that to happen. He will waive or provide some low-cost source of NOx emission allowances. As I

mentioned in my testimony, he has already issued an executive order to do that.

Clearly, the Clean Air Act in certain parts of the country has made it very difficult to site new generation. Southern California is probably one of the worst because they have to find emissions offsets. Other parts of the northeast, for every new source in places where there are not a lot of existing industrial sources from which one can obtain offsets—I know in southern California, for example, one of the plants that is under construction, is closest to coming on line, desperately needed, the developer bought emissions allowances from the airport by converting the fleet of vehicles that run people around to natural gas as a source of emissions allowances. That is an example of how far and how deeply they have to go to get emissions allowances to build new power plants.

One could say, "Well, but California is a terribly bad air quality area. They've got to do this." What you're seeing now is perhaps they went too far too fast, and so it is going to have to be relaxed. They're going to have to use diesel generators. This is something that is coming up in New York and the northeast, as well, this summer. Emissions from diesel generators are much higher by magnitudes of five or six than a coal-fired plant. But if the choice is shutting down a hospital or something, what do you do?

So these are real choices, and it is not—I can't answer the question generically across the country, but, with respect to coal plants, I would say the Clean Air Act is a huge impediment right now, not because there aren't plants out there that could meet new source performance standards it's because they don't know what the next things are going to be. What are the NOx levels going to be? What are the SO_2 levels going to be? What is mercury? And what is going to happen on CO_2?

So I agree that there needs to be more certainty, and I think an increasing percentage of the industry sees that, as well. The problem is doing it in a manner that doesn't seem punitive and doesn't wipe out existing generation at a time when we really can't afford to lose any of the stuff we've got.

Senator VOINOVICH. What recommendations would you have to make this a more-reasonable environment?

Ms. STUNTZ. Well, I think that——

Senator VOINOVICH. And, at the same time, improving the environment. I think it is a given here that we do not want to go back, we want to go forward, and I think most people understand that, and I think that I want to make it clear to everyone on this committee and in this room that I don't want to go back. I want to go forward and continue to improve environment and our public health in this country. But how do we do that and at the same time deal with this situation that we're confronted with today?

Ms. STUNTZ. That's the central question. The only answer I can give you is I think you have to start from a basis, as I believe you are starting here, which is: what are the facts? What's the science? What is achievable? And I certainly agree with you—I don't know of anyone that wants to go back. I don't know of anyone that is advocating rollbacks. The question is: how quickly can we go forward? My sense is that now may be an excellent time to work out a deal with existing coal-fired plants, being that natural gas prices are

where they are and look like they are likely to stay north of $4, for some time. That has changed the economic dynamics, even from a year-and-a-half ago.

There may be opportunities to work out deals to retrofit existing coal plants and clean them up that might not have been there before, but if we are going to continue to engage in, you know, "Well, you've got to commit to do new source performance standards in 5 years or we're not going to let you in the room," then we'll just continue to have a standoff, I believe.

Senator VOINOVICH. Well, it is—again, if you can get people in the room and start talking to each other, there might be something that could be achieved.

Do you believe that even if we are able to get more transmission lines and all the rest of it that natural gas is going to stay at—where, about, do you think? Did you say $4?

Ms. STUNTZ. Well, in the near future I don't see it going below there. I looked at some of the Government estimates, and it depends on how quickly production responds to the recent healthy prices. I hope we won't see $10 in the Mercantile Exchange like we saw in January and December, but I don't think it will be below $4 either. Remembering that just about a year ago it was down around two, it presented then—since natural gas sets the competition at the margin for electricity in most regions, it makes it much more difficult for owners of large coal fleets to say, "Well, I can spend 'X' billion dollars installing new equipment," because they are very mindful of putting that power out of the market.

So there has been a change in the market dynamics. I'm not an economist, although I am occasionally accused of trying to sound like one, but I do work with people in the industry and I have just heard enough to suggest that there may be—the economic dimension may have changed and there may be an opportunity now to do some things, along with continuing development of technology.

There are a lot of people looking for multiple pollutant approaches, technologies that would not only address NOx and SOx but look at mercury, too. They know it is coming. They want to deal with it. They don't want to put a lot of retrofit technology on now, SCRs and so forth, only to have that obsolete in 2 or 3 years from now. It doesn't work.

Senator VOINOVICH. Well, I have looked at the numbers. The people from Babcock and Wilcox were in. They're building a new coal-fired facility out in Wyoming. Comparative cost, I think, for coal is about $1.50, and I think natural gas right now is about $5.50. Some of our people in Ohio on the spot market have had to pay $7.50 for natural gas, which has been—you know, it is unbelievable for them.

All of the new generating plants, as I've mentioned—in Ohio we've got nine. There's another 20 or so. They are all, at this stage of the game, talking about being natural gas fired. I think the reason for it is because the alternative that you just discussed in terms of using coal doesn't make very much sense because of the hurdles that one has to overcome.

The other thing I just want to mention is I was in Hamilton, Ohio. They have a little—and it's really interesting. They have a hydroelectric facility they've built on the Ohio River they call

"Green Up." They generate power with coal. They bought, 5 years ago, a scrubber, $14 million, and it is still not really operating today, and they were bitter about the fact that it is 5 years and they've spent almost a $0.5 billion on what they call "paperwork" to get this thing so it is up and running.

So I think not only should we look at some of these new ideas, but perhaps look at the capacity of some of these regulatory agencies in order to deal with the problem.

That gets to another subject that I have, and that's the human capital crisis that we have where one-third of our workers are going to retire before the year 2004, another 22 percent are eligible for retirement, and if you start going through these agencies, many of the key people that they are going to need to get the ball across the field are leaving, and our capacity to hire new people is limited.

So I think that has also got something to do with where we are today in terms of moving forward with new facilities and fines and the rest of it.

Senator Lieberman?

Senator LIEBERMAN. Thanks, Mr. Chairman. Thanks, too, Ms. Stuntz and Ms. McGinty.

I want to pick up on the words you spoke about bipartisanship and also go back to those halcyon days in—I think it was room 224 at the Capitol in 1990 when we adopted the Clean Air Act Amendments. I must say that that was my second year here. I'm now in my thirteenth year. If you ask me to name three or four things I have been involved in here that I am proudest of, that would definitely be one of them. It was an extraordinary experience.

Part of what drove it in the midst—as you remember, because you were there—in the midst of all of the complexities of the science and the technology and all of the political and regional differences and difficulties was that there was a sense that we were all—we all had common goals here, and I must say that President Bush—the previous President Bush—was part of that. He set that standard, if you will; that sense that we—and we were going to have arguments along the way. We had a lot of work to do to balance them out, but we all understood that there was a problem here.

I want to try to do this in a way that doesn't seem partisan.

I think the first signals from this Bush Administration are not similarly inclusive. They are not similarly balanced. It may be that the true intention of the present Administration is not getting through. But the two things that we looked at that are most visible so far are drilling in the Arctic and the change of position on CO_2 emissions, and those are both very controversial.

I want to put it this way—they get people's back up. There's a sense that we are into a game of stark choices and irreconcilable differences. I don't believe that is true. Just the short exchanges that we've had here show that there is a lot of common interest. But I do hope that we can get ourselves to a point on some form of a multi-pollutant bill, on other forms of the balance of energy and environmental policy where we can find common ground and go back to some room somewhere, maybe not too far, to try to negotiate with the same sense, basically that same sense, we're not leaving the room until we have an agreement, because the truth

is that our country cannot afford gridlock, cannot afford partisan debate that produces nothing on these questions of energy and the environment. They are too critical to our economy, to our health, to our strength, as a nation.

So I don't know whether you want to comment on that whatever that was—a sermon, evocation—but I think it is quite possible—and this committee can play a role in it, but we need our leaders, both in the Administration and in Congress, to strike those notes that say, "We're going to have some arguments here, but we've got a goal that we share in common." Right now I don't feel that.

Ms. STUNTZ. I would only say, Senator, I think your point is well taken, but I would ask you not to—to keep alive the possibility that it could work out that way again. President Bush in Texas, as part of the electric restructuring program, did—I believe unique among all of the electric restructuring programs in the country—impose control requirements on existing coal-fired power plants.

The issue of CO_2 is a confounding one. I agree with the President. It is not a pollutant under the Clean Air Act. I'm afraid it could be allowed to continue to prevent progress on anything else in this area. I don't represent the Administration on these issues and can only say my hope would be that perhaps that could be put, if not to the side, at least back in the pack and progress made on other issues, or at least see how much can be made on other issues.

It's like your work on a conference report—it's never done until everybody has signed off on all the titles of the bill. Right? But see what can be done and then, as I said, see what is happening in the environment.

I believe there are a lot of companies that want to build new coal-fired power plants——

Senator LIEBERMAN. Right.

Ms. STUNTZ [continuing]. That cannot afford—the reason, Senator—and I don't think I was as clear as I should have been—they do cost more money up front to build, to build them to standards. It is an increased capital cost. The fuel cost, you're right, is lower, but they cost more up front by way of capital cost. If you're going to make that investment in a 30-or 40-year long asset, you've got to have some understanding of what is happening in the future.

There are people who will make that investment. I think there are more people all the time that believe they can't do that until they know where things are going to come down. We could talk greenhouse gas emission minimization, as opposed to rigid reductions. Those are decisions that you need to make. But I believe that dialog can occur. I believe this is a President that wants to be in that position. I think he needs a little more time to get a few more people in place, a few more conversations with you and Administrator Whitman, and perhaps we can be back in that conference room again.

Senator LIEBERMAN. Well, that's great. Look, it's early and there's time, but we've really got to do it. As we say on our side, we're always prepared to keep hope alive.

I thank you.

I guess I've used my time. I'm sorry about that. Thanks, Mr. Chairman.

Thanks for the exchange, Ms. Stuntz.

Senator VOINOVICH. Senator Clinton?

Senator CLINTON. Thank you both for your testimony.

I want to just throw one additional element into this debate, because I really do appreciate greatly both what the witnesses have said and my colleagues. I really think that we have an opportunity to bring people back into that metaphorical room, and I think that shame on us if we don't.

Just as in the 1950's we knew we needed a national highway program to link our country together, I don't think it is any overstatement at all to say that, if nothing else, California should have persuaded us that we need a national approach to try to work toward a national energy policy that does represent the kinds of sensible conclusions that you are advocating.

I'm concerned, however, that, in spite of what might be good intentions not yet expressed or realized in the Administration, there is very little in the budget that we've heard about which would support an effort that would enable us here on this side to put in the incentives—the carrots that are needed to go along with the sticks.

I am very concerned that if we rush to judgment and pass the tax cut that the President is still urging on us, despite what I think many of us now see as increasing doubt about these 10-year projections and growing concern about the impact that such a large 10-year tax cut backloaded to the last 5 years would have on the economy, as opposed to a smaller, more-targeted stimulus if that is necessary, that, despite our best efforts—suppose, you know, if this tax cut stays on this fast track and the votes are there to push it through, May or June or July, when we start trying to get people in the room, and we say, "OK, what is it we can offer to our generators? What is it we can give to our utility companies to make sure that they are not put at severe financial disadvantage? What can we help with our States in order to be able to meet the generating transmission and distribution needs that exist in their States," we won't have any way to do that. We won't have any way not just this year, but we won't have any way to do it for the next 10 years.

So we can sit here and talk about how bipartisan we want to be—and I believe that about this subcommittee, as I believe it about the committee, and I hope that maybe somebody sitting here would recognize that there is a great willingness on both sides of the aisle to do the hard work that was done 10 years ago on the Clean Air Act Amendments that I think were a crowning achievement of the first Bush Administration and those who served in Congress at that time, but we're not going to be able to have the resources to do that.

I'm on the Budget Committee, and I'll offer an amendment if we have a markup, which I'm told we may not even have a markup, but if we have a markup I'm going to propose an amendment to try to set aside some significant dollars for an energy initiative that would come through this committee to the Congress because I think we have to do more as a nation to invest in some of these technologies. We have to help our utility companies realize that we're all in this together. It shouldn't be us versus them. I love to turn on the lights in my house, you know. I don't have any bad

feelings about people who run utility companies and provide that energy for us. I want to have us all in the same boat, just as in previous decades in our country we all made those kinds of decisions. But we sure can't do it if we are going to be saddled with a 10-year uncertain set of projections that lead to large tax cuts that I believe will take us back to deficits. So I think we have to be honest in our assessment of what is possible.

I wanted to ask just a couple of quick questions.

I was recently visited by a utility executive—actually, somebody I went to high school with who I haven't seen since we graduated, but now that I am in the Senate he has discovered me again, and I was more than happy to sit down and reminisce with him.

Senator LIEBERMAN. It wasn't enough when you were the First Lady?

[Laughter.]

Senator CLINTON. No. Never found his way to me there. I think after the committee assignments were put out there might have been some e-mails going.

In any event, I looked him up in my yearbook and I did recognize him and we had a nice conversation.

[Laughter.]

Senator CLINTON. But one of the points that he made, which I was very grateful for, because I hadn't hear this, George. I mean, I never had been told about this—is that there might be some technology that has been used, particularly in South Africa, to use coal for liquification that would enable us to produce cleaner energy using this enormous coal reserve that we do have that is cheaper to produce. That's something I think we ought to look into. Again, I think that's something that, you know, could help us on this chart that Ms. Stuntz has given us.

Could you, Ms. Stuntz, enlighten me even further than my old classmate did about whether this is a realistic option that this committee should look at and figure out if there's ways we can promote it?

Ms. STUNTZ. Senator, I think coal liquifaction, coal gassification—there have been some tremendous recent improvements in—it's called "integrated gassification combined cycle," which gassifies the coal, and then you've got essentially natural gas, with good emissions performance and efficiency of natural gas.

The issue is one of economics in terms of deploying it, and it is the rules.

I believe that Senator Murkowski's bill, which is a starting point, has a lot of investment in clean coal research and development in there. I think sequestration has been, in my opinion, tremendous underfunded by the Government. I think if we have issues with respect to global climate change, we could do substantially better by looking at the anemic budgets we have now on carbon sequestration.

It is the sorts of things I think your Energy and Natural Resources Committee will be looking at as they examine their bill, but I think this committee has a very important stake in that, and I do believe—and perhaps the witnesses behind me from the utility industry could tell you more—I think the Department of Energy has had a coal liquefaction program for many, many years. The

question is one of cost and competitiveness. There are also some emissions issues with some of the earlier versions of it. But I don't think we've tapped the potential of that by any means.

Senator CLINTON. I'd also like to ask Ms. McGinty, I know that you have spent some time abroad recently.

Ms. MCGINTY. Yes.

Senator CLINTON. And I am concerned about our national leadership on global environmental issues and our need to figure out ways of helping to control emissions, because, you know, the worst of all possible worlds, it seems to me, is that we would finally deal with, you know, sulfur dioxide and mercury and diesel and other things here but take CO_2 off the table. Then, as we see China and India, for example, industrializing and people being affluent enough to buy automobiles, and we then are stuck in a situation where whatever progress we've made domestically is overshadowed by the extraordinary global impacts of the failure to have any global agreements that control emissions elsewhere.

Would you comment on the role that you think the United States should be playing in environmental and air quality issues?

Ms. MCGINTY. Thank you, Senator. Yes. I think in this area, as well, what we are faced with is an opportunity, and there are two kinds of opportunities that come from looking overseas on the climate issue, in particular. One is that, as Linda can probably say better than I, some $25 trillion of energy capacity will be put in place in the developing countries between now——

Senator CLINTON. Was that $25 trillion?

Ms. MCGINTY. Trillion, T—between now and the year 2050. Some country is going to be supplying that technology. If we partner with these countries, it increases the chances that it will be U.S. companies doing that.

The second reason I think it is important to open that kind of partnership with the developing world is, again, for something Linda referred to, which is, as we look at our own cost of reducing greenhouse gases, there is no question that it is cheaper in many respects for U.S. business to be able to invest in a country like India or China than simply to have to meet the requirements within the four corners of the United States, so we want to nurture those partnerships and it is an opportunity for us if we do.

Thank you.

Senator VOINOVICH. It's interesting that you mentioned that, because Senator Craig has a company in his State that has the best technology, and they said to him, "Unless this energy thing is worked out here, we're moving. We can take 8,000 jobs overseas. We can do that tomorrow." That's a threat that they're not going to put up with this.

I think that's something else that we need to look at. Even China, for example, used to provide oil. Now it is importing oil. As its economy grows, and other parts of the world, some of the things that we just take for granted are not going to be available to us. We need to look at that. I think your point is well taken on the environmental issue.

My good friend, Senator Carper?

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thanks, Mr. Chairman. Thanks for bringing us together today around these issues.

I have a statement I'd like to ask unanimous consent be entered into the record.

Senator VOINOVICH. Without objection.

[The prepared statement of Senator Carper follows:]

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

I am grateful to the chairman, my friend from Ohio, and the ranking member, my friend from Connecticut for calling this hearing. I understand that this is the first of several hearings this subcommittee will hold where we examine the nexus between clean air, the environment, and the nation's energy policy. I am looking forward to the testimony we will receive, and to working with my colleagues as we move forward.

The issues of clean air, and energy policy are important to Delaware. In my State, which has urbanized areas as well as rural farming communities, it is important that we have both a clean environment and a reliable energy supply. Delaware has come a long way toward achieving this, but we still have work to do.

In Delaware, in-fact throughout the mid-Atlantic and northeast, we are still faced with a clean air problem. In States like New Jersey, New York, and Delaware we have been working hard over the past decade to clean up the air by reducing or controlling the emissions from the sources ranging from automobiles to factories to power plants within our State borders.

This is not just a State problem however; it is a regional, and national problem.

We need to be very smart about how we proceed on this. Last week, I had a chance to speak at a conference on energy policy.

I told that group, and I'll repeat it today, we need to be broad-minded and very creative. The link between this nation's energy use and our air quality is not the question. The question is what do we do about it? Clearly, we need to both protect our air and also provide an abundant, reliable source of energy. We need to think about incentives as well as regulations. The toolbox will need to be diverse.

Delaware is an importer of energy. The major power plants in the State generate the majority of our electricity, mostly from coal, but still we must import electricity from States such as Pennsylvania and New Jersey to meet demand. Thus, we need to have a dialog with our neighbors to determine what we can do to allow for both a reliable energy supply, and clean air.

Last year, Delaware joined with the EPA and other eastern States in urging the Midwest power utilities to clean up their emissions. As others today have mentioned, those of us downwind from the Midwest utility plants are faced with trying to clean up the air in our States by controlling the emissions within our borders, while at the same time facing penalties for pollutants imported from other regions. We have to work together with States such as Ohio to achieve results, and I am ready to work with everyone here to find a solution. I was pleased to hear that recently the Supreme Court indicated that utilities need to abide by provisions of the Clean Air Act, but I recognize that this will be expensive and that the costs imposed on States and companies with older power plants will be significant. That being said, we must begin to find out how to address those costs, instead of how to avoid them.

Generation of electricity releases more than two thirds of the sulfur dioxide emitted, and close to half of U.S. carbon dioxide. The bottom line is that we are accustomed to burning fossil fuels to generate electricity and as long as we burn fossil fuels, we will have to be mindful of the impacts on air quality. Through application of various technologies, we've probably done the easy part in cleaning up the majority of pollutants. Further progress will be difficult. But we must keep moving. I look forward to today's discussions, and to working with my colleagues this Congress on this issue.

Senator CARPER. I was looking through my school yearbook last night——

[Laughter.]

Senator CARPER [continuing]. I was reminded, when I was at Delaware graduate school in the mid–1970's that we were in the

throes of an energy crisis, concerned about clean air, as well. I'm tempted to say sometimes it seems like we never learn, but we can—we're always learning, I suppose.

I want to ask each of you the same question, and I'm going to ask each of you to take about two or two-and-a-half minutes or so to answer it for me, if you will. It's not a hard question, but an important one.

Our friend, Senator Murkowski, and maybe this week or next week Senator Bingaman will lay out their energy proposals for our country. I talked with Senator Bingaman about it a little bit yesterday to get a feel for what was coming from his proposal.

I'm reminded that—and he shared with me a graph that showed consumption of energy, particularly oil, that is attributed to our transportation sector. I've had some interesting conversations of late with friends from the auto industry about hybrid technology that is coming in vehicles that are literally in the pipeline—they're going to be out, are out, are coming out—and about fuel cell vehicles, as well.

Here's what I want to ask you to do. Just help us briefly piece together part of an energy policy for our country that would encourage Americans to actually purchase hybrid vehicles, fuel cell powered vehicles, other energy-efficient, clean-operating vehicles in the years ahead. So that's No. 1. Give us some thoughts on how do we actually encourage people to buy them? I think they are going to be produced. The question is whether anybody is going to buy them.

Second piece I want to ask, Senator Clinton has already talked to you about coal, so I'll skip over that one, but I do want you to give us some thoughts on nuclear power, and particularly the environmental problems with nuclear power and how maybe in 2001, maybe in this decade, we're better able to deal with those problems.

The last piece, just some thoughts, if you will, on renewable fuels, not so much photovoltaic or solar or wind, but more bio—stuff that we grow, whether soybeans or ethanol, that sort of thing.

Just those three components, if you will, for an energy policy, and if each of you would take a couple minutes and share some thoughts with us it might be helpful as we grapple with these issues. I would be grateful.

Ms. MCGINTY. Thanks, Senator. I think you've outlined several major pieces of the kind of comprehensive approach that is being talked about here.

In terms of buying clean vehicles, several thoughts I would offer. First, I think on the front end the Government has a very important role to play in helping to reduce the cost of those technologies up front by promoting research and development partnerships. A fine example along these lines is the current partnership for a new generation of vehicles. I think it has shown this win/win we are struggling for in terms of energy and environment and the transportation sector.

On the back end, in terms of a pull for those technologies to help consumers afford them, proposals have been made to offer tax credits to consumers or to businesses that would buy fleets of these ve-

hicles, for example, to again ease the up-front cost of affording some of these vehicles.

I would add to this mix, in terms of the transportation sector, I think it is very important not only to improve the automobile but to offer consumers choices, and that means that, again, what the Federal Government can do to invest in and provide local communities resources for transportation alternatives—mass transit, high-speed rail—those kinds of investments are very critical to our infrastructure and to our future.

I think as the sprawl issue demonstrates, there is a quality of life issue there, too, where some people want to get out of their car and out of traffic jams.

Nuclear power—I think the issues have been touched on here. There is an opportunity to increase the operating life and usefulness of our nuclear power plants, and the Federal Government has made investments in partnership with industry along those lines, but the waste issues, the storage issues, and the proliferation issues are tough ones that need to be wrestled with.

Senator CARPER. Take 30 seconds on waste. Is there anybody in the world who is doing a better job than we are with respect to the waste recycling and that sort of thing?

Ms. MCGINTY. Well, I wouldn't present myself as any kind of expert on that. I think that the French consider themselves to be quite advanced in handling these issues. This country has experimented with technologies like vitrification, which tries to encase that waste in glass. So there are different approaches that are being pursued.

We maybe have suffered from too single-mindedly pursuing just things like Yucca Mountain, which need to be examined, but maybe we have too single-mindedly focused on that.

I can't present a more-thorough analysis of that.

Finally, in renewable fuels, I think you are right to point to biomass sources of fuels, in part because not only does it offer us an opportunity for some more degree of autonomy, since we have plenty of biomass that we can put toward fuel production, but it is one of these things that improves the environment, but also offers promising new economic opportunity, even in depressed areas of the country like our farming and rural sectors, where they could have whole new business opportunities that they could pursue with Federal Government support for biomass, both research and deployment.

Senator CARPER. Ms. Stuntz, before you respond, for the past year in Delaware we have been conducting an experiment in Sussex County—actually, throughout that State—where we take soybean oil and we mix it with diesel fuel, and we use it to provide power for our vehicles in our Department of Transportation, and we find that their performance is good, energy efficiency is good. They burn more cleanly. The emissions smell like kind of a cross between popcorn and french fries.

[Laughter.]

Senator CARPER. When people drive to the Delaware shore this year or to Ocean City, Maryland, they're going to be driving through these fields of soybeans. They can maybe think of not how just we use that soybean to feed chickens and raise chickens on the

Delmarva Peninsula, but maybe some day to provide power for our vehicles.

Ms. Stuntz?

Ms. STUNTZ. Yes, Senator.

On hybrid vehicles, I think first the issue is performance. If they don't provide the basic services—reliable, taking you to the grocery store, dropping the kids off at school, or whatever you need—I don't think it will work. But I believe we are close on that. I, personally, am very excited about hybrid vehicles. I would agree with Katie the keys would be perhaps tax incentives to buy down any price differentials, and maybe trying to get creative, maybe to give them access to HOV lanes. Unlike some of the things we've discovered now, you let dual-fuel cars in some places, fuel-flexible cars access, and then they run on gasoline all the time, so is it just kind of a cute way to avoid HOV requirements.

Those kinds of things in urban areas, which is where I think some of these vehicles have their greatest potential, might really encourage people to do that, because they're getting some benefits they otherwise wouldn't get.

Nuclear power—I think it is a tragedy what this nation has done in the area of nuclear power. In my views the issues are not technical, they are political. I think, you know, France is not known for being careless about its citizens' health and well-being, and it is virtually entirely dependent on nuclear power and it is very low cost and it is very reliable.

Our industry a great success story. The nuclear plants in this country now operate at something over 90 percent capacity. Their utilization, their performance, with very few exceptions, has been extraordinary. It is one of the reasons that the air in the northeast and elsewhere, even California, is better than it otherwise would be with anything else, and yet we seem, as a nation, not able to deal with the political issue of what to do about the waste. We don't even have an EPA that can get out a standard to allow people to determine whether Yucca Mountain can meet it, and I just think that's wrong.

Renewable fuels—I am not as big a devotee, I guess, of biomass. Certainly there is a role for biodiesel and ethanol. Where it is available, close at hand, it play make a real role, but I, personally, in the area of renewable fuels am most excited about wind. I think wind is really taking off. I think the Federal Government has played an important role.

Senator CARPER. There's a pun in there somewhere.

Ms. STUNTZ. I didn't mean one, but it is possible.

The Federal tax credit, production tax credit that came about as part of the Energy Policy Act of 1992 and has been extended by the Congress since then, along with some of the State initiatives on renewable portfolio standards—in Texas, for example, under the President—has made a huge difference. There are wind farms of not just a few but hundreds of megawatts worth popping up in Texas, Iowa, Wisconsin, California, even Ohio, West Virginia, wherever there is a good resource. We're getting a lot smarter about, yes, it is intermittent and you can't always count on it, but now that we've got wholesale deregulation—and this is a good side of it—people are learning to firm it up by matching it up with

maybe some gas or something else so you can provide a firm product, you can rely on it.

We taxpayers pay for the production of it. We don't just pay for building machines that stand around and don't do anything. I think it is an example that could be looked at that has really helped to promote, I think, cost-effective, renewable fuels around the country, and I think there is the potential for more than that.

Senator VOINOVICH. Thank you.

Senator CARPER. Mr. Chairman, there you have it. That could be our energy policy.

Can I just say one last quick thing, and then I'll stop?

Senator VOINOVICH. Yes, you can.

Senator CARPER. Solar and wind don't always work. The sun doesn't always shine, and the wind doesn't always blow, as we know. To the extent that we can develop the ability to better harness and store the energy that is created for the times when the sun is—like today. Today we could harness the wind, maybe, but not the sun. But, to the extent that we can develop better a way to store that energy when the sun is shining and the wind is blowing, we will have struck a blow for cleaner air, I think.

Thank you.

Senator VOINOVICH. Thank you.

We are very fortunate to have the chairman of our committee with us this morning, Senator Smith.

Senator SMITH. Thank you, Mr. Chairman.

I won't take any time for questions, because I came in late, and I apologize for that and to the witnesses. But I certainly want to thank you and Senator Lieberman for holding the hearing. This is vital that we look closely at whatever ways we can to improve the performance of the Clean Air Act. That's what we're working on. I believe that we can find ways to get better environmental results and at the same time reduce the compliance costs, and that's what we're about. It needs to be a bipartisan effort.

I was particularly impressed with the comments that you just made, Ms. Stuntz. You don't hear that said too often on the nuclear power side, but I think we need to say it more often and we need to start thinking seriously about that.

I am looking forward to working with you, Mr. Chairman, as we move down the road, and with others in a bipartisan way to try to address the issue of clean air, and, at the same time, more energy, which is obviously a need right now.

Thank you.

Senator VOINOVICH. Thank you, Mr. Chairman.

I want to thank the witnesses for coming here this morning. We appreciate your being here and certainly will be reviewing the questions and the testimony.

Thanks.

Ms. STUNTZ. Thank you.

Ms. MCGINTY. Thank you.

Senator VOINOVICH. Our next panel is: Mr. Tony Alexander, president of FirstEnergy; Mr. David Nemtzow, president of the Alliance to Save Energy; Mr. David Hawkins, the Natural Resources Defense Council; and Mr. Olon Plunk, who is vice president for environmental services at Xcel Energy.

Good morning, gentlemen. Let me say welcome to all of you. We appreciate your being here. I know some of you had to travel to get here, and we appreciate it.

Mr. Alexander, are you ready to go if I start with you, or would you prefer to go down the other end?

Mr. ALEXANDER. I guess I am, Mr. Chairman.

Senator VOINOVICH. All right. We'll start with you, president of FirstEnergy. Nice to have you here.

STATEMENT OF ANTHONY J. ALEXANDER, PRESIDENT, FIRSTENERGY

Mr. ALEXANDER. Thank you. Good morning, Chairman Smith and distinguished members of the Senate Subcommittee on Clean Air. Thank you for the opportunity to share FirstEnergy's perspective on this important issue.

My name is Tony Alexander, and I am president of FirstEnergy. FirstEnergy is a diversified energy services holding company headquartered in Akron, Ohio. We are in the process of merging with New Jersey-based GPU, Incorporated. That transaction will make FirstEnergy the fifth-largest investor-owned electric system in the country, based on serving 4.3 million customers.

FirstEnergy owns and operates more than 12,000 megawatts of generation. Of this, 62 percent is coal fired, 32 percent is nuclear, and the rest is natural gas, oil, or pump storage hydro.

FirstEnergy was the first U.S. company to install and use large SO_2 scrubbers, starting in 1976. We've also participate in more clean coal technology projects than any other company in the United States.

Since the Clean Air Act was amended in 1990, we've reduced our emissions of nitrogen oxides by 60 percent, sulfur dioxide by 57 percent, and carbon dioxide by 20 percent. I21As electricity deregulation continues to evolve, we must strike an appropriate balance between meeting the electricity needs of our customers and our responsibilities to the environment. We need to recognize that the rules of our industry have changed. Under deregulation, the impact of environmental regulations on the supply and the price of generation needs to be considered, especially since customers will no longer have the protection of regulated generation service when transition periods end.

This is not to say that competition and environmental regulations are mutually exclusive. Environmental regulations must be an integral part of a successful, competitive electricity market.

FirstEnergy believes that the following five principles are important to developing a comprehensive energy policy that addresses both environmental and market issues.

First, the production of electricity from increasingly clean and diverse fuel sources should be encouraged. A balanced portfolio of generation, including coal, nuclear, natural gas, solar, wind, and hydro will minimize the risk of price fluctuations and better assure an adequate supply of electricity for consumers.

Second, there must be recognition of the significant role coal plays in meeting the nation's growing electricity needs. Policies that would eliminate coal as a viable fuel source or that would dis-

courage ways to burn it cleaner and more efficiently are counter productive.

Third, environmental regulations must be implemented fairly and consistently across all geographic regions so that in the competitive market all participants are subject to the same rules.

Fourth, future environmental legislation must allow adequate regulatory flexibility and certainty. Doing so will encourage development of innovative and more cost-effective control technologies and provide more options for existing facilities when meeting new regulations.

I would point out that today's best available control technology (or BACT) requirements significantly limit the industry's flexibility in balancing the environmental and energy needs of the public. For example, under the USEPA's current interpretation of BACT, promising technology that is in the development process today may never be deployed because, while it would reduce pollutants at high levels—even mercury—it may not be able to quite reach the best available technology reduction levels for each of the pollutants that it would otherwise control. Yet, if this emerging technology were retrofitted throughout the industry, far more emission reductions could be achieved than through selective best available technology deployment.

This kind of interpretation doesn't make sense from a business or an environmental perspective.

I would recommend that Congress determine what the appropriate reductions requirements should be and the timeframes and then allow the industry to meet them in the most cost-effective ways possible, including through market-based trading for all sources of generation. The command and control approach will only serve to drive up costs and curb innovation.

Finally, and not least, we need to encourage energy efficiency programs that would require, among other things, for customers to experience real-time prices.

In summary, environmental regulations must work within, not against, the competitive electricity marketplace. They should provide flexibility, uniform performance obligations, and reasonable compliance schedules. They should also encourage fuel diversity, energy efficiency, and continued use of coal.

Thank you very much.

Senator VOINOVICH. Thank you, Mr. Alexander.

Mr. Nemtzow?

STATEMENT OF DAVID NEMTZOW, PRESIDENT, ALLIANCE TO SAVE ENERGY

Mr. NEMTZOW. Thank you very much, Mr. Chairman and members of the committee, for allowing the Alliance to Save Energy to testify before you today.

I am David Nemtzow, president of the Alliance to Save Energy. We are a bipartisan, nonprofit coalition of business and government leaders who are dedicated to energy efficiency. We were founded by Senator Charles Percy and we are chaired today by your colleagues, Senators Jeff Bingaman and James Jeffords. Over 70 companies are members.

Mr. Chairman, you know what a competitive world we live in. It seems that whenever somebody wins, somebody else must lose. After all, there is only one NCAA winner, only one survivor gets to keep the million dollars, and only one film is getting Best Picture this year. So it could be tempting today to think that energy and environment goals are competitive and that one must win and the other must lose. We've heard different testimony—you'll hear more—suggesting that environmental goals are interfering with energy goals and that energy goals are interfering with the environment.

That is small wonder. You've heard other statistics, and I'll give you some more about how intertwined energy and environmental decisions are. We can never forget that over 80 percent of the air pollution generated every year in this country is generated from the production, consumption, or transportation of energy. The number is even higher for carbon dioxide. The list doesn't end with air pollutants. It goes on to water pollution, land use disruptions, toxic waste. We heard about nuclear waste. So we have to accept how inter-twined the energy and environment decisions are, and that is, of course, why this subcommittee is holding this important hearing.

That is also why it is so essential to cut energy waste and to use energy much more efficiently than we are. Energy efficiency isn't the "conservation" of the past; energy efficiency is using modern technologies to do the services that we demand—the heating and cooling, transportation and lighting services, information technology, all of the others—that is, doing the same with less energy input. That means having the same or superior services, the same or superior productivity in the work force, the same or superior comfort for homeowners.

By having less energy input, it means less of the environmental stresses that this subcommittee and this Congress is so concerned about.

Separately—I know it is not the jurisdiction of this subcommittee or full committee—you will also save Americans money, and I suspect your constituents will be happy about that as you do your work on tax and budget issues.

You can have it all. You can have a good energy policy, good environmental policy, save money for businesses and consumers.

I know this all sounds too good to be true, but I want to say to you it not only can happen, it has happened, and it is still happening.

I'd like to look at the record. I'd like to show you this chart, if I could. What is key here is to remember that energy efficiency is providing more energy to this nation today than any other energy source but oil. If we look at energy efficiency as an energy source—and you won't see these in the other charts, the traditional charts that forget about the efficiency side of the meter. You'll see it is ahead of natural gas or coal or nuclear or the others, which, of course, are very important to our nation's energy balance. Efficiency is second only to petroleum. When we remember that over half of our petroleum is imported, energy efficiency becomes our No. 1 domestic energy resource today, and that number can even go up higher if this Congress adopts further policies.

The implications for environment I think are quite clear to all of you, but I'd like to just show it graphically, if I might. If we could start with the NOx chart, this is a chart that shows two scenarios, Mr. Chairman. The top line is what NOx emissions in this country would have been—this is from 1973 forward to 1997—if we hadn't embraced energy efficiency as much as we had. NOx emissions would be that much higher. That delta there between the higher bar and the actual bar is the lowering due to the improvements that we've had in energy efficiencies—more efficient refrigerators, lighting, appliances. Your home State, Mr. Chairman, of course is a great champion of energy efficiency. Owings Corning and many other companies that are based in Ohio have been leaders technologically, and Carrier in New York, and companies throughout the country. I won't even speak to the Yankee ingenuity in New Hampshire that has produced so much of these important technologies. These technologies have lowered air emissions, and we can see the same pattern for the other key pollutants. With SO_2 it's not as dramatic, but, again, because of energy efficiency we have the lower level of emissions, not the higher level.

Finally, the most dramatic graphically is carbon dioxide. What CO_2 emissions would have been in 1999 is that higher number. Luckily, they were the lower. That's what energy efficiency can do.

How do we get more energy efficiency? How do you make sure that energy and environmental policies work together? I'd like to offer some recommendations on how to do that.

First of all, cap and trade programs such as Chairman Smith, described earlier are key. Cap and trade programs not only give companies the flexibility that Mr. Alexander talked about, but they create an implicit incentive to produce less power because then they need less of the tradable permits.

Second, just as the Clean Air Act did in 1990, there should be set-asides for energy efficiency and renewable energy so that they remain the preferred approach to dealing with energy and environmental issues at the same time.

Third, this committee and this Congress should support energy efficiency standards that explicitly look at environmental performance. The recent air conditioning standard that was adopted will save seven million tons of carbon dioxide annually in 2020 and will avoid the need for about a hundred power plants that won't be needed because of more efficient air conditioners.

Fourth, you should support programs that educate the public about the linkage between energy and environment. Senator Clinton talked about the Energy Star program. It has been a big winner. One of the winners, Mr. Chairman, was from New Hampshire, Harvey Windows, who has been a leader in energy-efficient windows, as well as winners from other States.

I would encourage this subcommittee or full committee to have a hearing on the Energy Star program. I think you might agree, Senator, it is a wonderful program that was established under the first President Bush and deserves your support.

Fifth, the public benefits fund for electricity consumers—as Senator Bingaman will be introducing, we believe, in a few days, and as Governor Pataki in New York has recently doubled his State's public benefits fund, in a deregulated era you need some kind of

market-friendly mechanism to have the resources to invest in energy efficiency.

I have to talk briefly about these proposed cuts we expect in R&D spending for efficiency and renewables. I must say I don't get it. If you had an encyclopedia of aphorisms and you looked up "penny-wise and pound-foolish," you'd see a chart that looks like this budget cut—efficiency and renewables cut by one-third while this country is going through the worst energy crisis in a generation is something that I cannot explain, and certainly not defend.

Finally, I would like to encourage you to support tax credits for efficiency as your colleagues are doing. Senator Grassley has a proposal for highly efficient appliances. Your proposal, of course, Chairman Smith, for highly efficient homes, and Congressman Bill Thomas in the House has a very similar bill, we thank you for that. Of course, the bill introduced by Senators Murkowski and Lott have half a dozen tax credit proposals, and we expect Senator Bingaman's to, also. The tax credits are a great way to help your constituents embrace these technologies.

Finally, I want to thank you very much again. You can have it all. You won't win the NCAA championship. You won't get the million bucks. You won't get Best Picture. But you can have a good energy and environmental policy simultaneously if you tackle energy waste first.

Thank you.

Senator VOINOVICH. Thank you very much.

Our next witness is Mr. David Hawkins, who is the from the Natural Resources Defense Council.

STATEMENT OF DAVID HAWKINS, DIRECTOR FOR AIR AND ENERGY PROGRAMS, NATURAL RESOURCES DEFENSE COUNCIL

Mr. HAWKINS. Thank you, Senator Voinovich, members of the committee. I am David Hawkins. I am director of the air and energy program at NRDC.

NRDC is a citizens advocacy organization devoted to protection of the environment and public health. NRDC started in New York 31 years ago and now has over 400,000 members around the United States.

I'd like to address three points today. First, why we need a comprehensive policy to clean up electric power plants. Second, why President Bush's decision last week on CO_2 is bad policy. Third, why the public discourse on energy policy, in my opinion, is off to a bad start.

Cleaning up power plants—the truth is, to have clean air we need clean energy, but today's electric powerplant fleet is dirty. It is dirtier than needed to protect public health. It is dirtier than needed to protect the environment.

As Senator Lieberman summarized, and I'll repeat quickly, electric generation today is responsible for two-thirds of sulfur oxide emissions. It is responsible for 40 percent of carbon dioxide, and it is responsible for about a third of nitrogen oxides and mercury.

What do these pollutants do to us and to our planet? Much too much. Let me quickly summarize.

Sulfur dioxide produces soot that causes tens of thousands of premature deaths a year. That figure was challenged by industry, but it was recently reaffirmed in an independent analysis, and the Supreme Court has also upheld that standard against legal challenges.

The same sulfur dioxide produces acid rain that continues to destroy lakes and streams, forests, and monuments.

It also produces haze in our national parks that spoils visits by millions of visitors every year, denying them an opportunity to experience truly clean air.

Carbon dioxide—carbon dioxide is the driving force behind climate change, a phenomenon that threatens to kill millions of people due to increased, more-destructive floods, droughts, heat waves, intense storms, and climate-related infectious disease, to produce sea-level rise that would inundate the homes of tens of millions of people and cost hundreds of billions of dollars in damages, and for counter-measures in those countries that are fortunate enough to have the resources to respond.

Climate change also threatens to destroy complex ecosystems that have evolved over thousands of years under the influence of climate cycles that were not de-stabilized by fossil fuel combustion.

Nitrogen oxide causes smog that blankets more and more of our country, and it also contributes to the degradation of our very productive estuaries through excess nutrients.

Mercury is a brain poison. The electric generating sector is the only sector in the United States that is currently not regulated for mercury. Mercury continues to buildup in the environment, contaminating our lakes so that 40 States have to issue warnings about eating the fish therein.

Dirty plants also waste energy. More energy is wasted in making electricity each year in the United States than all the energy in all the coal we burn in the United States. That's a phenomenal figure. We can do something about it by modernizing our powerplant fleet.

Dirty powerplants are also anti-competitive. They keep from the market cleaner and more-efficient power sources, because, absent comprehensive pollution control requirements, the market places no value on the fact that cleaner plants emit far fewer of each of these pollutants, what I call the "four horsemen of air pollution."

Now, Chairman Smith, you have recognized the need to address this problem, and we are proud of the fact that you have done so, and other members of the committee have recognized the need to do something about it, as well. In fact, just last week the Clean Power Act of 2001, S. 556, was introduced, and Senators Lieberman, Clinton, and Corzine of this committee are among its lead sponsors. We hope others of you will consider sponsoring, as well.

NRDC strongly supports S. 556, and we applaud these members for their leadership.

The bill establishes industry-wide caps on the four horsemen pollutants. Plant-by-plant reductions are required for mercury, while, for the other three, market-based programs will allow great flexibility for firms to meet the bill's targets. This approach will not only protect the environment and public health, it will give clean power the recognition in the market that the current law impedes.

The bill will also give investors in the electric sector certainty they now lack about future regulatory obligations and help them avoid costly mistakes in investment strategies.

A critical feature of the bill is the cap on CO_2. The cap in the bill is set at 1990 levels. That's the level that the United States agreed to to meet the 1992 Rio Climate Treaty, which was signed by the current President's father and ratified by the Senate.

Now, in his campaign, the current President pledged to support a powerplant bill requiring mandatory reductions in all four pollutants, including CO_2, but last week he announced he would not honor that promise. That, in my opinion, was a mistake, and we urge Congress to proceed with a bill that covers all four pollutants. Let me give you a few reasons why.

Failure to include carbon will increase costs in the long run. When carbon controls are required—and they will be—much investment that could have been made intelligently today will have been wasted. A narrow bill will prolong uncertainty. Is carbon really off the table? For how long? Will it be put back on the table right after companies have made investments?

As Katie McGinty pointed out, a narrow bill would miss the opportunity for the United States to position itself ahead of competitors in the global marketplace for designing cost-effective strategies to fight global climate change.

The smart money knows that there is going to be a huge market for climate-friendly energy technologies. The United States can either play a leadership role in looking at that market or it can play a catch-up role. This legislation gives the United States an opportunity to get ahead of the curve.

I detail in my testimony the reasons that President Bush gave for his reversal. I won't go into those points now.

Let me just conclude by my final point, which is why things are off to a bad start.

As the director of the choir that I sing in reminds us, even the most beautiful music can be spoiled by a few discordant voices, and, no matter how people try to make harmony, it is impossible with those discordant voices. I'd like to mention a few discordant voices that we are hearing.

One is the proposal to drill in the Arctic National Wildlife Refuge. If you really want to encourage a reasoned discourse about energy policy, why does one lead with a policy to drill in a very special place? That should be the last place we look to meet our energy needs, not the first place to talk about drilling.

Second, pointing the finger at environmental rules as a cause of California's energy problem is wrong and it diverts attention from real solutions and further polarizes debate.

Third, the coal lobby is now promoting huge new exemptions from the Clean Air Act for coal-fired power plants. This, too, is not the way to promote a reasoned discussion about the role coal should play in the nation's energy policy.

Finally, efforts to blame New Source Review and other permitting requirements from interfering with development and location of new powerplants is short-sighted. Fundamental advertising principles should remind us that if you associate things in the public mind, you're going to reap the consequences of that association. If

you say over and over again, "We can't build new powerplants because of environmental rules," what is the public going to conclude? They're going to conclude they should be anxious about those new powerplant projects because somehow they are in conflict with their environmental aspirations. That's not the way to reduce controversy; it is the way to increase anxiety.

I hope that what we can do in the months ahead is move away from looking at energy policy like a boxing match where we are trying to score points for a referee and instead look at this as an opportunity where we can take a deep breath, work together, figure out how to find solutions.

Thank you very much.

Senator VOINOVICH. Thank you very much.

Our next witness is Mr. Olon Plunk, vice president for environmental services, Xcel Energy.

Mr. Plunk?

STATEMENT OF OLON PLUNK, VICE PRESIDENT FOR ENVIRONMENTAL SERVICES, XCEL ENERGY

Mr. PLUNK. Good morning, Mr. Chairman, members of the committee. My name is Olon Plunk. I am vice president for environmental services of Xcel Energy. Xcel Energy is a public utility holding company headquartered in Minneapolis, Minnesota. We own or operate more than 15,000 megawatts of electric capacity generated by coal, natural gas, nuclear, and renewable energy generating facilities. We have operations in 12 States and serve over three million customers.

Today I am testifying regarding some of our experiences with the Clean Air Act. I am also here to express my support for alternative approaches to the current air quality regulatory scheme. We believe that the current regulations and EPA's implementation of them present very real obstacles to the goal of ensuring an adequate, reliable, and reasonably priced supply of energy for our nation.

Xcel Energy serves most of Colorado and all of the fast-growing Denver metropolitan area. In recent years, we have embarked on an aggressive effort to meet these burgeoning energy demands. Our new capacity acquisition efforts, however, have not been without difficulties. One of the chief obstacles we face involves new source permitting under the Clean Air Act. For example, in early 2000 we were struggling to obtain a permit for a new gas-fired combined cycle unit at our Ft. St. Vrain facility located in eastern Colorado. The permit that we submitted would have used the cleanest low-NOx combustion technology available. Despite this fact, EPA demanded additional expensive emission controls at the facility.

We proposed a different approach. In the Denver area, approximately 50 miles away, we operate an existing coal-fired facility that has significantly higher NOx emissions than the proposed gas turbine. We offered to install new burners on this coal-fired plant that would have reduced its NOx emissions by a much greater amount and at significantly less cost than the EPA's preferred controls on the new gas-fired Ft. St. Vrain unit.

Both the State of Colorado and the members of the environmental community were supportive of this proposal. Unfortunately,

EPA was not. Although some EPA managers expressed great interest in the idea, EPA ultimately stopped it because, in EPA's words, it was contrary to the integrity of the PSD permit program.

Because of our customers' great need for this additional generation capacity, we could not risk the potential that an EPA enforcement action would prevent or delay construction of the plant. We agreed to install EPA's preferred controls at much greater cost and less environmental benefit than under our proposal.

In sharp contrast to our experience with EPA, we have found that, working with the State of Colorado, we have been able to achieve great environmental progress at much lower cost by focusing on flexibility and certainty. We operate three coal-fired power plants in the Denver area. In 1997 we proposed a voluntary emission reduction program to reduce uncontrolled sulfur dioxide emissions from those plants by 70 percent.

We worked closely with the Colorado environmental community and a diverse group of stakeholders to develop and pass legislation that encourages the Colorado Air Pollution Control Division to enter into flexible, voluntary emission reduction agreements for stationary sources. In return for these significant reductions, the legislation grants such things as a period of regulatory assurance, during which the sources will not be subject to additional state regulatory requirements.

The act also requires that regulated utilities, such as Xcel Energy, can recover the cost of these controls from their customers.

In July 1998 we entered into an emission reduction agreement with Colorado. Under the agreement, we will reduce our sulfur dioxide emissions by approximately 20,000 tons per year. The agreement grants the company flexibility in complying with its requirements through annual emission averages, flexible tonnage caps, and trading of emissions between the different plants. It grants us certainty by ensuring that the plants will not be subject to new or different State requirements for a period of 15 years. Finally, it assures that we can recover the cost of these controls in a way that does not put the plants at a competitive disadvantage.

From our experience working with these issues and struggling to meet energy demands in the west, we have learned several things about the kinds of reform that would help the nation resolve its current energy security problems and prevent their recurrence.

First, the tremendous growth in the nation's energy demand requires that our industry build and maintain new and existing power plants. In order to protect the air quality while meeting these needs, Clean Air Act regulations must become more flexible. Our own experience in Denver is proof that the right kind of flexibility creates the conditions that lead to cleaner, cheaper power.

Second, the Clean Air Act should provide plant owners with greater certainty. Owners of existing plants must be able to maintain their facilities and improve their efficiency without the fear that these efforts will be punished by an EPA enforcement action for alleged violations of New Source Review rules.

Plant owners should be allowed to plan rationally and flexibly for the emission reduction requirements that will be associated with their operations for the life of their facilities.

Finally, the Clean Air Act should recognize that States are uniquely situated to address the concerns of local air quality. Our experience in Colorado demonstrates that States are well equipped to think creatively about clean air issues and find innovative solutions. Congress should be responsible for setting the broad agenda and national goals for the nation's air quality program. States should implement that agenda and those goals at the local level without unnecessary interference by the EPA.

Finally, Xcel Energy believes that nuclear power must remain an important part of our nation's energy portfolio. We cannot maintain and improve upon the nation's air quality without taking full advantage of this emission-free generation source.

As many members of the subcommittee know, we are facing the very real prospect of prematurely closing our Prairie Island plant in Minnesota because of the Federal Government's failure to meet its obligation to manage the spent fuel generated by the facility. We hope that this issue will also continue to receive attention by Congress.

As Congress considers various multi-pollutant strategies for the utility industry, these principles should serve as a valuable guide. We believe that, if properly designed, such strategies could achieve greater environmental progress at less cost than the current regulatory program. By bringing flexibility and certainty to the construction and operation of power plants, these strategies would also play an important role in a comprehensive, effective energy policy.

Mr. Chairman, I thank the committee for taking time to listen to me today, and we would be happy to answer any questions that you may have.

Senator VOINOVICH. Thank you, Mr. Plunk.

I'd like to start the questioning with a question to you, Mr. Alexander.

You describe the problem with the EPA's best available technology program, and you say that it limits the industry's flexibility in balancing environmental and energy needs of the public. I'd like you to explain if the problem could be fixed administratively by EPA, or does it require congressional action?

The second question is the question about New Source Review. We have heard from Mr. Hawkins that that isn't a real problem, and I would like you to comment on that, also.

Mr. ALEXANDER. With respect to the best available technology issue, especially with respect to a retrofit application, it is extremely important that there is some understanding and recognition that the types of facilities that are out there. Much like if you had a home, you cannot necessarily put the very best in that limited space that you have.

In Ohio we have some facilities that are space limited, and when we think about having to put best available technology, it is impossible to retrofit those plants. In fact, in one of the plants we have a consent decree that says that.

Yet, we are working on a technology called "Powerspan" that is a multi-pollutant technology that reduces SO_2, NOx, mercury, and collects small particulates, but yet that technology doesn't quite reach the best available levels that could be achieved compared to

a new technology on a brand new facility where you have the space to do that.

That technology won't be deployed or may not be deployed because the EPA requires and will recognize only the very best. So the option for that facility may be shut down as compared to continue to operate.

It leads into the New Source Review and the uncertainties that that has created for our industry. Both of these, while I would suggest that over the last 20 years the interpretation of both BACT, as well as New Source Review, would not have led to the problems that we're dealing with today. So today's interpretation of those requirements are leading to circumstances in which what everyone had considered to be routine maintenance now is leading to a circumstance in which facilities and, quite frankly, things that were done on powerplants 20 years ago are now being challenged, and there is a suggestion that new source standards must be applied, and that is best available technology again in a retrofit application.

I think it is very, very important as we move forward that we deal with these kinds of issues in a way that will allow the industry to make investments. There needs to be a certainty about the investment decisions that we make. We need to have some flexibility so that we can take—that we can balance the existing fleet with what the new requirements are going to be.

Obviously, we are going to need some reasonable time limits to change this fleet out and meet the energy requirements of this country.

Senator VOINOVICH. Thank you.

Mr. Nemtzow, I would really like to have you give me a report on what you think of the incentives in the Murkowski bill and other incentives that you feel that might be worthwhile to look at, because it is interesting, now that we have the incentives in that bill, I'm getting calls from everyone around the country saying I've got a great idea and we ought to incentivize this new idea. I'd be really interested in your organization's review of that for me, and if you could share it with the other members of this committee.

Mr. NEMTZOW. Thank you. I'd be pleased to.

There is an embarrassment of riches of ideas, as you are finding out. I would like to also comment on Senator Smith's bill and the other leading bills there.

The Alliance endorses the provisions, the thrust of those in the Murkowski-Lott bill, and while we do have some sharp critiques of that bill, it is not for what you're talking about; it is for what is missing from the bill, the issues it doesn't deal with.

In terms of the tax incentives, I think Senator Murkowski has done a wonderful job in terms of taking some of the best ideas he has got—tax incentives for new homes, for highly efficient new homes, similar but slightly different from your bill, Mr. Chairman; for existing homes; for highly efficient appliances, which is virtually the same in that case as Senator Grassley's bill. He's got provisions for combined heat and power, which, for example, DuPont and others in Delaware and throughout the country have been leaders in that technology, and this is for the next generation there. So there is a wealth of good policies there.

Senator Smith's bill has those and also has provisions for commercial buildings, which we support, and for air conditioners.

Then, what is missing from both those approaches—and, Senator Smith, if I may speak for your bill, if not for you—is not—I don't think you ever said it is a comprehensive tax incentive for energy, but you were doing some of the leading provisions, so I don't mean to cite anything that is missing there.

What Senator Bingaman and Senator Hatch and Senator Rockefeller are likely to do in different vehicles are provisions for tax incentives for new automotive technologies. This, of course, is key. This is the problem we are not solving.

I wish I knew what Linda Stuntz was driving, but she is not driving the hybrids that are on the street today, the Toyota Prius, a phenomenal car, the Honda Insight, and now, of course, the big three led by Ford are racing to catch up.

What the new provisions will do is provide incentives for fuel cells and hybrids and the next generation technologies, and I'm ahead of myself and the NRDC, who is negotiating with the auto makers—and I think you will see something very exciting, politically exciting, in terms of bringing together different players, as well as technically exciting.

In conclusion, if I could say, Senator, I think the philosophical approach that Congress should take on these incentives are to provide tax incentives for cutting-edge technologies, for things that are just at arm's reach, as Senator Smith's and the other approaches are.

You don't want to provide incentives for things that people will do, anyway. It is too expensive for the taxpayers. You don't need those incentives. You need the ones for the ones that are cutting edge, not so far that they are beyond reach of companies or individuals, but just at the edge. I think if you follow that philosophy you will find a lot of good in the Murkowski and the other proposals.

Senator VOINOVICH. I'm interested, as a sponsor of the Murkowski legislation, to get your thoughts on it on what you think may be missing. It's all going to cost money, and you're going to have to prioritize, you know, the incentives. You won't be able to do them all.

Mr. NEMTZOW. Homes, cars, appliances I think are key there, and I would also submit that politically homes will resonate in ways because it affects so many Americans in ways that some of the other technologies don't. So I think I would recommend you put those at the top of your list.

Senator VOINOVICH. I was in Cleveland with the administrator of the EPA on Monday, and visiting a home that is about as energy efficient as you can find, and I think that, even with the high cost of gas, their original projection was, like, $300 a year. I think it is probably going to be around $600, but some people's gas bill a month is $600, so there's a lot of things that are going on out there that I think we can do on that side of it.

Senator Carper?

Senator CARPER. Thank you, Mr. Chairman.

Gentlemen, welcome to each of you.

As someone said in their testimony, there can only be one winner in the NCAA. Actually, there will be two—the men and women. I'm

reminded of that as our Delaware women's team went to the first round and lost. But had they won we could still be in the hunt.

One of the real values for me for a hearing like this is to find out where we agree and where you agree. I'm reminded in some of what I've read lately that, whether it is technology to provide cleaner-operating, more-fuel-efficient motor vehicles, whether it is technology to provide less energy consumption for air conditioners, I was reading about small—I guess it is an electric co-op out in Colorado which has taken a heat pump and they bury the coils of the heat pump down under the ground and, instead of being up on the surface where the temperature might be 10, 20 degrees, down several feet under the ground it is always 54 degrees, and it can be used to heat the homes in winter and cool them in the summer. They install a couple hundred a year of these. I'm just reminded, if we could do that sort of thing all over the country we could really get something done.

I'm convinced that we have a lot of the technology, and, frankly, a lot of the products that are developed, whether it is for more energy-efficient homes or cars or air conditioners or appliances. We actually have this stuff being manufactured, and manufactures would probably like to build them and sell them. The question is how do we make sure that we buy them. How do we make sure that we buy them?

What I really want to do is just go down the row and ask each of you just to dwell on that if you will. All the technology, all the ability to take and harness that technology and turn it into more energy-efficient products doesn't do us a lot of good unless people and companies put the stuff to good use. What should we do to better ensure that that happens?

Mr. Plunk, I was struck by your accent. For a guy from a company from Minnesota, I was wondering what part of Minnesota you were raised in.

[Laughter.]

Mr. PLUNK. I have been bumped around a little bit. I've gone through two utility mergers. I started out in Amarillo, so what you're hearing is a West Texas accent.

Senator CARPER. All right. I thought maybe southern Minnesota.

[Laughter.]

Mr. PLUNK. Southern Minnesota.

Senator CARPER. Southwestern Minnesota.

Mr. PLUNK. We have a real diverse service territory , essentially from the Canadian border to the Mexican border. I presently live in Denver, Colorado.

Senator CARPER. Thank you.

Mr. PLUNK. I might give you an example, Senator, of an issue that we are experiencing right now that does deploy an electrotechnology.

In one of our service territories, speaking of the region in Texas, we have we have a lot of natural gas supply and compression facilities in that service territory . Most of that natural gas compression is driven off of internal combustion engines. It is not very efficient when compared to the heat cycle in a steam electric generating plant.

Because of the high natural gas prices that they have experienced in that region, they have come to us asking us to electrify that gas compression, rather than them doing it by natural gas fired internal combustion engine.

What that will do is give them essentially an emission-free compression source coming off of our electrified system. Now, our system is going to be coming off of highly efficient steam electric generating cycles. It is being produced through a mix of coal, natural gas, and even some wind in our system down there, so it is going to be driven off of a diverse fuel mix.

So the essential thing there that is driving them is the price signal for that energy, because it is more efficient for them to electrify that process. Overall, even though that is going to make our emissions of CO_2 and NOx and SO_2 a little bit higher on our system—I haven't done the calculations, but I suspect overall there is a net emissions decrease because of them replacing it with something that is driven by a more efficient process.

Senator CARPER. OK. Thank you.

Mr. PLUNK. That's just one example.

Senator CARPER. All right. Again, thank you very much for that example.

The question I'm asking you to come back to is what are we to be doing, as policymakers, to encourage the actual purchase and putting to use of the technology and the products that have been developed? Thank you.

Mr. HAWKINS. Thank you, Senator Carper.

I would mention information, incentives—including dealing with financing—and performance standards. I'll give you an example. NRDC's offices use about one-third the electricity that conventional office space uses. We have those offices built out for maybe 20 percent more initial cost than it would have cost for standard construction job, but we had one person spend about two-thirds of his time for a year collecting the information. Most organizations don't have the ability or the insight to actually allocate a person's time to do that. You have to root around and find all these things. They are there. They are on the market and you can apply them and get two-thirds savings, just as we have.

Information is very important. Keeping programs alive in the Federal, State, and local governments to provide this information, finding ways for entrepreneurs to provide the information.

Incentives—first-cost financing is a problem for some energy-saving technologies. We all know the examples of the compact fluorescent lights. They use a quarter of the energy, they last ten times as long, they save everyone who uses them lots of money, but they cost more, first cost.

Through things like the Public Benefits Trust, electric generating companies or other service providers can provide a way of dealing with this up-front financing issue so that the whole country will save money and consumers will save money and they won't be deterred by the higher first cost of some of these products.

Performance standards—David Nemtzow has mentioned energy efficiency standards for refrigerators, for other forms of major appliances. The motor vehicle industry is another huge opportunity for better performance standards. Those are all places where prod-

ucts that we buy and then have a lifetime for maybe a decade or more using energy, we can influence our energy footprint by just being smarter about having modern performance standards.

Senator CARPER. Thank you.

Mr. NEMTZOW. Some of these issues have been covered, but let me suggest that the philosophy with which to approach your question is we should try to get the marketplace to work wherever possible, and that, I think, is a truism, but there is a "wherever possible" there.

Let me start with the exception first. In the energy marketplace, in the consumer marketplace there are many market values that classical economics teaches us about. For example, almost half of the refrigerators bought every year in this country are bought by somebody who will never, ever see the electric bill for them—landlords, home builders, developers—so they are going to buy based on what makes sense—first cost or looks. They don't have to pay the electric bill. They won't care about efficiency. Nobody would expect them to. That's a market failure that needs to be addressed by regulation or some other non-market force.

Let's talk about the marketplace, which is the right way to do it. First, of course, are price signals. You have to give people the price of their decision and the cost of it, as much as possible. One of California's many mistakes was to protect consumers from the reality of what was happening in the real world of natural gas prices. Consumers haven't conserved—well, they are conserving now, but they hadn't planned, they're not doing it voluntarily.

Even better than that is educating consumers about what products are out there and why it is in their interest, and there is a bevy of programs. Governor Pataki in New York is on TV all the time trying to head off his summer's problems. Governor Ridge I think will soon be there, of course, Governor Davis.

We talked about the Energy Star program. If you want to come to the Alliance to Save Energy home page, Senator, we have a calculator there where you can estimate how much energy you are saving or wasting at home and some opportunities for saving, so there are a lot of ways to educate consumers that you, as a policymaker, can support.

Finally, we talked about the tax incentives that the chairman asked about, and I think that is key in this day and age. To provide the economic incentives for those new technologies, get them out there, let people try them. You try it, you like it, and then the marketplace will be more friendly.

So those are some of the approaches, but there's a lot to do. Consumers now, after a decade of not having to worry about energy, of course have to worry about it now, so they are primed. Now we just have to give them the tools to make some smart decisions.

Senator CARPER. Thank you.

Mr. ALEXANDER. Senator, thank you.

My company has been engaged in energy management and offering controls for a number of years—geothermal applications for residential homes, whole house energy efficiency. We are the largest mechanical contractor in the Midwest. We offer energy management controls on HVAC equipment, lighting equipment, and also a green roofs program, which is a reflective roof on buildings.

We have seen in this experience boils down to three simple prospects. I think a lot of it has already been talked about. First, you have to have a quality product that serves the needs of the customer. If it is a quality product, first in the door works.

Second, the customer has to see real-time prices. You cannot continue to have subsidized prices, controlled, capped prices. They must see real-time prices so they can make those kinds of economic decisions and choices which will allow the deployment of these new technologies, which are more expensive.

Third, we talked a lot about subsidies. I would suggest that if we look toward subsidies, you look toward subsidies that help the development and the initial deployment of the resource, because if you have a quality product, customers are seeing real-time prices, then what you need to do is to get the business started, but that there is not a large capital investment required for the market to get developed.

If you can do that and target subsidies toward the—there are direct subsidies to the customers—you could target those toward people that could not otherwise afford to make that capital investment because they don't have that ability to even make that tradeoff. That's where I think you should concentrate your effort.

Senator CARPER. Thank you all.

Senator VOINOVICH. Thank you. That information, Mr. Hawkins, is very, very important. We undertook the green lights program in the State of Ohio, and it has just been wonderful. It is an initial high cost to get into it, but we've saved so much money. We asked the universities to do management studies—and this sounds like a no-brainer, but a lot of them weren't turning down their heat at night, and one of our universities saved almost $750,000 just by doing that, and others installing those automatic things at certain times when they're shut down.

There's a lot that can be done, and I was really impressed with your second—the energy efficiency right next to the petroleum. That is our No. 1 source. Then the next source was energy efficiency, which was terrific.

Mr. NEMTZOW. If I may comment, Senator, one of the problems is energy efficiency is invisible. What we want is for the Maytag appliance that's fuel efficient to look just like the other one. That's the plan. We want it to be invisible. But then our success story gets lost because of that invisibility.

Senator VOINOVICH. I'd just like to make one comment. One of the questions that I have got, and I think that maybe every member of this committee, and that is that we have conservation and we have technology and we have alternative fuels, and that's all happening, and some of it more rapidly than others. Then folding that into—and I know this is difficult—but folding that into looking down the road 15 years, say, in terms of our energy needs, and what impact does that have on our use of natural gas, what impact does it have on nuclear power, what impact does it have on use of coal. It is how do you put all of this together in a way that doesn't get you off on one thing and you fail to recognize there's something happening over here. It is a very difficult thing for us to weigh.

I think part of what we are going to come up with here has got to take that kind of thing into consideration if we are going to deal with this thing appropriately.

I've spoken enough.

Chairman Smith?

Senator SMITH. Thank you, Mr. Chairman.

I think I indicated before, and as all four of you gentlemen know, we are trying over the next several months, and the purpose of these hearings is to try to gather enough information to be able to write a bill that amends, if you will, the Clean Air Act in a way that provides for the energy that we need and a safer, cleaner environment.

With that in mind, let me just probe with you a little bit, Mr. Hawkins. If we make the assumption that we are putting more carbon into the atmosphere than the natural system can accomplish across the board—we're not just talking utilities here—if we make that assumption and in order to reduce the CO_2 levels in the atmosphere, if we assume that energy efficiency will increase if we give the right incentives to do it, we make some reasonable assumptions that Mr. Nemtzow talked about, which I agreed with, in terms of where we are headed with automobiles—I don't know what the timeline is, but we certainly have hybrid automobiles now. We're certainly moving toward fuel cells. As to when they are here, I don't know exactly. If we make the assumption that what Mr. Alexander just talked about a few moments ago, that with cleaner coal technology voluntarily administered with the company from New Hampshire, Powerspan, reducing emissions and reducing some of the emissions, if we make all those assumptions why is it necessary to go regulate specifically the powerplant, command control powerplant emission for carbon? Why can we not put all of these together and I can add one more, which is the creation of coral reefs, more tightening up the gas pipelines, providing reforestation or rain forest purchase, landfills. All of these things could be done in a trade and exchange program that would get us there, allow more flexibility, as they have all asked for, and get us there.

Are you insisting that it be command, control, end-of-pipe, end-of-powerplant emission control on carbon?

Mr. HAWKINS. To answer your question, Mr. Chairman, no, we are not insisting on end-of-pipe carbon control for powerplants, nor are we insisting on command and control. However, we do believe that sound policy is to establish a cap on carbon emissions, just as the successful 1990 law established a cap on sulfur emissions. That will permit a market mechanism for the electric sector to respond in a variety of ways so that it integrates reducing carbon with the objectives that are set forth for the other three pollutants.

If that isn't done, the risk is that the engineering calculation and the short-sighted cost calculation that is driven by discount rates will say, "All right, even though this strategy won't do anything to reduce our carbon, it will get us in compliance with sulfur, nitrogen, and mercury, so that's what you ought to do. Even if it means that 15 years down the road you are going to face an obligation to control carbon that you won't have put yourself in a position to deal with, I can show you with my slide rule and my calculator that the discount rate should cause you to ignore that right now."

But that's still a wasted resource, and it also perpetuates the release of carbon into the atmosphere at levels greatly in excess of what we need to start thinking about in order to get us moving.

So failure to integrate this runs the risk of investments that will be optimized for the other three pollutants, and if carbon is reduced at all it will only be because it is incidental to those other three decisions.

The analyses that we've seen say that you cannot robustly predict that you will get significant carbon reductions by pursuing the other three pollutants independently.

Senator SMITH. Even if we had a system involving credits provided to those utilities for such things as reforestation, coral reefs, etc.?

Mr. HAWKINS. Well, a credit is useful if there is an obligation that one applies the credit to, but if you don't have any obligation to limit carbon, then whether you pursue an opportunity to reduce carbon is going to be pretty questionable, because why are you doing it. Are you doing it because of some speculative future possibility? That causes the discount rate calculator to run even harder.

Senator SMITH. Well, if you implement a voluntary system under a so-called "cap and trade system" out there, and you implemented a voluntary system to try to achieve the reasonable goals on these emissions, if it is getting results that's what we want, isn't it? I mean, I'm just asking you, can you envision any way of supporting any type of legislation that would—the result would be a reduction. Obviously, there will be a reduction in NOx, SOx, and mercury, but the result would be reductions in carbon, but without command control at each powerplant? Can you envision supporting any type of legislation that would accomplish that?

Mr. HAWKINS. We think that a target for carbon needs to be an integral part of the legislation, and we are willing to work with you, Mr. Chairman, to see if there are ways that you can robustly get a program that will, in fact, allow all of us to conclude that yes, we will hit that carbon target because there are effective and accountable means for determining what the obligations are, and even if they were flexibly implemented that they, nonetheless, will reliably produce a carbon target and achieve a carbon target.

So we are not locked into one particular formula for how one writes legislation to produce the carbon target output, and, indeed, I would point out that the Clean Power Act of 2001 does not specify how the carbon target is to be achieved. It leaves that in the bill that has been introduced to the administrator to design market-based systems to achieve that target. But it is a clear target, and one that has meaning, and meaning that is as clear as it is for the other three pollutants.

Senator SMITH. Final point, Mr. Chairman. If we look at Mr. Alexander's example, where they are working with Powerspan, as I said, a New Hampshire company, on a voluntary basis—and mercury, as you know, is not regulated. However, if this pilot project which they're working on, if the preliminary reports are anywhere near accurate, you're looking at a possible 75 to 80 percent reduction in mercury with this technology without any regulation whatsoever.

So I think we have plenty of evidence that the companies, utilities are willing to move forward on a voluntary basis, perhaps under a cap and trade system, to make these reductions. Indeed, we don't have one now and they are moving in that direction. That's a dramatic reduction in an emission that we don't even regulate, 80 percent.

Mr. HAWKINS. If I could comment, Mr. Chairman, in a deregulated electric market, capturing a portion of the market or losing it will depend on fractions of a cent per kilowatt hour. So if there are technologies that improve performance at zero additional cost—and I have to underscore "zero"—then sure, there is a possibility that they will be used. But unless that additional cost is zero, no matter how small it is, no matter how good a bargain it looks to be, if it does raise the cost of generation by a fraction of a cent, I would say it is not going to be chosen because of the forces of the competitive marketplace.

So if you want to accomplish it, it is critical that the industry have targets that apply to everybody so that it isn't just a matter of volunteerism, because volunteerism will carry you only so far in a very competitive market.

Senator SMITH. I'd just make one other point.

Mr. Nemtzow, in your discussions or your comments regarding autos, do you have any idea when you—this ball park you think that a hydrogen vehicle, for example, would be—fuel cell vehicle would be marketed extensively here in the United States? Fifty years?

Mr. NEMTZOW. Less than that. I'd have to quote Samuel Goldwyn about not making predictions about the future, and so it is dangerous in this business.

Fuel cells that don't run on hydrogen you can expect much sooner. You'll see them this decade. Daimler-Chrysler is a leader domestically on select models.

The problem with hydrogen—of course, it works very well in the fuel cell. The problem is getting it to the customer, getting the infrastructure, and that's why the big three are betting, I think correctly, on gasoline for the next period of time because the infrastructure is there and it is much easier.

So I would say fuel cells, yes; hydrogen fuel cells, it's beyond this decade. Hybrids are the next exciting technology.

Senator SMITH. Sure, and I think looking at that—and, although that's not under anybody's proposal here on cap and trade—if, in fact, in the next 25 to 50 years—be generous and say 50—we take 50 percent of the source of all of the emissions we're talking about, including carbon, out of the equation completely because automobiles are no longer burning gasoline, we've made dramatic reductions and dramatic progress without any end-of-pipe regulation on the utilities that are producing the energy for us.

The question is when is Armageddon. I mean, is it 10 years from now? Twenty years from now? Fifty years? One hundred years? Is it tomorrow? I mean, that's really the issue, and those are things we all have to put in play here as we try to craft legislation that makes all this work.

Unfortunately, we don't have all those answers specifically.

Senator VOINOVICH. Thank you.

Senator Carper, do you have any other questions you want to ask?

Senator CARPER. Well, we don't have all the answers, but we got a couple of them here today. This has been a real good session.

I wanted to go back, Mr. Chairman, if I could to the issue of real-time prices. When I think of real-time prices, I think of a different context.

Let me just use an example. I was talking with the president of AMTRAK a week or two ago, and we were talking about the pricing of train tickets, and you've got some trains that run maybe early in the morning or late afternoon where everybody wants to ride those trains, and trains that run in the evening, 7, 8, 9, not as many people want to leave Washington around those times.

We were talking about how we might adjust pricing so that those folks who wanted to get on the 5 Metroliner, they pay more money. Those people who were willing to wait until 7, 8, 9, they pay less money. But we charge the same price for all the trains.

When you talk about real-time pricing, particularly with pricing of electricity, there are times during the day when electricity ought to cost more for us to consume than other times. When you're talking about real-time pricing—I think it was Mr. Alexander—I'm thinking adjusting how much we pay for electricity by virtue of the peak demand times, but that's not what you're talking about, though, is it?

Mr. ALEXANDER. Senator, I think yes, that is in part. I think there needs to be a—you need to have two kinds—when you think about real-time pricing, you need to have two kinds of issues that need to be solved. No. 1, you have to have metering and information in the customer's hands so that they know what they are using at any point in time and they also know the price of what they're using. Now, the deployment of that type of metering capability and information kind of capability is seriously lacking in the industry. I mean, the large industrial customers have it, some large commercial customers have it, but it is not into the residential class and it is not in the small commercial class, so that part of the deployment of moving toward a true system in which customers make real-time choices, they need real-time information to do that. That is going to be developed and will be deployed over a series of years as we move through deregulation.

The second aspect of it is that we are still operating in many, many States—Ohio included, California included—on the basis of a capped, regulated rate which does not allow even today customers to experience even an average real price in the marketplace, so they are continuing to experience the prices that, for example, might have been set in a utilities case back in the early 1990's and are going to be frozen for another 10 years or so, and they will see no price change in that bill for that timeframe.

When you're in that environment, it is very difficult to deploy new technology, especially when it costs more, or to make customers make those kinds of energy efficiency decisions. Those are the things that need to be addressed as you move through this transition in the history of our industry.

Senator CARPER. All right. We were talking about the same thing. Thank you for that clarification.

Mr. Chairman, thank you.

Senator VOINOVICH. Thank you.

Senator Smith?

Senator SMITH. Thank you.

Senator VOINOVICH. We would like to thank the witnesses for coming this morning. I think it has been very, very informative and gives us a little perspective that we didn't have before and will help us in our decisionmaking, and we thank you very, very much for taking time out of your busy schedule to be with us today.

[Whereupon, at 11:50 a.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF SENATOR JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Thank you, Mr. Chairman. I would like to thank you and Senator Lieberman for your leadership in scheduling this hearing on the interaction between our environmental regulations and our nation's energy policy.

Mr. Chairman, the President has called for a comprehensive energy policy and I agree that we need to do more. But a comprehensive energy policy should not come at the expense of protecting human health and the environment. While we have made great strides in cleaning our nation's air since the enactment of the Clean Air Act 30 years ago, there is more that needs to be done.

In my State of New Jersey, for example, 6 of our cities and counties rank among the worst in air quality in the nation, due to problems from high-levels of ground ozone, also known as smog, according to the Environmental Protection Agency. These high levels of ozone have caused significant respiratory problems in our population, especially among our most vulnerable: the youngest, the oldest and the infirm.

I understand that much of the smog that hangs over New Jersey is produced by the people who live there and the cars that they drive. New Jersey can and should take steps to deal with pollution caused by its auto emissions. But a large amount of the smog and other air pollutants which we face comes from other regions of the country. In fact, the New Jersey Department of Environmental Protection estimates that as much as one-third of our air pollution—including smog—either comes from or is caused by pollutants from another State.

What this says to me is that we simply need to do more to reduce the levels of air pollutants on a comprehensive basis. That's why I became a co-sponsor of the Clean Power Act, sponsored by Senators Jeffords and Lieberman. This is an important bill because it marks the beginning of a debate as to how much further we should reduce already regulated pollutants such as sulfur dioxide and nitrogen oxide.

This bill is also important because it regulates carbon dioxide. I was disappointed when the Bush Administration reversed itself last week on the question of whether carbon dioxide should be regulated. There is little doubt now that increased carbon dioxide in the atmosphere causes global warming. It is time we take steps to reduce its levels.

Again, Mr. Chairman, I thank you for holding this hearing. I look forward to working with you as the subcommittee considers these and related issues.

STATEMENT OF LINDA G. STUNTZ, FORMER DEPUTY SECRETARY OF ENERGY

Mr. Chairman and members of the subcommittee: Thank you for the opportunity to testify before you today on this extremely important subject: "Harmonizing the Clean Air Act with our Nation's Energy Policy." Some 12 years ago, when I served as Deputy Undersecretary for Policy at the Department of Energy in the Bush Administration, I was the Department's point person in the development of the Clean Air Act Amendments of 1990, both within the Administration and with respect to Congress. That experience, including countless hours with some of you around then-Majority Leader Mitchell's conference table to hammer out agreement between the Administration and the Senate, left me entirely persuaded that there is no more difficult, nor more important, challenge than coordinating our air quality objectives and our energy policy objectives.

Current Energy Consumption

Let me start first with where we are. In Figure 1, you can see total U.S. energy consumption for the year 2000, broken down by fuel source. (This and the other four charts used in my testimony all come from the U.S. Energy Information Administration's Annual Energy Outlook 2001, published in December 2000.) As you would expect, the three energy pillars on which we rely are oil (39 percent), natural gas (23 percent) and coal (22 percent), with nuclear, hydropower and non-hydro renewables making up another 16 percent, collectively.

Previous Trends

That is a good snapshot, but to understand the challenge of harmonizing clean air and energy policy, we need to understand where we have been, and where we are going. Let's start with where we have been. . Figure 2 shows U.S. energy production by fuel from 1970—2000. Interestingly, total production has remained about constant. As a result, the growth in demand for energy has been met by imports, primarily of oil and natural gas. Coal and nuclear production have risen steadily. Natural gas production has still not returned to where it was in the early 1970's, although it is growing. Oil production is falling, hydro is virtually static, and nonhydro renewables, despite substantial Federal and State incentives in the form of guaranteed markets, research and development spending, production tax incentives and other efforts to boost its production, have risen only slightly.

Future Energy Production—Electricity

The implications of these trends for future energy production, and for future air quality policy are highlighted in EIA's projected U.S. energy production by fuel, looking out to 2020, as depicted in Figure 3. The three emission-free sources of energy are projected to decline (nuclear), increase only slightly (nonhydro renewables) or remain static (hydropower). The decline in petroleum production levels off. Coal production continues a steady upward growth, and natural gas production soars, driven in large part by increased electrification of our economy.

This increased electrification of our economy deserves special attention. Buried in the dry statistical language of the Annual Energy Outlook for 2001 is a very profound statement:

> Electricity demand is projected to grow by 1.8 percent per year from 1999 through 2020, higher than the rate of 1.3 percent forecast for the same period in AEO 2000. The higher demand projection results from the higher projected economic growth and a reevaluation of the potential for growth in electricity use for a variety of residential and commercial appliances and equipment, including personal computers.

In other words, between this year and last year EIA increased its forecast of annual electricity growth by 38 percent!

To meet this increased demand, which still is less than projected GDP growth, natural gas use for electricity generation, excluding cogeneration, is projected to triple over the next two decades, as 89 percent of new electricity generation built between now and 2020 is projected to be gas-fired. This is depicted in Figure 4.

Now I have always been "bullish" on U.S. natural gas resources, and the ability of our industry to develop the advanced technologies necessary to find and recover natural gas from ever more difficult locations, BUT this picture makes me uncomfortable. Whenever this country has decided as a matter of national policy that we will prefer one fuel (or as I call it, engage in "fuel fads"), the experience has been uniformly dismal. Nuclear was going to be too cheap to meter. Gas was in such short supply that we banned its use for electricity generation in 1978, and insisted that coal be used to generate electricity. Remember the Synthetic Fuels Corporation? One could even consider MTBE to be a similar fuel "fad." If nothing else, we should have learned from these experiences that our national well-being is best served by a diverse portfolio of energy supplies, and by setting performance standards, not dictating the means by which those standards should be met.

Let me point out also, with respect to this chart, that despite the phenomenal growth in the use of natural gas to generate electricity, coal remains the largest source of electricity.

Future Petroleum Consumption

Figure 5 expresses EIA's projections for future petroleum consumption. This is really a tale of cars, trucks and planes, and should not be a surprise given continuing growth in miles traveled by increasing numbers of SUVs, planes and trucks. Yes, there are exciting .developments with respect to hybrid vehicles, fuel cells and hydrogen fuels, but wide use of any of these is judged by EIA to be unlikely at least before 2020.

Implications for Clean Air Policy

Based on EIA's analyses, it plainly will not be possible for us in the foreseeable future to reduce in any meaningful way the use of coal to generate electricity, or the use of petroleum to fuel our cars. Therefore, air quality policies need to focus NOT on phasing out coal-based generation, but on developing and requiring deployment of technologies that will enable us to use coal more cleanly and efficiently.

Similarly, we can continue to reduce emissions from vehicles, both by improving fuels and by improving the vehicles, but we need to be mindful that we have pushed our existing refinery industry and the fuel distribution and storage infrastructure to its limits. The entire motor fuel supply system is more brittle and subject to disruption if anything goes wrong, because refined products are far less fungible, and it is more difficult to use imports to offset short-term disruptions. We saw this last summer in Chicago.

I have heard many times the argument that "industry always cries wolf," and ultimately, "if we regulate it, they will do it, and do it at less cost than they said they would." It is true that emissions reductions have been achieved at lower cost than initially predicted because of the use of flexible trading mechanisms, as in the SO_2 reduction program contained in the Clean Air Act Amendments of 1990. There are important lessons here. But one is not that, "if we mandate it, they will do it and there will be no problem."

Last week, I heard the Governor of Washington report to the Energy and Natural Resources Committee that he has worked with EPA Region 10 to obtain waivers to allow diesel peaking generators to be used around the clock in order to keep the lights on in Washington State. Emissions from these generators are far worse than any coal-fired power plant.

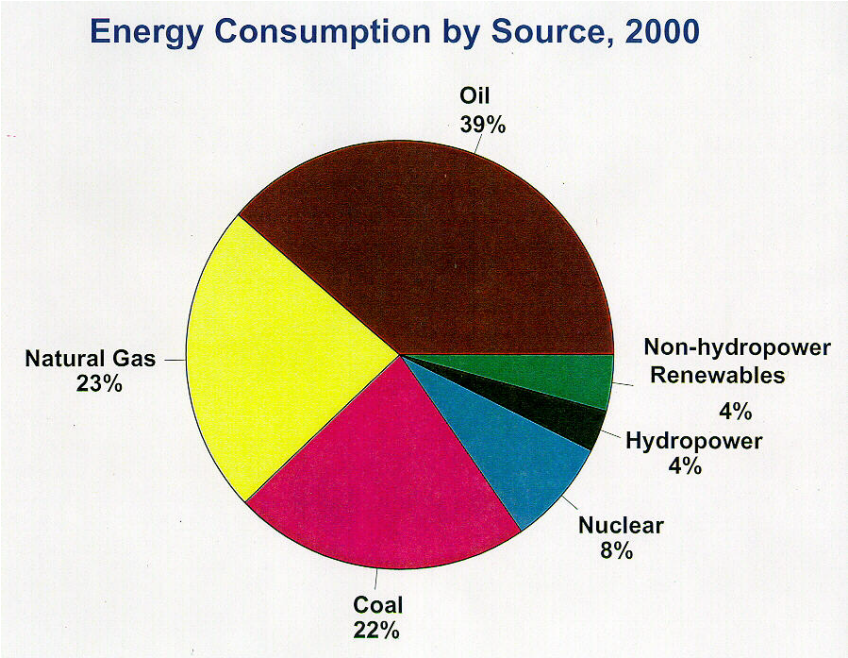
In California, Governor Davis has issued an Executive Order requiring the South Coast Air Quality Management District to make NOx allowances available to power plans at $7.50 per pound, essentially suspending, for the time being, the AQMD's NOx reduction program based on an ever-shrinking pool of NOx allowances available.

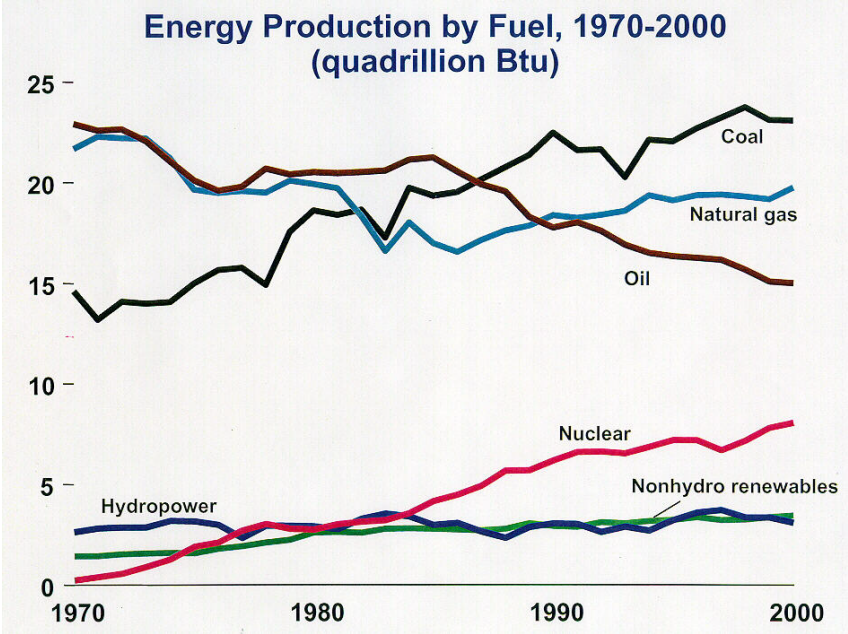
I cite these examples NOT to suggest that air quality regulation is responsible for the Western electricity crisis. That would be overly simplistic. What these examples show is that sound energy policy is the ally, not the opponent, of good air quality policy. When we make it too difficult to site, construct and maintain adequate electricity generation, and when we place too much reliance on a single fuel, we expose the environment and ourselves as consumers to damage that can wipe out months and years of careful progress.

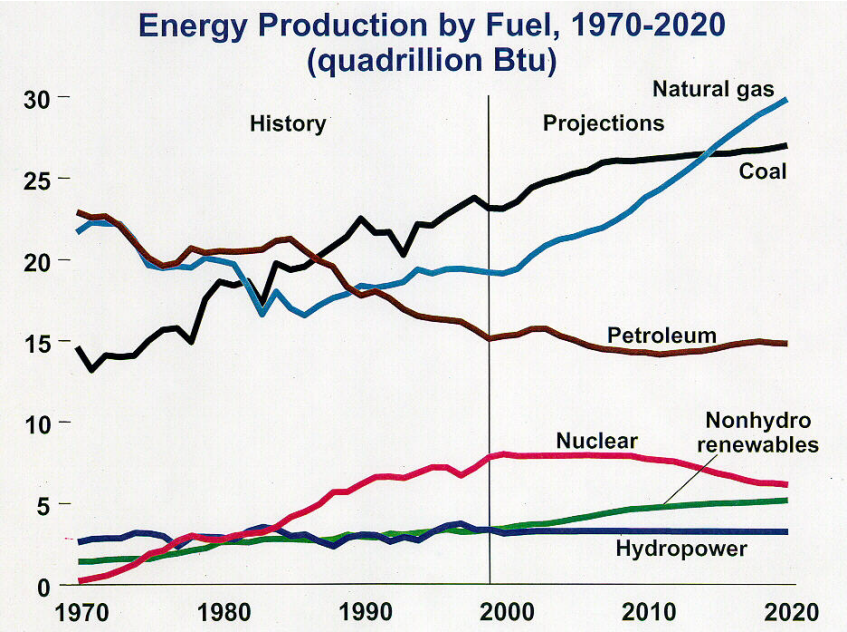
Conclusion and Recommendations

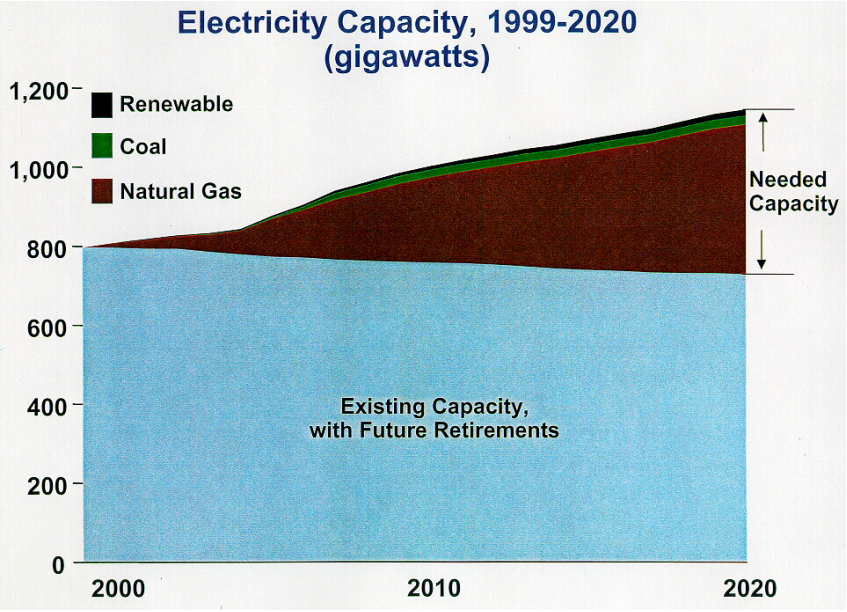
I commend you, Mr. Chairman, for conducting this hearing. At a time when California is struggling through rolling blackouts, the Northwest and much of the West is seeing soaring electricity prices, and much of the rest of the country is experiencing substantial increases in natural gas bills, we are reminded how essential it is that we have access to adequate, affordable supplies of energy. As a nation, we have made great progress in cleaning our air over the past decade. Unfortunately, the story with respect to our energy foundation is a far less happy one. If we do not work harder to keep energy and environment in better balance, both will suffer. . I would encourage this subcommittee to continue and deepen its inquiry as to the linkages between energy and clean air policy. In the "Lower Body," on whose staff I served many years ago, the Energy and Commerce Committee now includes the Subcommittee on Energy and Air Quality. I think the collection of this jurisdiction in a single subcommittee is a very important step in addressing these issues in more integrated fashion. Senate committee jurisdictions being quite different, I understand that such a subcommittee would be a good deal more difficult to construct here, but I encourage you to explore the ways in which this subcommittee can work more closely with your colleagues on the Energy and Natural Resources Committee. You have a great deal to learn from, and teach, each other, and both energy and air quality policy will be the better for it.

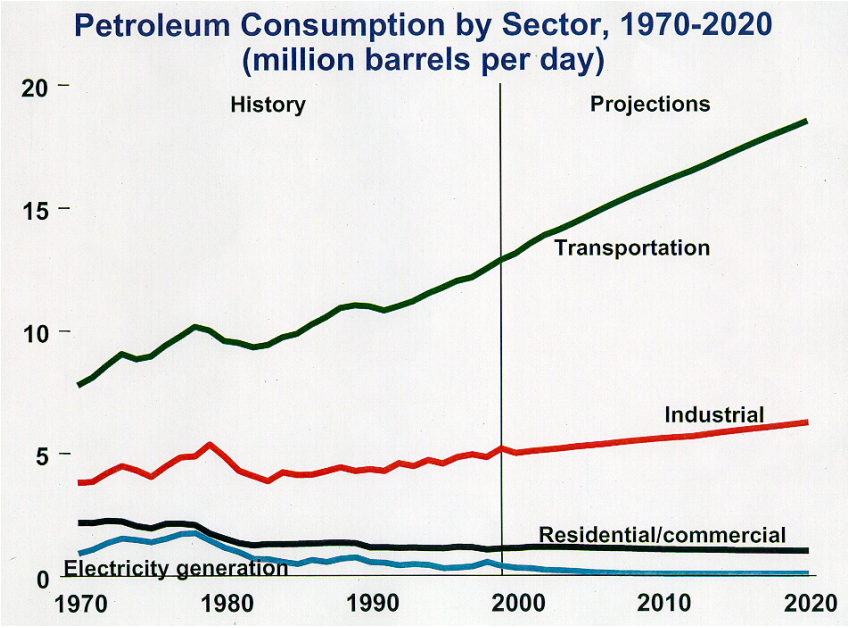
Thank you for your attention. I welcome your questions.


Energy Consumption by Source, 2000
Oil
39%
Natural Gas
23%
Non-hydropower
Renewables
4%
Hydropower
4%
Nuclear
8%
Coal
22%


Energy Production by Fuel, 1970-2000
(quadrillion Btu)
25
20
15
10
5
0
1970
1980
1990
2000
Coal
Natural gas
Oil
Nuclear
Nonhydro renewables
Hydropower


Energy Production by Fuel, 1970-2020
(quadrillion Btu)
30
25
20
15
10
5
0
History
Projections
Natural gas
Coal
Petroleum
Nuclear
Nonhydro
renewables
Hydropower
1970
1980
1990
2000
2010
2020


Electricity Capacity, 1999-2020
(gigawatts)
1,200
1,000
800
600
400
200
0
Renewable
Coal
Natural Gas
Needed
Capacity
Existing Capacity,
with Future Retirements
2000
2010
2020



STATEMENT OF HON. KATHLEEN A. MCGINTY, FORMER CHAIR, COUNCIL ON ENVIRONMENTAL QUALITY

Mr. Chairman and members of the subcommittee: Thank you for inviting me to join this discussion today.

Let me move right to my bottom line: when it comes to meeting our energy and environmental needs, we face an enormous wealth of opportunities. Yet, instead of fostering and tirelessly promoting these opportunities, leadership in Washington today seems bent on creating a climate of "crisis" and fear.

The hyperbole being thrown around bears little resemblance to reality. So, what is going on? Sadly, One can only surmise that events of the day are being seized upon opportunistically to promote narrow special interests, and sacrifice the broader public interest in the process.

A glaring example in the energy and environmental area is the effort of the Bush Administration to use the California energy situation as an excuse finally to sacrifice the arctic national wildlife refuge to the short-term interests of a few oil companies. This effort is objectionable on many grounds. But, the reasoning of the Bush Administration is particularly objectionable. Less than 1 percent of California's electricity comes from oil. But even if more of it came from oil, the refuge likely holds only a very limited amount of economically extractable oil, and we know that it will take 10–15 years to bring that even that oil on line. In short, sacrificing the refuge will do nothing to help California's near-term problem. Yet Americans nonetheless are being asked to sacrifice this priceless, irreplaceable resource.

And, with all due respect, I suspect that this hearing is part of a similar strategy-namely, to seize upon current energy issues to push through policies that roll back critical environment and public health protections. It is no secret that this has been a top goal of the leadership on Capitol Hill at least since Mr. Gingrich's 1994 "Contract with America." Over the last 6 years, citizens groups, doctors, teachers, religious leaders, workers, and yes—a vast array of responsible business leaders—and others, joined committed leaders in the Congress and a determined Clinton/Gore White House to foil most of these special interest drives. But, with the change of administration, special interests are seeing opportunity anew and, I believe, are grasping at any and all developments to justify their self-interested campaigns.

Let's just take on the implicit premise of this hearing-did the Federal Clean Air Act cause the energy problems being experienced in California?

Answer: no. You don't have to go to the Sierra Club for that answer. Just ask some of the major electricity generators operating there. In response to assertions by the White House and others that environmental regulations are holding back output, generators have repeatedly said: "absolutely false."

What are the main drivers? They are economic and they have to do with best guesses about markets. We need look no further than recent stock market performance to know that even the experts don't always guess right about how the markets will behave.

Power plants were not built in California in the early 1990's because there was an excess of power. Then came-not new regulation, but deregulation in the mid 1990's, and with it some market uncertainty that further dampened interest in plant construction. Indeed, the California policy of prohibiting long-term supply contracts is evidence of a widespread anticipation that there would continue to be excess capacity and decreasing prices.

But, the unanticipated then happened: stronger economic growth than had been anticipated; stronger growth in electronic-based commerce than had been anticipated; and the weather hit new extremes of hot and cold. The result-instead of excess supply, there was not enough supply.

And let's look nationally. Is the Federal Clean Air Act-even including the strong new requirements put in place by the Clinton/Gore Administration-preventing increases in generation?

Again, absolutely not. In fact, experts say that some 190,000 Megawatts of new capacity is in the pipeline-roughly a 25 percent increase in the nation's generating capacity. Some 22,000 megawatts of the new capacity projected by EIA to come on line by 2020 is coal fired. In fact, Wall Street will tell you that investments in energy generation are some of the hottest investments out there now, and that environmental issues are a pull for those new investments, not an obstacle to them.

Are environmental concerns completely irrelevant to the California story? No. But to the extent they play a role, they are largely local concerns related primarily to the siting of plants, pipelines and transmission lines. Now, since "local control" and "States rights" are professed as articles of faith by the White House and many on Capitol Hill, it would seem inconsistent at best for there to be a Federal effort to interfere in these areas of local prerogative. I assume therefore that no such thing is intended in this hearing.

To me, this whole debate is a tremendous tragedy. Why? Because, quite simply, our country is better than this. Americans are smarter than this. With ingenuity and inventiveness, we have moved beyond the tired old rhetoric of "it's the environment vs. the economy. Its jobs or the environment." We know that we can and we must have both-or we will have neither.

This principle was proved repeatedly during the Clinton/Gore Administration. While some of the most demanding environmental protections ever were put in place, the nation experienced unsurpassed economic performance as well.

Let's look at the energy area in particular. It has been charged that the Clinton/Gore Administration neglected energy policy and/or that environmental policies were in conflict with energy goals. Absolutely not so. The record proves the opposite:

> According to numbers compiled by the minerals management service, in 1992, the last year of the last Bush Administration, domestic oil and gas drilling activity was at the lowest level since World War II. By contrast, under Clinton/Gore, natural gas production on fed lands onshore increased 60 percent. Oil production offshore, particularly in the Gulf of Mexico was increased 65 percent over 1992 levels, and natural gas production in deep waters in this area increased 80 percent in just the last 2 years of the Clinton/Gore Administration. Moreover, coal production on fed lands was substantially higher under Clinton/Gore than under either Bush or Reagan.

And, all of that was accomplished while more lands were protected and preserved than in any Administration since that of Teddy Roosevelt.

The Clinton/Gore Administration also pushed for and secured new investments in drilling technologies that will enable the production of millions of additional barrels of oil and some additional 6 trillion cubic feet of natural gas domestically every year. These increases will be realized without increasing the environmental footprint of current oil and gas extraction activities.

But, while shoring up these conventional sources of energy, the Clinton/Gore Administration also moved aggressively to achieve better balance in our sources of energy. Contrary to the statements of the Bush Administration and the congressional leadership, when nearly 80 percent of our electricity is derived from fossil fuels, you cannot achieve better balance (and therefore security) by just aiming further to increase supplies of fossil fuels. That just makes a dangerous situation worse. To re-

duce risk, you have to diversify your portfolio. That is what we worked to do in the Clinton/Gore Administration. In doing so, we advanced policies that enhanced our energy security, were a boost to our economy and helped cleanup the air. We did not pit these vital interests against each other as is being done today.

Wind: we invested in new turbines and now wind is the fastest growing source of energy in the world. It is a clean source of energy and it is now working to boost even depressed economies like those that have been experienced in rural America and in the farming sector.

Geothermal: investments have reduced the cost of this technology by one-third.

Photovoltaic: sales and shipments of this key technology have tripled.

Efficiency: investments in just 5 key technologies have already saved consumers some $15 billion; new appliance efficiency standards will save consumers $40 billion by 2010; and the intensity of Federal energy use has decreased by 12 percent, saving taxpayers some 600 million/year.

While impressive, our gains in these areas should be even larger. Why? Because while the Clinton/Gore Administration achieved nearly a 40 percent increase in efficiency investments and more than a 50 percent increase in renewables investments, those increases only represented some 12 cents on the dollar of overall increases the Clinton/Gore Administration requested of the Congress. If we are serious about achieving a better balance in energy, these investments must be increased substantially. It is particularly troubling in this regard to learn that the White House apparently proposes to go in exactly the opposite direction. Estimates are that the Bush budget will slash efficiency and renewables by some 30–40 percent. This kind of policy simply cannot be squared with any sincere effort to improve balance and security in energy in this country.

Perhaps the most compelling example of bringing the environment and the economy together in the energy area is the multipollutant approach to cleaning up power plants. When former Vice President Gore first publicly announced his support for this kind of approach in April of 2000-after having worked on it since 1996—his statement was endorsed by everyone from the sierra club to some of the nation's largest coal fired power generators like American Electric Power, WEPCO, and others. Indeed, the consensus was so broad that even candidate Bush endorsed the plan.

Why? Because so many realize that good energy policy is good environmental policy, and good environmental policy is good economic policy.

And, they realize that we need a comprehensive policy that protects the environment while giving power generators the certainty they need to plan investments. That, in turn, means that the climate issue simply must be accounted for in a comprehensive approach. To fail to include climate as the White House now proposes is irresponsible; it virtually guarantees that current supply problems will be repeated in the future since it ignores one of the most important drivers on the energy horizon. It is a threat to reliability.

And that is why the Bush reversal on this issue seems so inexplicable. Why would such a broadly supported and smart policy be so cavalierly thrown overboard? Sadly, again, one has to assume that the broad consensus was sacrificed to some narrow, short-term special interest.

My hope is that this committee will chart a different course. That this committee will see that Americans have come together as never before-leaders in business and the environmental community working with a common vision and pursuing a shared interest in economic and environmental vitality. The opportunities are enormous for technological leadership; for substantial economic advance; and for a healthy and whole environment.

True leadership requires that strategies-like those being advanced by the Bush Administration and many in Congress—calling for Americans to sacrifice their quality of life and values they hold dear—must be rejected. True leadership consists in supporting the common interest over the narrow special interest. True leadership today consists in nurturing the wonderful and promising consensus that has emerged among Americans-business and environmental leaders alike-and seizing the wealth of opportunities with which we are blessed.

STATEMENT OF ANTHONY J. ALEXANDER, PRESIDENT, FIRSTENERGY CORP.

Chairman Voinovich and distinguished members of the Senate Subcommittee on Clean Air, thank you for the opportunity to share FirstEnergy's perspective on this important issue.

My name is Anthony J. Alexander, and I am president of FirstEnergy. FirstEnergy is a diversified energy services holding company headquartered in Akron, Ohio.

Our four electric utility operating companies comprise the nation's tenth largest investor-owned electric system. We serve 2.2 million customers within 13,200 square miles of northern and central Ohio and western Pennsylvania.

We are in the process of merging with Morristown, New Jersey-based GPU, Inc., a transaction that will make FirstEnergy the fifth-largest investor-owned electric system in the country, based on serving 4.3 million customers.

FirstEnergy owns and operates more than 12,000 megawatts of generation. Of this, 62 percent is coal-fired, 32 percent is nuclear and the rest is natural gas, oil, or pumped-storage hydro.

Last year, more than 60 percent of our generation was produced by nuclear and scrubber-equipped coal-fired units.

Since passage of the Clean Air Act in 1970, we've spent a total of $4.6 billion on environmental protection to ensure that our plants meet all Federal, State and local environmental laws and regulations.

Just since the Clean Air Act was amended in 1990, we've spent nearly $1.5 billion in environmental protection. During that same time, we've reduced emissions of nitrogen oxides by 60 percent and sulfur dioxide by 57 percent.

As electricity deregulation continues to evolve—along with regional problems associated with tight generating supplies—we must strike an appropriate balance between meeting the electricity needs of our customers and our responsibilities to the environment.

We need to recognize that the rules of our industry have changed. Under deregulation, the competitive market will determine how much capacity is built, what types of sources are used, and what the price of electricity will be. As utilities are relieved of their obligation to supply power, the economics of making investments further change.

The impact of environmental regulations on the supply and price of generation needs to be considered, especially since consumers will no longer have the protection of regulated rates when transition periods end.

If supplies remain tight, or become tighter in order to retrofit environmental equipment, the impact certainly will be reflected in customer prices—and perhaps, even in service reliability.

This is not to say that competition and environmental regulations are mutually exclusive. In fact, I believe the opposite is true.

Environmental regulations must be an integral part of a successful competitive electricity market.

FirstEnergy believes that the following five principles are important to developing a comprehensive energy policy that addresses both environmental and market issues:

1. Encourage the production of electricity from increasingly clean and diverse fuel sources.
2. Recognize the significant role coal plays in meeting the nation's growing electricity needs.
3. Implement environmental regulation fairly and consistently across broad geographic regions.
4. Provide the regulatory flexibility and certainty to meet emission reductions.
5. Encourage energy efficiency efforts to limit energy demand and usage.

Let me briefly address each of these five principles.

• First, the production of electricity from increasingly clean and diverse fuel sources should be encouraged. A balanced portfolio of generation—including coal, nuclear, natural gas, solar, wind and hydro—will minimize the risk of price fluctuations affecting any single generation source.

• Second, there must be recognition of the significant role coal plays in meeting the nation's growing electricity needs. Policies that would eliminate coal as a viable fuel source, or that would discourage ways to burn it more cleanly and efficiently, are counterproductive.

Natural gas generation will continue to play a key role in minimizing price spikes in the electricity market—as long as the price of natural gas doesn't become cost prohibitive. However, it cannot replace coal, which provides more than half of the electricity we use in this country, and more than 90 percent of Ohio's use.

• Third, environmental regulations must be implemented fairly and consistently across all geographic regions so that, in the competitive market, all participants are subject to the same rules. Otherwise, selective enforcement will ultimately undermine the development of retail competition.

In the recent initiative by U.S. EPA claiming decades of routine work at power plants constituted major modifications that triggered New Source Review, the Agency targeted specific regions of the country—the Midwest and South, and only certain companies in those regions—in what amounted to a radical reinterpretation of existing law.

It is impossible for a capital-intensive industry such as ours to operate effectively under unclear, ever-changing rules and regulations. Such actions can only have a negative effect on future development of generation.

As the national energy policy is crafted, we hope that Congress supports Senator Voinovich's proposal that new, second-generation environmental laws include cost-benefit considerations that balance the full spectrum of public needs and interests. That's especially important considering that consumers will bear the costs in a competitive energy marketplace. New laws should not add needlessly to the future cost of electricity or adversely affect available supplies.

• Fourth, future environmental legislation must allow for adequate regulatory flexibility and certainty. That will encourage development of innovative, more cost-effective control technologies, and provide more options for existing facilities when meeting new regulations.

As part of that effort, we support market-based allowance trading that provides trading credits to all sources of electric generation—not only to those sources that burn fossil fuels. This would help create an economic incentive for the use of low- and non-emitting sources and produce ongoing environmental benefits. I would point out that today's best-available control technology—or BACT—requirements significantly limit the generating industry's flexibility in balancing the environmental and energy needs of the public.

Under the U.S. EPA's current interpretation of BACT, for example, we could not use a new control technology to help achieve NOx or SO_2 reductions, even if it was almost as effective as the best available, and achieved reductions of other substances as well. Yet, if that new technology were used throughout the industry, far more emission reductions could be achieved than through selective BACT deployment. This kind of regulatory inflexibility doesn't make business sense and, more important, doesn't make environmental sense.

I believe Congress should determine the appropriate reduction requirements and timeframes, then allow the industry to meet them in the most cost-effective ways possible. The command-and-control approach will only serve to drive up costs and curb innovation.

• Finally, we need to encourage energy-efficiency programs. Conservation and a shift to more off-peak consumption can be achieved by providing customers with real-world price information. Ultimately, that means retail prices will need to track more closely with wholesale prices. While this will be a difficult adjustment, there's no other way to truly achieve a dramatic reduction in the consumption of electricity, or an improvement in the efficiency of its use.

In short, environmental regulations must work within—not against—the competitive electricity marketplace. They should provide flexibility, uniform performance obligations and compliance schedules. They should also encourage fuel diversity, energy-efficiency and continued use of coal and other abundant natural resources to ensure that we maintain a clean, reliable, affordable supply of electricity.

Thank you.

RESPONSES BY ANTHONY J. ALEXANDER TO ADDITIONAL QUESTIONS FROM SENATOR LIEBERMAN

Question 1. Do you believe that CO_2 reductions will be required of your industry in the next decade?

Response. It is up to Congress to decide whether it is appropriate to require reductions of CO_2 emissions. However, I believe that this decision should take into account the fact that there are currently no commercially available technologies for reducing CO_2 from power plant emissions. While some CO_2 reductions will occur as a result of the ongoing changes within the electric industry—including increased use of renewables and natural-gas-fired generation, as well as improvements in the way we burn coal—large-scale reductions are only possible today by significantly reducing our use of coal-fired generating plants. Should research result in a viable CO_2 reduction technology, it may be possible to have larger scale reductions of CO_2 without drastically reducing our use of coal—the source of more than half the nation's electricity. In my testimony, I stated that we need to encourage energy-efficiency programs. While programs that reduce the demand for electricity will result in CO_2 reductions, they are not likely to provide a return to 1990 levels of CO_2 within this

decade, if that is the standard being considered. At FirstEnergy, we have reduced CO_2 by about 20 percent since 1990 through a combination of various voluntary activities, including an exchange with Duquesne Light of some of our coal-fired plants for nuclear generation, DOE-sponsored climate challenge efforts, the shutdown of some older, less efficient coal-fired units, and increases in electricity generated at our nuclear units.

Question 2. You asked for uniformity in our regulatory scheme. Sometimes, however, different areas have different sensitivities to pollutants. For example, the soils of the Adirondacks lack the buffers they need to absorb acid rain. National parks are more sensitive to the aesthetic concerns posed by smog. Shouldn't our laws be capable of recognizing such regional variability to protect particularly sensitive areas?

Response. My request for uniformity relates to new second-generation control schemes in addition to, not in lieu of, the National Ambient Air Quality Standards (NAAQS) program. As you know, the NAAQS have been the cornerstone of the Clean Air Act since 1970. The NAAQS are set at levels that protect public health with an adequate margin of safety, and protect public welfare. The Supreme Court recently held that the economic costs of implementation are not relevant to the level of health and welfare protection to be provided by the NAAQS. So, my request for uniformity is based upon a belief that most of the emerging regional issues can be solved by national programs which produce the maximum environmental benefits per dollar invested, and do not upset the current competitive balance between companies. The NAAQS attainment program, which typically deals with source impacts within 50 kilometers, would presumably remain in the law. Attainment and maintenance of NAAQS would continue to be a national requirement, whether or not additional uniform emission reductions are required. For example, the attainment and maintenance of the NAAQS was in no way compromised, relaxed, or superseded by the additional ten-million-ton reduction in utility SO_2 emissions and two-million-ton reduction in utility NOx emissions mandated by the Acid Rain Program. Even without attempting precise source-receptor correlations, the emission reductions called for in the Acid Rain Program certainly don't cause any added adverse air quality impacts anywhere, and probably help the particularly sensitive areas as much as or more than less efficient and more complicated and costly command-and-control programs. National emissions trading programs, such as the one included in the Acid Rain Program, provide an opportunity to reduce emissions at lower costs than the command-and-control approach. Such programs also share the benefits widely and spread the costs across more of our population. The Acid Rain Program has been among the most successful environmental programs ever passed by Congress. Last year we began Phase II of the Acid Rain Program and the positive environmental results should become evident throughout this decade and beyond (over the next 50 years according to the congressionally directed National Acid Precipitation Assessment Program study).

Question 3. I sympathize with your desire for certainty and flexibility. Some contend, however, that we should only proceed with the regulation of the first three pollutants. Would your business decisions as a result of such comprehensive regulation differ if CO_2 was or was not included?

Response. If Congress elected to include CO_2 as a regulated pollutant in a comprehensive environmental law, it could affect future business decisions. Much would depend on how Congress addressed CO_2, including the timing and level of reductions, and whether an emissions trading program would be included. As I said in my testimony, there must be recognition of the significant role coal plays in meeting the nation's growing electricity needs. In the absence of commercially available CO_2 control technology, we would have no choice but to shut down much-needed coal-fired generating plants to meet reduction mandates. Considering that more than half the nation's electricity is generated using coal, I don't believe this is a viable option.

STATEMENT OF DAVID M. NEMTZOW, PRESIDENT, ALLIANCE TO SAVE ENERGY

Mr. Chairman and members of the committee, thank you for the opportunity to testify before you today about how we can meet the nation's future energy needs while limiting, even lessening, environmental impacts.

My name is David Nemtzow. I am President of the Alliance to Save Energy, a bipartisan, non-profit coalition of business, government, environmental, and consumer leaders dedicated to improving the efficiency with which our economy uses energy. Senators Charles Percy and Hubert Humphrey founded the Alliance in

1977; it is currently chaired by Senators Jeff Bingaman and James Jeffords as well as Representative Ed Markey.

Over 70 companies and organizations currently belong to the Alliance to Save Energy. If it pleases the chairman I would like to include for the record a complete list of the Alliance's Board of Directors and Associate members, which includes many of the nation's leading energy efficiency firms, electric and gas utilities, and other companies providing cost savings and pollution reduction to the marketplace.

The Alliance has a long history of researching and evaluating Federal energy efficiency efforts. We also have a long history of supporting and participating in efforts to promote energy efficiency that rely not on mandatory Federal regulations, but on partnerships between government and business and between the Federal and State governments. Federal energy efficiency programs at the Department of Energy (DOE), the Environmental Protection Agency (EPA), and other agencies are largely voluntary programs that further the national goals of environmental protection, as well as broad-based economic growth, national security and economic competitiveness.

I. INTRODUCTION

Energy-Efficiency: A Bipartisan Tradition

From the days of our first national nightmare of gas lines and soaring fuel prices, energy efficiency has had champions in Congress from both sides of the aisle. Sen. Charles Percy, who founded the Alliance to Save Energy in 1977, recognized the need to promote energy efficiency to address a glaring hole in our nation's economic security. He knew that a partnership between business, government, environmentalists, and consumer advocates would not only result in benefits for each sector, it would help avoid the need for coercive regulation when our problems reach crisis level.

That maxim is no less true today, even though oil supplies and prices have eased. Our fossil fuel economy is now believed by many to have put new stresses on our environment. Energy efficiency has been repeatedly cited as a key solution to slow the loading of carbon and other greenhouse gases into the atmosphere. Fortunately, we now have a quarter-century track record of showing how energy efficiency reduces air pollutants—including SO_2, NOx, mercury, carbon dioxide, particulates, and others.

Support of action by the Federal Government to promote energy efficiency has also been historically bipartisan. Though the establishment of the Department of Energy and energy efficiency programs is most often associated with the Carter Administration, key advancements in Federal efforts were made under the Reagan and Bush Administrations. While funding was cut severely from Carter-era levels, President Ronald Reagan signed the National Appliance Efficiency and Conservation Act (NAECA) the law requiring DOE to set energy efficiency standards for appliances and other equipment. That program has led to tens of billions of dollars in savings for the American people and significant carbon emissions reductions. The first Bush Administration, in the context of its support for the Rio Treaty, began to significantly expand funding for DOE energy efficiency and renewable energy efforts and created the Green Lights and Energy Star programs at EPA. In addition, former President Bush signed the Energy Policy Act of 1992, which expanded the scope and magnitude of energy efficiency efforts.

The House and Senate caucuses devoted to promoting renewable energy and energy efficiency continue that tradition of bipartisanship. Currently, the House Renewable Energy and Energy-Efficiency Caucus features 173 members from both parties, while the newer Senate version counts 32 of your colleagues as its members. Such support from all parts of the political spectrum is what has made clean energy a driving force in the American economy.

Today's Testimony

I am here today to testify on the relationship of energy policy and environmental policy. At today's hearing I know you will receive testimony indicating that certain environmental policies make it more difficult to produce energy in this country, and other testimony that certain energy policies are lessening our nation's environmental quality.

That is small wonder, after all energy and environmental decisions are inexorably linked since so many of our environmental challenges result from the production, transportation and/or consumption of energy resources. Most notably, 80–90 percent of our air pollution comes from energy use, as does an even larger percentage of carbon dioxide, the leading greenhouse gas. Unfortunately, the list doesn't end there: energy use contributes significantly to other environmental problems, including

water pollution, land use disruptions, toxic and nuclear wastes, etc. So we must accept that energy and environmental decisions are intertwined, and the policies designed to aid in one area will often have impacts—often negative—in the other.

That is why cutting energy waste and using energy efficiently is so critical. Energy efficiency means providing the services that our modern, in fact future, economy and lifestyles demand—lighting, heating, cooling, transportation, IT, and much more—but doing so with less energy input. Energy efficiency means relying on technologies—many of which are familiar, while others are still innovative or still in the laboratory, perhaps at Oak Ridge National Laboratory in the chairman's home State or at the United Technologies company in the ranking member's home State—that can provide the same or superior services, productivity and comfort while using less energy input. Lessening energy input means reducing the numerous pollutants and environmental stresses that result from our currently wasteful energy practices.

II. ENERGY EFFICIENCY AND ENVIRONMENTAL POLLUTION

Proven Performer

Increasing energy-efficiency has been reducing air pollution in the United States for at least 25 years. Alliance research shows that the gains made in energy efficiency alone during the past 25 years have resulted in 18 percent less air pollution today. This massive assistance to our environmental health is in addition to improvements made through the Clean Air Act and other air regulations.

The most polluting activity on earth is the production, transportation, and use of energy. Electricity generation, vehicle exhaust, oil spills, the heating and cooling of buildings, industrial processes, and myriad other uses of energy account for what is estimated to be 80–90 percent of environmental pollution in this country. As our population and economic activity increases into the 21st Century, environmental stresses on our air, water, and land will be heightened.

We can bring these large figures down to some snapshots. In March, 2000, the Rand Corporation completed a study of the economic and environmental impacts of utility energy-efficiency programs in California. Rand's analysis found that the reduction in demand for electricity achieved by these programs prevented a 40 percent increase in stationary source air pollution in California. In addition to these findings, it is important to note that Rand documented a return of roughly $1000 for every $1 spent on commercial and industrial energy efficiency by utilities between 1977 and 1995, and asserted that 3 percent of the 1995 California State gross state product can be attributed to these investments.

While some may now say that we could use more plants in California now that the current crisis has taken hold, it is important to note that energy-efficiency efforts by utilities were cut back drastically in the onset of deregulation in the State. Continued demand reduction through the end of the 1990's would have put the State in a significantly more secure position than it finds itself today.

NOx, SOx, and Carbon: EPA Data

Alliance to Save Energy analysis of Environmental Protection Agency pollution data shows that energy-efficiency has been particularly effective at reducing emissions of nitrogen oxides and carbon dioxide. On average, since 1977, energy-efficiency measures in the U.S. have reduced nitrogen oxides by 13 percent over what annual emissions levels would have been. Energy-efficiency has reduced sulfur dioxide by an average of 3 percent per year. (See enclosed tables.)

Energy-Efficiency and SIPs: A New Tool for States

More than ever, States are looking for innovative ways to meet their obligations under the Clean Air Act to develop and issue State Implementation Plans. A growing acknowledgement that energy-efficiency is an effective tool to reduce criteria air pollutants and carbon is fueling a new look at energy-efficiency set-asides and other measures.

We strongly support this move to look at energy and environment as two parts of the same equation. Their separation in the public consciousness—and Mr. Chairman, often times in committee jurisdiction—is the single biggest obstacle we have to solving our energy crises and environmental problems. If energy and environmental policy is moved in concert then better programs will be developed. With the U.S. Supreme Court's recent decisions regarding the State Implementation Plans for NOx and the 8 hour rule for ozone, this effort should have new immediacy.

Climate Change and the Alliance to Save Energy

Let me start, Mr. Chairman, by stating that the Alliance to Save Energy currently has no official policy on climate change. We are not on record regarding targets or timetables, the Kyoto treaty, nor any other proposed form of regulation to address

the problem. However, we are very cognizant of both the science and politics surrounding the issue, and even more acutely, the potential for energy efficiency to be a large part of the solution to global climate change.

But we must look at where our carbon emissions would be without the investments that have been made in this country since 1977.

Mr. Chairman, our nation's emission of carbon would be a full one-third (33 percent) greater without the progress that has been made in the past quarter century.

Mr. Chairman, the Alliance is not surprised that energy efficiency stands to be a key component of nearly any climate change strategy. Slowing or stemming climate change should rightly take its place with economic growth, reduction of other environmental pollutants, increased national security, and promoting American competitiveness abroad, as a reason to move full speed ahead with research, development, and deployment of energy-efficient technology throughout the economy. We are such believers in the positive effects of energy efficiency that if you told us it cured the common cold, we might not be surprised.

However, energy efficiency becomes an even more crucial component for our nation's near-term future when we think of the fact that a huge amount of our nation's capital stock will turn over in the next 10 years. EPA estimates that fully 60 percent of our carbon emissions in 2010 will come from equipment not yet purchased. Decisions about how we develop and deploy technology will have a profound effect on whether the nation is even able to sufficiently reduce emissions if a political consensus on action to stem climate change should develop. In this context, energy efficiency becomes an insurance policy that the nation can ill-afford to pass up, and one that should be pursued with no regret.

Five of our most prestigious national laboratories recently came out with a study titled, "Scenarios for a Clean Energy Future." The conclusion of that study was that targeted investment in a selection of energy-efficiency measures could get us more than one half of the way to 1990 levels of carbon emissions. Furthermore, by 2020, these targeted efficiency measures would pay for themselves. Let me state that again Mr. Chairman. Five of our national laboratories believe that targeted investments in energy-efficiency can get our nation at least half way to the targets of the Kyoto treaty FOR FREE. In no place have I seen these findings refuted or substantially questioned. Yet few policymakers are seriously considering implementing these investments.

Frankly, Mr. Chairman, we should stop carrying on an increasingly surreal debate over how much evidence we need for a conclusive finding that climate change exists, and start putting in place an insurance policy that will benefit the country economically and environmentally no matter what happens—and mitigate potential impacts of global warming.

III. FEDERAL ENERGY EFFICIENCY EFFORTS

Energy efficiency Research, Development, and Deployment: Why the Federal Government?

Back in 1995, when some in Congress were contemplating the dissolution of the Department of Energy, two major reports were released that came to the same conclusion: If we forego Federal research and development in energy technologies, it will not be replaced in kind by the private sector. Both the Galvin Commission studying the national laboratories and DOE's Yergin Task Force looked at energy research and development and arrived at this conclusion. Among the reasons they cited as barriers to corporate efforts are high R&D costs, internal cost-cutting which has resulted in widespread downsizing of companies, uncertainty of property rights and the ability to capture all the benefits of R&D, and high initial investment in R&D capability.

In the early 1990's, Federal energy research efforts were criticized for producing technology and innovation in a vacuum. While research accomplishments were substantial, many business leaders believed that these efforts were not relevant to markets for lighting, building materials, automobiles and other products. This decade has seen an exponential rise in cooperation, planning, and cost-sharing with the private sector to assure that Federal research and deployment really do create the maximum value added. These process gains are exemplified by EPA's Green Lights and Energy Star as well as DOE's Industries of the Future and Buildings Roadmap programs.

Technology Deployment is Integral to a Successful Research Agenda

Some critics of DOE and EPA energy efficiency efforts have argued that while basic research is an acceptable activity of the Federal Government, deployment and market transformation are not.

The need for having deployment in the toolbox of DOE is illustrated by the story of the flame retention oil burner. DOE did not develop this technology. However, in response to the oil price shocks of the 1970's, DOE worked with the oil heat industry to field test and promote the technology as a substantial energy-saver. The key was a program to train fuel oil technicians how to install these advanced burners to yield the most savings for homeowners.

The subsequent realization by the oil heat industry of its attributes created demand, and adoption of the flame retention head oil burner increased about tenfold between 1979 and 1983. As of 1996, the technology was in use in about 7.3 million households, over half of oil-heated homes. The burner provides an 11–22 percent energy saving, Mr. Chairman, and, as of 1999, a conservative energy savings estimate of over $14 billion billion for consumers from a simple, existing technology—in large part due to deployment efforts by DOE. DOE's responsibility for this benefit can be traced to addressing barriers that were inhibiting wide use of the technology, and accelerating market penetration.

Federal Programs: Have They Returned Our Investment?

In 1996, Mr. Chairman, the General Accounting Office did a study of a variety of success stories which DOE had published in 1994. Unfortunately, the purpose of the study appeared to be political, and it attempted to discredit energy efficiency programs by attacking DOE's methodology for preparing the success stories. But rather than achieving this goal, it ended up validating billions in energy savings for a few key technologies which far outstrip out entire national investment in energy efficiency over the past 20 years.

Mr. Chairman, the accumulated success of these programs at saving money for American consumers and taxpayers is remarkable. The GAO study validated DOE's assertion that just five technologies developed or assisted by the DOE buildings program resulted in $28 billion in energy savings over the past 20 years for an approximate $8 billion in investment in all energy-efficiency programs as of 1994. DOE has updated results for those programs that credits these technologies with returning $50.9 billion to the U.S. economy through 1999. Add gains from the low-income Weatherization Assistance Program, State energy programs, and building and appliance standards work, and returns total $89.6 billion. Add FEMP gains and it moves to $101 billion. Add the hundreds of other technologies to come out of the business, industrial, and transportation programs and the additional accrued energy savings of the past 5 years and you get a portrait of an overwhelmingly cost-effective effort which has contributed significantly and directly to the quality of life of Americans.

Mr. Chairman, I have yet to know of another Federal program that has returned more than $100 billion to the economy for such a relatively small investment of $12.0 billion through 1999.

(The technologies are: low-emissivity windows, electronic ballasts, advanced refrigerator compressors, the flame retention head oil burner, and DOE-II building design software.)

By the same token, the EPA Energy Star and Green Lights programs, as well as other EPA climate programs, have already returned more than $40 billion in energy savings to to the economy from less than $750 million in Federal investment through 1999. In addition, these Federal partnerships with businesses, State and local governments, school districts, non-profits, and other organizations have yielded reductions of more than 300 million metric tons of carbon equivalent pollution.

It must be noted, Mr. Chairman, that these dollar returns are from just lower fuel and energy bills—they do not include the economic value of reductions in pollution, increases in productivity and comfort of employees and consumers, or national security benefits of oil imports.

A More Comprehensive Audit Must be Performed

Mr. Chairman, I believe we need an even more comprehensive review of the accomplishments of energy efficiency programs in the Federal Government that spans the work of DOE, EPA, the Agency for International Development, and other agencies. Until we get a clearer picture of the size and scope of the accomplishment of Federal energy efficiency efforts, we cannot fully assess their value in a climate change context.

Tax Credits

Numerous leading Senators and Representatives of both parties have introduced legislation to promote energy-efficient technologies. Rep. Bill Thomas of California has been a leader in promoting tax credits for energy-efficient new homes and for upgrading existing homes; Sen. Charles Grassley has done the same for highly efficient appliances; and Sen. Bob Smith has introduced legislation that covers homes, commercial buildings and other equipment. Perhaps most significantly, Senators

Murkowski, Lott and others included tax credits for energy efficiency in S. 388/S. 389, the Republican comprehensive energy package, and Senator Bingaman is expected to do so in his comprehensive bill.

These actions are a powerful bi-partisan endorsement of efficiency as an environmentally responsive energy policy. The Alliance strongly supports such efforts.

Public Benefits Fund

We are all familiar by now, Mr. Chairman, with the ongoing electricity troubles in California. These ills are now spreading to other States in the west, and Chicago, New York, and other eastern cities expect to experience shortages of electricity this summer. A reliable, affordable source of electricity is extremely important to Americans.

Public benefits spending, such as that which was assessed by the Rand Corporation for California has been immensely successful at delivering electric capacity cheaply, quickly, and cleanly. In fact, Mr. Chairman, we assert that the delivery of energy-efficiency measures is a cleaner, cheaper, and quicker strategy for assuring electricity supply in our cities than building new generation and upgrading transmission.

The bill that Sen. Bingaman is expected to introduce today will include a non-bypassable wires charge for electricity consumers that will go directly toward insuring reliability in the power supply, as well as helping low-income Americans meet rising costs, and assisting States in their efforts to bring greater renewable energy resources on line. We strongly support this public benefits fund for use to shore up huge gaps in public interest programs that deregulation has left by the wayside.

IV. ENERGY EFFICIENCY AND THE ECONOMY

Energy efficiency makes money and puts people to work. The economic gains from energy efficiency come in two forms. The greatest benefit comes from displaced costs—money that households and businesses can spend elsewhere because they no longer have to spend it on energy. That spending includes additional investment and hiring additional workers. Direct economic benefits come from growth in industries that generate energy-efficient products and services. Companies that sell insulation or efficient windows domestically and/or for export employ Americans in high-skill service and manufacturing jobs. Secondary economic benefits come from businesses and consumers re-spending these newfound energy savings in sectors of the economy which are more labor-intensive than energy supply.

Energy efficiency Must Be Measured as an Energy Source

Our energy system operates against the backdrop of a U.S. economy that has become significantly more energy-efficient over the past quarter-century. But we often fail to realize the actual contribution of energy efficiency to our GDP and national well being.

Mr. Chairman, it isn't easy to compare the contribution of energy efficiency to the environment and the economy with more traditional energy sources such as oil and coal. It requires the observer to regard saved or unused energy as created energy in the same way that oil comes out of the well and coal comes out of the mine. In addition, I think that any economist would tell you that energy efficiency measures have increased the supply of energy and thus helped to lower the price. Energy not used is just as salable and usable when conserved as when produced. Upgrades in energy efficiency made to home appliances, industrial equipment, building systems, or car and truck fleets serve as an energy source that increases our overall supply of electricity, coal, oil, and natural gas.

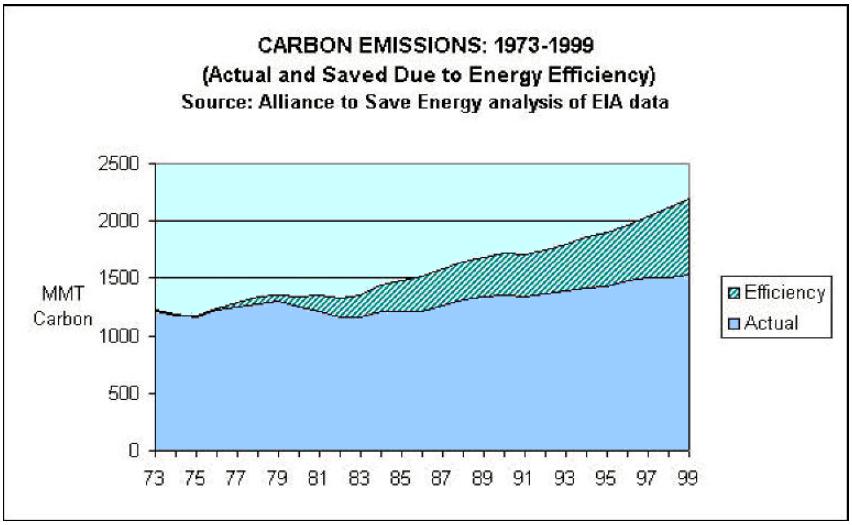
Energy-Efficiency, our Number 2 Energy Source in 1999

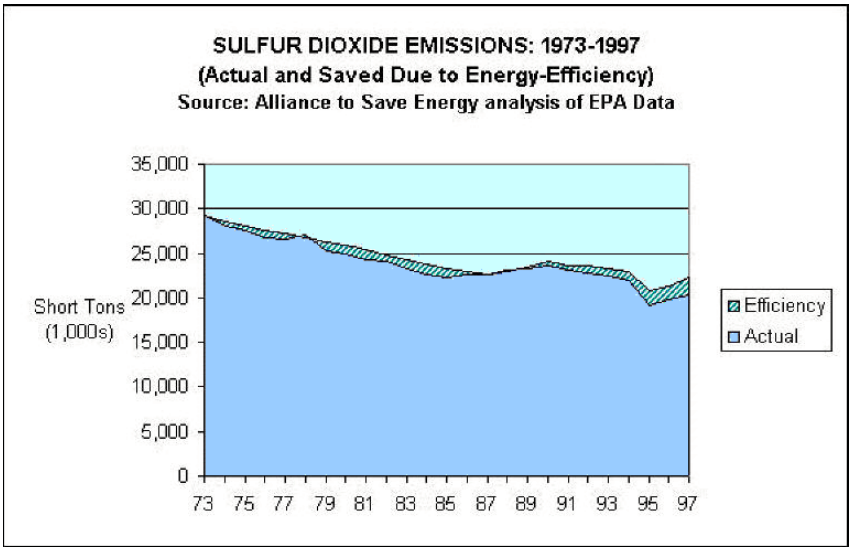
Alliance research shows that, for 1999, the most recent year for which we have complete data, energy efficiency was the second leading source of energy for U.S. consumption, and if we consider only domestic energy sources, it's No. 1. I might add, Mr. Chairman, this is an extremely conservative estimate, staying well within the tight parameters of Department of Energy modeling. Mr. Chairman, it would have been number-one if we declined to count oil imports, now more than half of this nation's oil consumption. Our analysis of 1999 energy consumption shows that energy efficiency provided the nation with 27 quadrillion Btus (quads), nearly 25 percent of U.S. energy consumption. While energy efficiency trails our mammoth oil consumption (38 quads), it significantly outstrips the contribution of natural gas (22 quads), coal (22 quads), nuclear (8 quads) and hydro (4 quads). (See attached chart.)

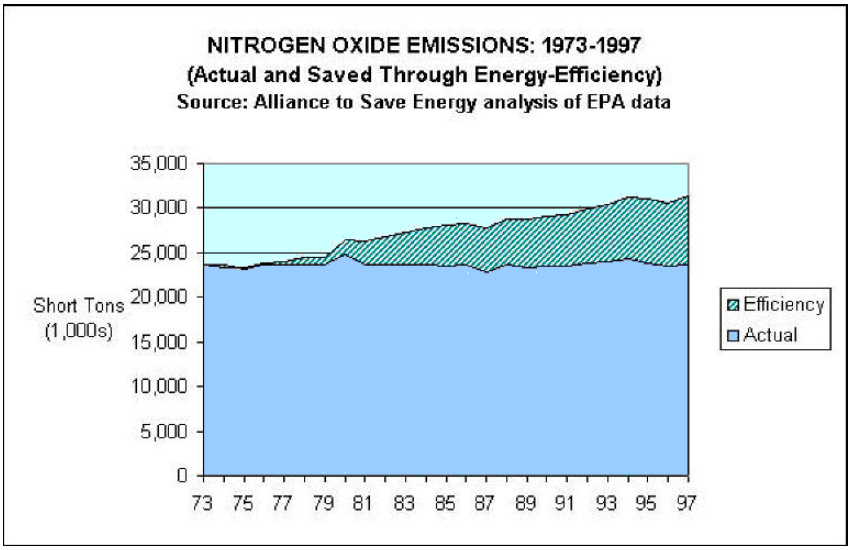
Mr. Chairman, the contribution of energy efficiency to our nation's overall supply is now so great that we cannot regard as an esoteric externality anymore. We must

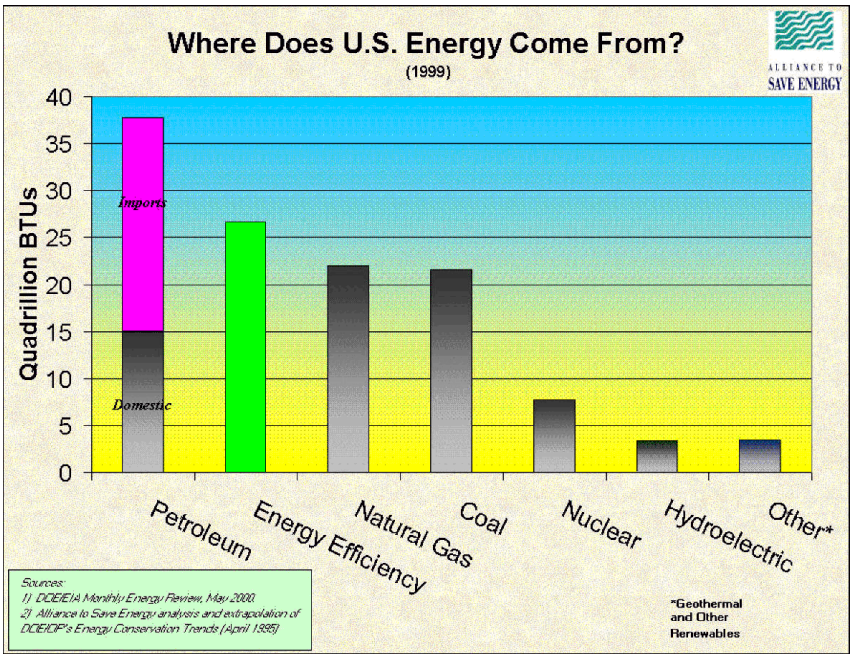
promote and support it in the same way we do the coal belt and the oil patch, which enjoy a variety of tax breaks and subsidies based on their use of fuel.

These figures show energy efficiency for what it is—an unparalleled driver of environmentally sound economic growth.









Mr. Chairman these economic snapshots of efficiency show an energy industry that spans the economy and the populace. But it is not an energy industry that looks like what we have known in the past. However, all the functions of traditional energy industries are represented. But with energy-efficiency, the miners are businesses trying to cut their costs. The roughnecks are homeowners trying to keep their families warmer in the winter. The geologists are mechanical engineers working to get more out of less. Energy efficiency is highly dispersed throughout the economy. Because of its diffuse nature, energy efficiency doesn't carry the political clout of the coal-mining regions, or of the oil and gas-producing regions. There is no "energy efficiency patch."

By the same token there is not a defined energy efficiency industry. Whirlpool makes highly efficient appliances but they sell washing machines and refrigerators, not energy efficiency. Honeywell sells controls that regulate building systems that can save a company millions of dollars a year, not energy efficiency. Owens-Corning sells fiberglass insulation which can make a house warmer, more comfortable, and more economical to live in, but they sell insulation, not energy-efficiency.

So when we have to make tough choices about what we do with Federal dollars, we must think about energy efficiency as what it is—an energy source that is essential for the economic health of our nation—and one that is paying off like a gusher for the American people. Yes, Mr. Chairman, that energy is produced cleanly, displacing both conventional air pollutants as well as ones believed by many to be causing a warming of the Earth's climate. It enhances our national security, as this year we again went to war to protect our interests in Mideast oil fields. Energy efficiency cuts costs for businesses and consumers, and it increases our international competitiveness—all the things we have traditionally talked about.

The tough choices on energy and climate must be made with a clear eye on the contribution to the environment, the economy, national security, and international competitiveness delivered in the past and promised for the future by energy-efficiency.

V. OTHER BENEFITS OF ENERGY EFFICIENCY

National Security

As historians consider the reasons for the Persian Gulf War, one must acknowledge that the U.S. went to war with Iraq in 1991 in large part to defend our critical oil interests in the region. Within the past year, we have again gone to war with Iraq to protect those same interests. When considered by economists, the billions which American taxpayers spent to protect those interests—never mind the dangers posed to a half a million American soldiers—should be added not onto our military or diplomatic budget, but onto our national expenditure for energy.

The U.S. has now crossed the line of being dependent for more than 55 percent of its oil consumption on foreign sources. Two-thirds of that habit comes from transportation. Without more aggressive research and innovation in automobile technology that situation will grow significantly worse in the coming decades for two reasons. One, U.S. consumption will continue to grow both in the number of vehicles on the road and the amount driven by each one. Two, the concentration of remaining global oil reserves will grow more consolidated in the Persian Gulf region as time goes on, making the U.S. more and more beholden to a region which demonstrates its volatility nearly every day. Consequently, U.S. dependence on foreign oil is projected to rise to nearly 60 percent within 10 years.

In the absence of congressional support for increasing Corporate Average Fuel Economy Standards (CAFE), the Partnership for a New Generation of Vehicles remains our best bet for the development of cleaner, more fuel-efficient cars with which to reduce our dependence on foreign oil supplies. This program has come under some criticism, and perhaps it is valid to question why the Big Three automakers require millions of dollars in Federal research to develop products that are less environmentally harmful. However, cleaner, more efficient cars remain a national priority, and PNGV is making progress. While much of the advancement made thus far through the program has been kept proprietary, the known advances in fuel cells and hybrids are getting us closer to clean cars. In fact, Mr. Chairman, the fact that this information is being kept proprietary is a good sign that progress is being made and that people are expecting money to be made in the future.

VI. INVESTING IN ENERGY EFFICIENCY: NOTHING TO LOSE AND EVERYTHING TO GAIN

Mr. Chairman, I have described here how energy efficiency has been a transforming force in the American economy, and how Federal energy efficiency efforts have played a key role in that expansion. Investments in research, development, and deployment of energy-efficient technology pay for themselves many times over in economic, environmental, and national security benefits. In addition, these are strides forward that would happen much more slowly or even not at all without Federal leadership.

Any evaluation of climate change programs must fully factor in the benefits of energy efficiency gains in any cost-benefit analysis. In order to do that, we must undertake a more comprehensive accounting of the benefits of Federal energy efficiency programs that began 25 years ago, and have continued through today.

Mr. Chairman, I believe that due to their contribution to environmental quality energy efficiency efforts at DOE, EPA and other agencies should be escalated. Accordingly, I am deeply troubled by reports in the press—that appear to be accu-

rate—that the Bush Administration will be deeply cutting the DOE efficiency programs when it makes its fiscal year 2002 budget recommendations in early April. I cannot imagine a worse way to face our nation's multiple energy crises and our environmental demands than by cutting energy efficiency programs. I have yet to learn of a Federal investment that has yielded such rich rewards so broadly dispersed over the economy.

Thank you for the opportunity to testify before your committees today. I'm happy to address any questions you might have.

STATEMENT OF DAVID G. HAWKINS, DIRECTOR, AIR AND ENERGY PROGRAMS, NATURAL RESOURCES DEFENSE COUNCIL

Mr. Chairman, members of the subcommittee, thank you for your invitation to testify on behalf of NRDC, the Natural Resources Defense Council, regarding the Clean Air Act and national energy policy. NRDC is a nonprofit citizen organization dedicated to environmental protection, with more than 400,000 members nationwide. Since 1970, NRDC has followed closely the implementation of the Clean Air Act and has sought to promote actions under the law that carry out Congress' policy decisions to protect public health and the environment from harm caused by air pollution.

With all respect to the subcommittee, my first point today is to suggest that the title of this hearing does not capture the issue before us. Rather than discussing ways to change the Clean Air Act to harmonize with an independently determined national energy policy, we need to define our tasks as identifying the goals that are important to Americans in the areas of energy, public health protection, and environmental quality and then designing energy and clean air policies that support these goals. I think any objective view of the historical record would demonstrate that the way we have pursued our energy goals in the past has interfered with Americans' desire for clean air, rather than the other way around. Today's hearing appears to be prompted by concerns that the Clean Air Act is interfering with meeting the nation's energy needs. While I welcome the opportunity to speak to these claims, I think it would be healthy for your sister committee, the Senate Committee on Energy and Natural Resources, to hold a hearing to review widespread concerns regarding the impact of our energy policies on public health and the environment. NRDC certainly would appreciate any encouragement you can give your colleagues on that committee. Perhaps Senators Campbell, Graham, and Wyden, who serve on both committees, could form an Health, Energy, Environment Harmony Caucus!

In this testimony I would like to touch on three topics: the need to clean up electric power plants, the flaws in President Bush' change of position on including carbon dioxide in that program, and the role of new source pollution control requirements in the nation's air quality management program and useful improvements to that program.

I. THE NEED FOR A COMPREHENSIVE PROGRAM TO CLEAN UP POLLUTING POWER PLANTS

Today, electricity generation imposes an enormous burden of air pollution on the American public and the great bulk of that pollution comes from plants that are not meeting technically feasible, affordable modern environmental performance standards. This fact is the product of actions, both lawful and unlawful, that have resulted in an electric generating fleet that is older, dirtier, and less efficient than is needed to protect health and the environment.

As I explain in greater detail in Part III of my testimony, Congress in 1970 drew a distinction between existing pollution sources and sources that are new or modified: new and modified power plants were required to minimize air pollution through performance standards based on state-of-the-art clean power techniques, while existing, unmodified plants were required to clean up only to the degree needed to address local air quality problems.

There were several reasons for this approach. First, most air quality problems were perceived as local. Second, at the time, the electric power industry was mostly a local one. Third, the exemption was assumed to be temporary-Congress believed existing plants would retire and be replaced by new ones meeting modern performance standards.

Now, nearly 30 years later, the facts on the ground have changed. We know now that many of our most threatening air pollution problems are not local-they are regional, national, and even global. Our electric generating industry is rapidly becoming a national industry with all parts of the country connected by wires over which the product can move anywhere in three large regions of the lower 48 States. And those powerplants that were supposed to retire have, by lawful and unlawful means,

kept on running like the Energizer Bunny. As a result, pollution from electric power generation is a dominant cause of nearly all our most pressing air quality related problems.

Four pollutants cause a host of public health and environmental damage: sulfur dioxide, nitrogen oxides, mercury, and the pollutant no one can get away from, carbon dioxide, the dominant greenhouse gas. Electric generation in the U.S. is the largest single source of these four horsemen of air pollution. Electric powerplants release over two-thirds of total U.S. emissions of sulfur dioxide; they release 40 per cent of U.S. carbon dioxide; and they release about one-third of the nation's nitrogen oxide and mercury pollution.

These pollutants are responsible for a Pandora's box of health and environmental harm:

- fine particles, formed from sulfur and nitrogen emissions, that contribute to tens of thousands of premature deaths in the U.S. each year;
- smog, that plagues our major cities, and causes respiratory attacks in kids and seniors;
- acid rain, that still damages lakes, streams, forests, and monuments;
- regional haze, that spoils trips to national parks for millions of visitors annually;
- nitrogen emissions, that help over-fertilize estuaries, including the Chesapeake Bay, Long Island Sound, Pamlico Sound, and the Gulf of Mexico, leading to dead zones where aquatic life perishes;
- mercury contamination of lakes and streams, that has lead 40 States to issue continuing advisories of the fish that store this toxin; and,
- carbon dioxide driven climate change, that threatens—
- to kill millions of people through more destructive floods, droughts, heat waves, intense storms, and climate-related infectious disease;
- to produce sea-level rise that would inundate the homes of tens of millions of people and cost hundreds of billions of dollars in damages and for countermeasures in those countries with the resources to respond; and
- to destroy complex ecosystems that have evolved over thousands of years under the influence of climate cycles that were not destabilized by fossil fuel combustion.

Consider also the energy we waste with current generating technology. Today's fossil generating plants are about 34 percent efficient in converting the chemical energy found in fossil fuels into electricity. What that means in real terms is that we must mine three tons of coal and pollute the air with the emissions caused by burning three tons of coal just to get electricity with the energy equivalent of one ton of coal. In fact, the energy we waste each year in making electricity is greater than the total energy in all the coal we burn each year in the United States. Stated another way, if we could increase the efficiency of our power plant fleet from about 34 percent to around 68 percent, we would cut sulfur, nitrogen, mercury, and carbon pollution from electricity generation in half, even with no change in the fuel mix.

Our plague of pollution problems and wasted energy is the result of policies and practices that still allow 30-, 40- and 50-year old plants to keep operating without meeting modern performance standards for pollution or efficiency. In addition to harming health and the environment, the de facto grandfather status of most of today's power plants creates unfair competition in the electricity market. In effect, the patchwork of lenient or nonexistent rules at the State and local level, combined with evasion of Federal requirements, has created pollution havens where grandfathered plants can engage in domestic environmental dumping, distorting fair energy markets.

As we move to modernize the electricity market economically, we must accompany it with modern environmental performance measures. A central purpose of electric industry restructuring legislation is to create a free and fair, competitive market for energy services. But fair competition is impossible in an environment where air pollution performance requirements are balkanized. Because electricity markets are connected by wires, different pollution standards promote a "survival of the filthiest" market, where the power plants that are the dirtiest, run harder because they can slightly underbid cleaner generators.

These market distortions do not deliver consumer benefits. The price differences caused by different pollution requirements are quite small-usually 2–3 mills per kilowatt-hour or less-but these small differences are enough to give dirtier producers a decisive market advantage in many areas. The market distortions also discourage investment in new, cleaner, more efficient generation and in renewable resources.

Under the current rules, an entrepreneur who seeks financing for, say, a clean, high-efficiency natural gas plant can point out that it emits no sulfur, no mercury, and much less nitrogen oxides (NOx) and carbon dioxide (CO_2) than the competition.

But, with the partial exception of sulfur (for which allowance programs exist under the acid rain law), this superior environmental performance has no economic value in the market place. The financier wants to know whether the plant will be able to run more cheaply than the competition. If the competition is a group of grandfathered coal-fired power plants, the answer often will be no, and financing may go to a higher-polluting new plant rather than a clean one.

To address the egregious health, environmental, and economic flaws in the current air pollution control programs, a number of bills were introduced in the last Congress and last week the bipartisan "Clean Power Act of 2001," S. 556, was introduced in the Senate. Among its lead sponsors are three members of this committee, Senators Lieberman, Clinton, and Corzine. The Clean Power Act establishes industry-wide caps on tons of each of the "four-horsemen" pollutants: sulfur dioxide (SOx), NOx, CO_2, and mercury. The caps on SOx and NOx would provide building blocks for meeting health-based smog and fine particle standards (challenged unsuccessfully by industry in the Supreme Court) and would reduce acid rain further. The mercury cap would attack the largest single remaining U.S. source of this pollutant. And the CO_2 cap would return the industry's emissions to 1990 levels-the target set in the 1992 Rio Climate Treaty that the first President Bush signed and that the Senate has ratified.

With the exception of mercury, for which there are both local and regional concerns, the bill would implement the cap through market-based approaches where power generators could trade their clean-up obligations to meet the caps in the most efficient manner. One possible market mechanism, a "generation performance standard," would define the amount of pollution that could be legally emitted for a kilowatt-hour of electricity from fossil generation, thus creating a level playing field for those generators. This system will directly reward cleaner, more efficient generators.

In contrast to the current situation, if the Clean Power Act were now law, a developer of a new clean power plant would be able to show direct tangible economic benefits from its reduced environmental impact. Because the new plant would be able to generate electricity below the average pollution performance required under the law, every kilowatt-hour generated would also generate another source of revenue: emission allowances that can be banked or sold on the market. This additional revenue stream would make financing such projects that much more attractive.

A final benefit of these integrated pollution cleanup bills is that they provide a clear roadmap for business in planning long-term investments. The history of clean air progress has developed as a series of unconnected initiatives, typically focused on a single pollutant. Today, we can survey the next 10–15 years and be confident that additional measures will be pursued to reduce the four horsemen pollutants. But if we pursue the traditional approach, no one can say now with confidence, when, how deep, and in what order these important steps will occur.

As a result, business planners must approach today's investments by making educated guesses about environmental requirements. Billions of dollars are changing hands as generation plants are sold under State restructuring programs. One thing we can say for sure is that someone is guessing wrong. By enacting integrated cleanup programs, Congress could both provide certainty and reduce the tendency to prolong dependence on existing outmoded plants through the traditional process of applying end-of-pipe cleanup devices normally aimed at controlling only one pollutant.

In short, we know we need to reduce a range of damaging pollutants from the electric generating sector; we know how to do it; and we know that failure to take these steps now will increase damage, prolong uncertainty, and encourage unfair competition. Mr. Chairman and members of the subcommittee, we hope you will seize the opportunity presented by the Clean Power Act to harmonize clean air and energy goals. By doing so you can address the key issues that face the industry and the public in a manner that produces a cleaner, more efficient, more sustainable, and more competitive electricity market that delivers energy services for lower costs.

II. PRESIDENT BUSH' POSITION ON CARBON DIOXIDE

As you know, on March 13, 2001, President Bush announced that, despite his campaign promise to support emission reductions for all four major pollutants from power plants, including carbon dioxide, he now opposes inclusion of CO_2 in a power plant control bill. You may also know that NRDC and virtually every other environmental organization strongly objected to the President's change of position, the reasons he gave for his decision, and the way in which he made his decision.

From what I have said in Part I of my testimony you can understand that NRDC believes that control of carbon dioxide from power plants is as critical to health and

the environment as control of the other three pollutants. Requiring the electricity industry to return its carbon emissions to 1990 levels is a practical and necessary first step in demonstrating that the U.S. intends to honor its commitment under the 1992 Rio Climate Treaty, which, as I said, has been ratified by the Senate. Failure to include carbon dioxide in a clean-up bill would mean the legislation would not be comprehensive. By decoupling carbon emissions from control strategies on the other three pollutants, a limited bill would increase the tendency for plant owners to make short-sighted investments in control methods that might reduce sulfur, nitrogen, and mercury but would perpetuate high levels of carbon emissions. Indeed, a narrow-focus strategy that slaps controls on inefficient, outmoded generators could well extend the life of such facilities further, wasting energy and making it more difficult and costly to reduce carbon when Congress decides (as I believe will happen) to take on that threat to planet. A narrow bill would send a confusing signal to investors: is carbon really off the table or will it be put back on in a couple of years just after we have selected a strategy that ignores that pollutant? A two-step program to control the four major pollutants from electric generators will cost consumers more in the end than enacting a comprehensive bill now.

Let me turn to the reasons President Bush gave in his March letter for his about-face. The first reason cited by the President is his claim that carbon dioxide is "not a 'pollutant' under the Clean Air Act." To start, the claim that carbon dioxide is not a Clean Air Act pollutant is irrelevant as a justification for abandoning his pledge to support a new law (imagine President Lincoln announcing he would oppose adoption of the 14th Amendment because he had learned that the original Constitution did not prohibit discrimination). However, President Bush is wrong on the law as well as on his logic.

To my knowledge, the only official interpretation of the status of carbon dioxide under the Act was issued in a legal memorandum prepared in April 1998, by the chief agency officer authorized to interpret the Act, EPA General Counsel Jonathan Z. Cannon (copy attached). In his memorandum, Mr. Cannon concluded that while not yet covered by regulations issued under the Act, carbon dioxide met the statutory criteria for a "pollutant" as the term is defined in the law. Indeed, as pointed out by Mr. Cannon, carbon dioxide is mentioned by name in a list of multiple pollutants from fossil fuel power plants for which Congress directed EPA to develop pollution prevention programs. Sec. 103(g). To be sure, this section of the law does not by itself confer authority on EPA to regulate carbon dioxide, just as it does not provide regulatory authority for any of the other pollutants listed in section 103(g) that EPA has regulated under other provisions of the Act. While lawyers will argue about the scope of EPA's current authority to regulate carbon dioxide, the Act is clear that carbon dioxide is a pollutant. (See attached NRDC Fact Sheet.)

Perhaps some will argue, Mr. Cannon was general counsel in the last Administration and we now have a new president. It is true that President Bush is the Chief Executive of the United States but his oath under the Constitution is to faithfully execute its laws, not to make them up. If President Bush did not rely on Mr. Cannon's existing interpretation of the Act, on what official's legal interpretation did he rely? Was a memorandum of law prepared for the president's consideration? If so, by whom? We don't know the answers to these questions and we should know, to promote confidence in the way the president reaches his decisions.

President Bush' second reason for changing his position was an assertion that including carbon dioxide in new legislation would lead to significantly higher electricity prices. Was this conclusion based on any analysis performed by his Administration? Apparently not. His letter cites one report for the high cost conclusion: "Analysis of Strategies for Reducing Multiple Emissions from Power Plants." I will say more about this report in a moment. First, let me point out that while the president apparently did not ask his own appointees to prepare an analysis for him, there were four other reports done in the last 6 months regarding the costs of programs to reduce power plant emissions of carbon dioxide. The other four studies, including a November, 2000, Department of Energy report, Scenarios for a Clean Energy Future, concluded that substantial carbon dioxide reductions from the electric sector could be achieved at very low costs. For example, the DOE "Clean Energy Future" study found that electric sector carbon dioxide emissions could be reduced to 1990 levels with a net increase in Americans' energy bills of less than 1 percent in the year 2010 and with large energy bill savings in later years due to more efficient use of energy. Citations to this and the other studies are attached.

Thus, there were five studies the president could have consulted regarding the costs of carbon controls-four that found low to modest costs and one outlier that forecast high costs. Unfortunately, his letter leaves the impression that his staff seized on the EIA analysis, not based on any broad review of the issue but because it contained the conclusion that could be used to rationalize the president's change

of position. If this is correct, it is quite striking. The president made an explicit and clear policy commitment during the campaign. His surrogates repeated his pledge in additional public appearances during the campaign. One would think that before abandoning such an explicit promise, the president would have directed a thorough review by his own Administration team of policy options and the costs of those options to determine whether there was a real conflict between his promise and Americans' energy goals. At the very least, one would have hoped that the president's staff would have recommended a process that included an examination of all relevant recent analyses and, when presented with a conflict in those analyses, that more time would have been taken to determine which cost analyses were more reliable. While the president's letter states the information he received "warrants a reevaluation," he didn't announce he was undertaking a reevaluation. He just made a decision that flatly contradicted his campaign pledge. All of these facts suggest that careful policy analysis had very little to do with the president's decision.

What should we make of the report cited by the president? While he called it a "Department of Energy Report," the analysis is, in fact, a "Service Report" prepared by the Energy Information Administration (EIA) for submission to former Congressman David McIntosh in response to his request for an analysis of emission reduction scenarios specified by the Congressman. Now EIA is respected for its analytical capabilities but it is also clear that when Congressmen McIntosh requested the analysis, his staff knew before the EIA computers were turned on that the result would forecast high costs for carbon controls. Given Mr. McIntosh' vehement opposition to any form of carbon emission reductions, this prospect probably did not make him unhappy.

Is EIA's predictable result due to deliberate deception by EIA? Certainly not. It is an artifact of the approach EIA used to evaluate the policies specified by Mr. McIntosh. The analytic approach and assumptions that EIA adopts in modeling electric services options guarantee that any policy aimed at significantly reducing carbon from electricity generators will be calculated as having a high cost. One would have more confidence in the reality of this prediction if there were no credible conflicting conclusions. But, in fact, the Department of Energy Clean Energy Future study I mentioned above, uses the same model run by EIA and reaches dramatically different conclusions. A principle reason for this is that in DOE's runs, analysts incorporate a number of sensible policies designed to help Americans use electricity and natural gas more efficiently. These policies lower consumer energy bills and make it possible to clean up power plants at much lower costs. For example, the DOE analysis ignored by the president includes policies found in Chairman Smith's recently reintroduced Energy Efficient Buildings Incentives Act, S. 207, also sponsored by Senators Reid, Lieberman, and Chafee of this committee. By examining a harmonized set of energy and clean air policies such as those championed by Chairman Smith, the DOE Clean Energy Future report comes much closer to the truth about the costs of smart carbon reduction programs than the EIA service report done at Mr. McIntosh' request.

President Bush also refers to concerns about current high energy prices in California and other States as supporting his new position on carbon dioxide. This point really does not withstand analysis. Prices are high today and generation capacity in California and the West is constrained. But any legislation enacted by Congress for power plants will not affect energy supplies today. Instead, a reduction timetable will be some years in the future, allowing time to install pollution controls and for repowering or replacement of the very plants whose breakdowns contributed to California's problems in the last year. As explained in attached NRDC fact sheets, environmental requirements have not caused today's electricity price and supply problems and no amount of scapegoating will change the facts or improve our chance of designing effective remedies.

Finally, I must comment on the president's statements regarding the Kyoto Protocol in his letter. Just last month the president's foreign policy officials requested and received a delay in the resumed meeting of the parties to the Rio Climate Treaty, previously scheduled for May 2001. The State Department requested this delay because, it told other countries, the Administration was conducting a comprehensive review of climate change policy that could not be completed by the May meeting.

How is that need for a thorough review to be squared with the president's apparently definitive denunciation of the Kyoto agreement in his letter? Granted, in this case, his statements are consistent with views he expressed on the campaign trail. But why not await the review he has promised before reaffirming views he formed without benefit of such an analysis? The president says the Kyoto agreement would "cause serious harm to the U.S. economy." What analyses did he review in reaching this conclusion? The previous Administration published analyses concluding that compliance with the agreement would have less than a 1 percent impact on fore-

casted GDP, equivalent to adding no more than a month or two to a 10-year forecast for achieving a vastly increased level of wealth in this country. The president may well disagree with the previous Administration's analysis but on what basis? Wouldn't he and the American public be benefited by preparation of the best objective analysis that the new Administration is capable of producing? Why the hurry to issue the verdict before hearing the evidence?

The other thing the president had to say about the Kyoto agreement was that it was unfair because it does not establish the same reduction targets for China and India as for the United States. In my opinion, this is a shameful statement. Consider that the U.S. and other developed countries are among the wealthiest nations on earth and that they have put into the atmosphere about 75 percent of the carbon dioxide that has accumulated since the start of the industrial revolution 150 years ago. Consider also the relative economic ability of the U.S., India, and China to take the first steps in demonstrating that we can fight global warming. The mortality rate for children under 5 years old in India is 13 times higher than in the U.S.; China's mortality rate for these children is 6 times higher than ours. In India, close to half the population attempts to survive on less than $1 per day; in China, one in five people lives on this level. Consider electricity consumption: the average American uses more electricity in a day than the average person in India uses in a month; compared to China the average American uses more electricity in a month than a Chinese person uses in 15 months.

For the president to demand that India and China make equal commitments to control carbon dioxide as a condition for the U.S. to take a first step along with other wealthy nations, flies in the face of Americans' vision of our country as a compassionate and responsible world citizen. America's heart is bigger than this. The president spoke of compassion during the campaign and I have to believe his heart is bigger than this too.

There is a practical point to be made here as well. China and India are important nations to engage in global strategies to fight climate change. The U.S. certainly needs a strategy to break down barriers with these countries and produce a more cooperative basis for discussion of all countries' global warming responsibilities over time. But what possible strategy could underlie the President's decision to single out China and India for criticism in his letter? Did Secretary of State Powell advise that this would be helpful in moving those two countries to a position that is less contentious on this issue? That seems unlikely.

NRDC hopes the president actually will evaluate and reevaluate his positions on carbon dioxide from power plants and the Kyoto agreement, rather than flatly reversing one position and restating the other with no current analysis to inform his decisions. If he does so, he could rebuild some badly needed bridges that are now in flames.

III. THE CLEAN AIR ACT'S DUAL-TRACK AIR QUALITY STRATEGY

Now I want to turn to the role of new source review under the Clean Air Act. Members who read my testimony before this subcommittee in February, 2000, will find this material familiar, since I repeat in this section, what I said at that time.

In 1970 Congress adopted a dual-track program to protect and enhance our nation's air quality. The first program calls on States to adopt comprehensive pollution control programs under State law to achieve air quality objectives set forth in National Ambient Air Quality Standards (NAAQS) adopted by EPA. This ambient program is an example of the "assimilative capacity" approach to environmental management-based on the belief that the environment can assimilate a certain amount of dirt or toxins released from human activities without causing identifiable harm. This approach starts by identifying exposure levels of pollution that current research indicates may be tolerable for humans and ecosystems and then seeks to reduce emissions from pollution sources enough to meet the maximum tolerable exposure targets.

The 1970 Act's ambient management program strengthened previous efforts enacted by Congress in the 1960's and relied on States to set control rules for pollution sources at levels just tough enough to bring total pollution down to the level of the national ambient standards. Implicit in this approach is that an area's air quality determines the amount of clean-up required of sources. Even if there are readily available means of reducing a source's pollution, a State is not required to adopt such measures if not needed to meet the NAAQS.

But Congress did not rely exclusively on the assimilative approach to air quality protection in the 1970 Act. Congress adopted another strategy designed to minimize air pollution by requiring sources to meet emission performance standards based on modern "best practices" in pollution abatement. The performance standard approach

does not set required levels of control based on the air quality conditions of particular areas. Rather, the required emission reductions are determined by assessing how much polluting processes can be cleaned up, taking account of technical and economic constraints.

Congress expected that future ambient goals would likely be more ambitious than 1970's defined goals and wanted an independent program that would be effective in reducing total emissions over time. Congress' intent in the performance standard program was to use the force of new purchases and investments to incorporate advances in pollution prevention and control as a complementary strategy to the ambient management program.

Congress applied the performance standard approach to both stationary and mobile sources but with some important distinctions. In the mobile source area (cars, trucks, buses), only entirely new vehicles were subject to federally established modern performance standards. Congress was presented with analyses demonstrating that with traditional rates of "fleet turnover," most of the benefits of tighter new car standards would be experienced in less than 10 years.

In requiring performance standards for stationary sources, Congress adopted more sweeping provisions. The Act requires that both new and modified stationary sources must meet modern performance standards. Congress in 1970 also adopted a very expansive definition of "modification," to assure that environmental performance would improve as investments were made.

The 1970 Act's principal tool for improved pollution control for new and modified sources was the New Source Performance Standard (NSPS), a national, categorical requirement based on very good, but not the best, pollution minimizing practices. In 1977, when the Act was amended, Congress adopted the new source review (NSR) and prevention of significant deterioration (PSD) programs to strengthen efforts to minimize emissions and air quality impacts from new and modified sources.[1] In the 1977 Amendments Congress expanded both the scope of the rigor of the requirements for improved performance from new and modified sources. Coverage would no longer be limited to the categories for which EPA had adopted NSPS requirements; rather all new and modified sources above certain pollution tonnage thresholds would be required to minimize their emissions. Second, the level of the performance requirement would not be tied to often out-of-date NSPS; rather case-by-case determinations of current best performance would be required. Third, covered sources locating in clean areas as well as dirty areas would have to pass ambient impact tests to prevent a worsening of air quality. In 1990, Congress again increased its emphasis on pollution prevention from new and modified sources, reducing the size thresholds for coverage in badly polluted areas.

In sum, Congress has repeatedly endorsed the concept of modern performance standards for new and modified pollution sources, adopting, in successive amendments, strengthened requirements intended to make the NSR programs more effective in reducing pollution.

However, these programs have for 20 years been the subject of criticism from industry representatives and from many academic economists. The economists' argument runs, "why should new sources be regulated more strictly than existing sources? After all, air quality is determined by how much pollution is released and where it is released. The air certainly cannot tell the difference between a pound of pollution from a plant built in 1965 and that from a plant built in 1995."

Critics of the Act's new source requirements argue that instead of regulating new and old sources differently, we should simply establish our desired air quality objectives and allow them to be met by the most efficient means. Under this approach, agencies first would do research to identify the adverse effects of air pollution on health and welfare; next, agencies would convert this research into environmental standards; then, the agencies would design pollution control programs to achieve the environmental standards; finally, agencies and pollution sources would implement the pollution control programs and the air would become cleaner.

This critique and prescription has a certain superficial appeal. As I have mentioned, the ambient management program has been a central program of the Clean Air Act since 1970 and it should continue. The question is whether it is prudent to rely on the ambient standards approach as the only strategy for improving and protecting air quality. In my view that would be a mistake.

The 1970 and later Clean Air Acts reflect a judgment by Congress that the ambient standards approach should be the major pollution control strategy but that it should be complemented by other independently functioning programs such as the NSR and Mobile Source Emission Standards programs. I think that this judgment

[1]For simplicity, for this testimony I will refer to these programs generally as NSR. 2 Chevron, U.S.A., Inc. v. NRDC, 467 U.S. 837 (1984).

was a wise one. The history of air pollution control efforts both before and after the 1970 Act reveals that the ambient standards approach, while conceptually sound, has its weak spots, which when exploited by well-organized opposition, can prevent the program from solving air quality problems in a timely fashion.

First, the Government's capacity to acquire unambiguous information about natural processes is very limited. The research is complex, expensive, and time consuming. Due to perennial shortages of money, talent, and time, most of the studies undertaken in the past and those being conducted now are less than perfect. As a result, their conclusions are easy to pick apart and dismiss as not dispositive. Moreover, the health effects we are concerned about are increasingly related to chronic exposures to low levels of combinations of pollutants. We have never conducted an adequate study to characterize the effects from these kinds of exposures and none is even planned.

The uncertainties in what we know about air pollution effects in turn lead to controversy and delay in establishing environmental standards. All of us, including this committee, have experienced this controversy in the continuing disputes about EPA's revised ozone and particulate standards.

The next step in the process—control program design—can also be affected. Different interests argue at length about how emissions in a particular location relate to air quality in that location or elsewhere. This can and has led to uncertainty, controversy and delay in designing pollution reduction programs to meet environmental standards. The continuing fights over efforts to address transported air pollution are an example of this problem.

Another weak spot in the ambient standards abatement program is that it often requires large changes in established patterns of behavior. When an air pollution control agency adopts a regulation that applies to an existing source it is trying to get firms to spend their money, time, and thought in ways they have not planned. Not surprisingly, these firms often resist, which leads to uncertainty, controversy and delay in the final step of the ambient standards approach, the actual implementation of pollution reduction measures in the real world.

This resistance to change often feeds back to the first step in the ambient standards process, setting the standards themselves. Pressure is mounted to weaken existing standards and to oppose the setting of new ones. Again, the unified fight of industrial polluters against the revision of the ozone and particulate standards highlights this problem.

These weaknesses do not call for abandoning the ambient standards approach. But they do suggest the wisdom of complementing that approach with programs that are strong where the ambient approach is weak. The Act's NSR programs meet that need. Implemented properly, these programs can assure that as new well-controlled sources replace old ones, we will make progress in reducing emissions as our economy grows. By controlling the major pollutants, the new source programs also serve as a hedge against unidentified risks associated with those pollutants. By dealing with engineering facts rather than biological facts, the new source programs usually involve more manageable factual controversies. We are relatively good at measuring the dollar costs of meeting performance standards and calculating the emission reductions such standards can provide. Finally, by focusing on new and modified sources, the new source programs can lessen the social and political costs of reducing pollution. Because they operate at the time firms are making new investments, these programs allow firms to plan pollution prevention and control into their plant operations.

All of this does not argue that the new source programs should replace the ambient program, only that they should complement that program. For the new source programs have weaknesses in areas where the ambient program performs better. The new source programs focus on the highly technical details of engineering and thus are too insulated from effective public participation. Controlling pollution only from new sources often is not the cheapest way to achieve a unit of emissions reduction. In my view, the premium we pay to accomplish reductions where the ambient program has failed to deliver them is a prudent investment, but controls on new and modified sources should not be our only program. Finally, new source programs, because they are technology based, do not guarantee a desirable level of environmental quality. We will degrade our air quality unless we improve pollution reducing methods and processes at least as fast as we grow. The new source programs do not create adequate incentives for such improvements and thus must be complemented by the ambient standards and PSD programs which do recognize that clean air is a scarce resource.

In sum, the Clean Air Act's dual track approach to air quality management employs the principle of diversification to reduce risks. In an uncertain world, a prudent investor will forego putting all her money into the one stock with the apparent

highest yield. Instead she will spread her risk by selecting a range of investments-some which offer high risk and high yield and others which offer less risk and less yield. Similarly, the Act resembles a stable ecosystem which has a diversity of species. Such systems are much less likely to fail in the face of adversity than systems that have no diversity.

IV. How Should EPA's NSR Programs be "Reformed"?

NRDC has participated over the last decade in stakeholder discussions convened by EPA to consider ways to improve the Act's NSR programs. A major reason these talks have made little progress is the lack of agreement on the purposes of these programs. There are two major purposes: to assure that new investments do not degrade air quality and to assure that when new investments are made, emissions are minimized by requiring sources to meet performance standards that reflect modern emission prevention capabilities.

While a great deal of attention has been paid to the complexity of the NSR permitting process, the larger environmental failure of the NSR program is that the program has not brought down emissions as Congress intended. Citizens, pollution control agencies, and Members of Congress are increasingly aware of the fact that grandfathered air pollution sources are more and more the central impediment to clean air progress. Contrary to the intent of Congress, investments in new production have not resulted in existing grandfathered sources being replaced by facilities that must meet modern performance standards. As a result, grandfathered sources dominate the pollution inventory throughout the United States.

The degree to which old stationary sources determine our nation's burden of air pollution is striking, especially when compared to the impact of old cars on pollution loads. For example, fossil electric powerplants built more than 20 years ago are responsible for 84 percent of total U.S. nitrogen oxides (NOx) pollution from that sector and 88 percent of sulfur dioxide (SOx). In contrast, 20-year-old cars contribute less than 7 percent of U.S. car NOx pollution and 3 percent of that sector's VOC (volatile organic compounds) pollution. It is obvious that the Title II new mobile source program has done quite a good job of preventing old cars from dominating today's pollution problems but the Title I new stationary source program has performed miserably on this score.

There are some obvious reasons for the NSR program's poor pollution reduction performance. First, the rules themselves contain too many loopholes that allow sources to avoid NSR even though they continue to make significant investments year after year. Second, as recent enforcement actions have alleged, there are many instances of firms escaping the requirements of the rules by misclassifying projects in an unlawful manner.

Reform of the NSR program should address its failure to produce pollution reduction from old grandfathered sources as a priority issue as well as explore ways to simplify the NSR process. A genuine reform of the program should aim to make two basic changes: the program should apply to more industrial projects than it now does and the review process should be streamlined to enable decisions to be made quickly while protecting the public's right to participate. Instead, the "reform" proposals EPA has published over the last decade have concentrated almost entirely on changes that would expand the loopholes of the current rules so that even fewer grandfathered sources would be required to clean up as they upgraded their capital equipment.

The combination of categorical exemptions and exclusions, weak rules for calculating emission increases, and broad provisions for "netting out" of review allow far too many sources to avoid the NSR program indefinitely. When illegal evasions of the rules are added to the many exemption opportunities in the rules, we get the results we see-most sources never encounter the Federal NSR program and their pollution remains with us. NRDC has filed lengthy comments with EPA on these issues over the years and I will not burden the subcommittee with a recitation of the details here. I would like to mention one area-that of "netting." Netting is the jargon for a transaction that allows new projects at existing sources to escape NSR. In essence it allows the source operator to count "reductions" from grandfathered pieces of polluting equipment at the site in calculating whether a new project will result in an emission increase that would require new source review. By allowing sources to avoid the modern performance requirements of NSR, netting preserves the status quo, perpetuating excessively high levels of pollution originally emitted by poorly controlled, grandfathered pollution sources.

Netting rewards sources that have managed to manipulate the current system to preserve high levels of emissions. Current netting policy allows those high emission levels to function as an asset that can be deployed to avoid NSR/PSD review. Thus, netting operates at cross purposes with sound air quality objectives. It creates incentives to keep emissions at unnecessarily high levels and perpetuates an inefficient

allocation of emission "shares" by providing the greatest rewards to the most polluting sources. Netting frustrates one of the primary objectives of the NSR/PSD program, which is to link requirements for modern emission performance standards to investments, so that emissions are reduced as the economy expands. Instead, netting allows existing emission levels to be perpetuated indefinitely.

While the netting rules are complex, the fundamental problem with the approach is easy to understand. Netting allows a grandfathered pollution source to "bequeath" its excessive pollution privileges to its descendant, the new piece of equipment. Under netting, the new piece of equipment is not required to meet modern performance standards; it can emit at much higher levels by relying on the pollution entitlements transferred from old, grandfathered pieces of equipment. In this way, excessive amounts of pollution can live on long after the original sources have disappeared. Netting resembles the former hereditary peerage system in England, where membership in the House of Lords and other privileges were handed down from generation to generation. England recently acknowledged this system has no proper place in a modern democracy. We too need to eliminate the pollution peerage that is imbedded in EPA's netting rules.

For nonattainment NSR, the Supreme Court in Chevron made it clear that EPA has the authority to eliminate the availability of netting altogether.2 One perverse effect of netting in nonattainment NSR is that new equipment is installed without meeting "lowest achievable emission rate" (LAER) performance standards. This in turn means that a greater level of emission reduction is required to offset the new equipment's emissions than if the new equipment had met LAER standards. These additional emission reductions must come from a finite pool of existing emission sources whose total pollution load must be further reduced for the area to attain the ambient standards. Thus, the effect of NSR netting is to allow existing source owners to unilaterally dedicate the cheapest and easiest emission reductions in a nonattainment area to compensate for poorly controlled new units, leaving State and local control agencies with the more difficult task of developing an attainment plan from the more expensive, politically controversial remaining emission reduction opportunities.

EPA's original defense of its 1981 change to allow netting under the nonattainment NSR program was that areas choosing such an approach would be required to develop timely attainment plans in any event so that there would be no environmental harm. It is now the year 2000 and EPA can no longer deny that the theory it presented to the Supreme Court in the early 1980's has no basis in reality. In fact, areas have not succeeded in developing timely and adequate attainment plans. State and local agencies have protested repeatedly to EPA that they cannot identify sufficient, politically feasible emission reductions to demonstrate timely attainment. EPA has responded with policies that have permitted lengthy delays in the submission of adequate plans. Given that the premise for EPA's initial adoption of NSR netting in 1981 has not been achieved, it is time for nonattainment netting to be abolished.

To restrict netting in the PSD NSR program, EPA should reform its definition of contemporaneous so that only activities which are part of the project for which the netting claim is made can qualify. Second, EPA should reduce the netting credits available for shutting down or limiting operations at existing units to reflect the obvious fact that the new emission-increasing projects will have greater longevity than the older existing units that are generating the netting credits. For example, consider a source that proposes to build a 100-ton-per-year new unit with a 35-year useful life and to net out the increase with the shutdown of a 100-ton source that has only 5 years of life remaining. The stream of emission reductions from the shutdown source ends after 5 years but the emission increases from the new source continue for an additional 30 years. There clearly is an enormous increase in the cumulative emissions from the facility over the life of the new project that is not captured if netting credits are given for the shutdown unit based only on a comparison one year's emissions.

V. NEW SOURCE REVIEW AND ENERGY FACILITIES

Over the last year, as we have experienced high prices and shortages in some energy markets, the cry has been raised that permitting requirements, including the Act's NSR requirements, are preventing construction of needed facilities. These are not new claims. They are raised whenever the basic fact that energy is a scarce resource makes its way on to the evening news. So we see repeated references to the fact that California "has not built a major power plant in a decade" and the claim that permitting requirements are the reason. As NRDC's attached fact sheet points out, the claim is wrong. Power plant construction slowed to a trickle in California

in the 1990's not because of permitting requirements but because private investors first did not forecast enough demand to be assured of returns that would beat other uses for their money; then uncertainties created by the development of a deregulated electricity market caused further hesitation. A review of California's permitting files demonstrates that nearly all power plant projects were approved and without significant delays. The fact is, had there been no permitting requirements at all in California during the 1990's, private investors still did not have adequate market incentives to spend money building new plants.

However, in this Congress bills have been introduced that would carve gaping exemptions for from NSR requirements for new and modified power plants. For example, S. 60 and similar provisions in S. 389, Senator Murkowski's energy bill, would exempt from NSR and from any additional emission regulation, projects at new or existing coal-fired power plants. While these exemptions are labeled "credit for emission reduction" or "clean-coal" projects, in fact the legislation does not require emissions to be reduced as a condition for eligibility. The eligibility criteria are so broadly drafted that virtually any expansion project at an existing plant or any new coal plant could be built with an exemption from NSR and a prohibition of coverage by new pollution control requirements, such as future rules for mercury controls or rules to reduce nitrogen oxides to address regional smog problems. A detailed analysis of S. 60's exemptions, which applies as well to similar provisions in S. 389, is attached.

In truth, these efforts to repeal Clean Air Act safeguards are short-sighted and counterproductive to the goal of increasing public acceptance of new energy projects. While the nation's energy concerns continue to be a convenient excuse for attacking environmental permitting requirements, with the "NIMBY syndrome" derided as a telltale symptom of our ills, the fact is, people want nearby plants to be as clean as possible and want the chance to participate in location decisions. Weakening the Clean Air Act would increase anxiety and opposition to new projects, not lessen it.

As you consider this issue I would encourage each member of the subcommittee to ask, "how close is the nearest large fossil fuel generating station to my home–1 mile away, 2, 5, 10?" Suppose a new station was proposed less than a mile from your home; how would you talk about it in your own kitchen or living room? Would you like the opportunity to ask questions about the design, performance, scale, and perhaps even the location of the project? Would you like a public process that your neighbors could join in? Would you like the right to get answers from the approval authorities? Would you like some recourse if officials ignored your questions and suggestions for improvement of the project? Other Americans want these same safeguards and they deserve better than to be labeled "NIMBY."

The path to harmonizing clean air and energy goals is not down the road of exemptions from safeguards. The right path involves adopting comprehensive integrated programs to clean up existing polluting power plants and improving current new source programs so that they more reliably and efficiently assure citizens that expanded energy supplies can be achieved without degrading environmental quality. Mr. Chairman and members of the subcommittee, NRDC would be happy to work with you to move down this path. Thank you for the opportunity to present these views and I am happy to answer any questions you may have.

STATEMENT OF OLON PLUNK, VICE PRESIDENT, ENVIRONMENTAL SERVICES, XCEL ENERGY INC.

Mr. Chairman and members of the committee, my name is Olon Plunk. I am Vice President for Environmental Services of Xcel Energy Inc. Xcel Energy is a public utility holding company headquartered in Minneapolis, Minnesota. Its regulated subsidiaries have the capacity to generate over 15,000 MW of electricity from coal, natural gas, nuclear and renewable power facilities. Xcel Energy has operations in 12 States and serves over 3.1 million customers.

Today, I am testifying regarding some of Xcel Energy's experiences with EPA's implementation of the Clean Air Act. I am also here to express my support for alternative approaches to the current air quality regulatory scheme. Xcel Energy believes that the current regulations and EPA's implementation of them stand in the way of the efforts that will be necessary to ensure that the country will have an adequate, reliable, and reasonably priced supply of energy.

Xcel Energy has experience with the electricity challenges affecting the West. We serve most of Colorado and all of the Denver metropolitan area. Metropolitan Denver, as you know, is one of the fastest growing cities in the country. During the course of the last several years, Xcel Energy has embarked on an effort to build or acquire more electric generating capacity to meet the region's growing energy de-

mands. As a result of this new capacity, we have been able to avoid the power shortages that have had such a devastating impact on California.

However, because of air quality regulation, our resource acquisition efforts have not always gone smoothly. Our CEO, Wayne Brunetti, previously appeared before this subcommittee and described some of the problems presented to us by the new source permitting requirements of the Clean Air Act. For example, in early 2000, we were struggling to obtain a Prevention of Significant Deterioration permit for a new gas-fired "combined cycle" unit at our Fort St. Vrain facility located in Platteville, Colorado. The permit that we proposed would have used the cleanest low-NOx combustion technology available. Despite this fact, EPA demanded that we install additional, expensive emission controls at the facility. We suggested a different approach: In the Denver metropolitan area, approximately 50 miles from the Fort St. Vrain facility, we operate an existing coal-fired facility that has significantly higher NOx emissions than the new gas turbine. We offered to install new burners on this coal-fired plant that would have reduced its NOx emissions by a significantly greater amount—and at significantly less cost—than EPA's preferred controls on the new gas-fired Fort St. Vrain unit. Moreover, these reductions would have occurred in the Denver metropolitan area rather than far from the city on Colorado's eastern plains. Both the State of Colorado and members of the environmental community supported this proposal.

Unfortunately, EPA did not. Although some EPA managers expressed great interest in the idea, EPA ultimately stopped it because, in EPA's words, it was contrary to "the integrity of the PSD program." EPA threatened to bring an enforcement action if the State issued a permit to the new Fort St. Vrain unit based on our proposal. Because of our customers' great need for this additional generating capacity, we could not risk the possibility that an EPA enforcement action would prevent or delay construction of the plant. We agreed to install EPA's preferred emission control technology to reduce approximately 200 tons of nitrogen oxides per year at Fort St. Vrain at a total cost of $2.3 million—approximately one half of the environmental benefit at substantially greater cost than the approach that EPA rejected.

In 2000, we were also engaged in litigation with EPA over a somewhat different permitting issue. Under Colorado's resource acquisition process, Xcel Energy purchases most of the new generating capacity needed to meet its customer demands from independent power producers. These independent entities are responsible for building and operating the new facilities. Their only relationship to Xcel Energy is a power purchase agreement. Although the independent power producers are at most contractors of Xcel Energy, EPA in late 1999 ruled that their facilities were single sources with (and therefore modifications of) existing Xcel Energy power plants located a few miles away. Because of our concerns about the effect of this ruling on our ability to acquire the generating resources necessary to meet customer demands, we challenged the ruling in the 10th Circuit Court of Appeals. Regrettably, the 10th Circuit never reached the merits of our challenge. Notwithstanding the fact that EPA's ruling was issued under threat of sanctions against the State of Colorado and immediately became the settled law controlling hundreds of millions of dollars of investment in new generating plants, the court found that EPA's ruling was not final agency action and therefore not ripe for review.

Fortunately for our company and the people of Colorado, EPA's ruling did not prevent the construction of the new power plants necessary to meet our needs at this time. However, EPA's ruling did prevent some of the plants from locating close to one another near existing transmission capacity. Thus, EPA's ruling has had the effect of separating new power plants from one another and forcing the construction of new transmission lines. The committee is undoubtedly aware that transmission capacity is an important factor in the ability of utilities such as Xcel Energy to meet customer energy demands.

In sharp contrast to our experience with EPA, we have found that, working with the State of Colorado, we have been able to achieve great environmental progress at much lower cost by focusing on flexibility and certainty. As Mr. Brunetti told you last year, Xcel Energy operates three coal-fired power plants in the Denver metropolitan area. In 1997, after much study of different alternatives, we proposed a voluntary emission reduction program to reduce substantially the sulfur dioxide and nitrogen oxide emissions from those plants. For sulfur dioxide, we proposed to reduce uncontrolled emissions by 70 percent.

We worked closely with the Colorado environmental community and a diverse group of stakeholders to develop and pass legislation that would allow our proposal to become a reality. That legislation encourages the Colorado Air Pollution Control Division to enter into flexible voluntary emission reduction agreements with stationary sources. It grants such sources a period of "regulatory assurance" during which they will not be subject to additional State regulatory requirements. The act

also ensures that regulated utilities (such as Xcel Energy) can recover the costs of the new emission controls from their customers.

In July 1998, Colorado and Xcel Energy's operating subsidiary entered into an agreement to implement our proposed Denver emission reduction program. Unlike traditional command and control approaches, the agreement allowed us to define the most cost-effective way to reduce emissions from the plants. The agreement grants the company flexibility in complying with its requirements—through annual emissions averages, flexible tonnage caps and trading of emissions between the different plants. It grants us certainty by ensuring that the plants will not be subject to new or different State requirements for a period of 15 years. Finally, it assures that we can recover the costs of these controls in a way that does not put the plants at a competitive disadvantage. As a result of this agreement, Xcel Energy will make dramatic reductions in emissions from these power plants—reductions that are far greater than would have been achieved through traditional air quality regulation.

The success of this plan was the result of a great deal of hard work by a broad range of parties. We do not believe that, under the current Clean Air Act, we could have reached such an environmentally beneficial result by working solely with EPA. This plan became a reality largely because of the leadership of the State of Colorado.

From our experience working with these issues and struggling to meet energy demands in Colorado, we have learned several things about the kinds of reform that would help the West and the nation resolve the current electricity crisis and prevent its recurrence:

- First, the tremendous growth in energy demand in the country requires utilities to develop new power plants and maintain their existing facilities. In order to protect the air while allowing for the permitting, construction and maintenance of power plants, Clean Air Act regulations must become more flexible. We believe that the history of the Title IV Acid Rain program demonstrates that broad-based emissions trading programs are more effective and less costly than EPA's traditional plant-by-plant command and control approach. Our own experience in the Denver metropolitan area is proof that the right kind of flexibility creates the conditions that lead to an enhanced environment and cleaner, cheaper power.
- Second, and of at least equal importance, the Clean Air Act should provide plant owners with greater certainty in building and maintaining these existing generating plants. This certainty must allow owners of existing plants to maintain their facilities and improve their efficiency without fear that these efforts will be challenged by an EPA enforcement action for alleged violations of the New Source Review rules. They must also allow plant owners to plan rationally and flexibly for the emission reduction requirements that will be associated with their operations for the life of their facilities.
- Finally, the Clean Air Act should recognize that States are uniquely situated to address the concerns of local air quality. We believe that our experience in Colorado demonstrates that States are willing and able to think creatively about Clean Air Act issues and find innovative solutions. Congress should be responsible for setting the broad agenda and national goals for the nation's air quality program. States should implement that agenda and those goals creatively at the local level—without unnecessary interference by EPA.

Mr. Chairman, any discussion of a reconciliation of our nation's clean air and energy policies would remain incomplete if we did not discuss the role of nuclear energy. As you and other members of the subcommittee well know, nuclear energy has been, and will for some time continue to be, the largest single source of emissions-free, base-load electricity. In 2000, nuclear powered electricity plants set yet another record in this country, generating 755 billion kilowatt hours of electricity.

The role that nuclear energy plants have played in the avoidance of air emissions is without question. Between 1973 and 1999, U.S. nuclear power plants reduced cumulative emissions of nitrogen oxide and sulfur dioxide by 31.6 million tons and 61.7 million tons, respectively. Over the same period, the nation's nuclear plants reduced the cumulative amount of carbon emissions by 2.61 billion tons.

The experience of Xcel Energy matches these industry-wide figures. Approximately 30 percent of the electricity that our customers in Minnesota use is generated by nuclear energy. If we were to replace our two-unit Prairie Island facility with a new, state-of-the-art coal-fired facility, we would need to find clean air credits that would anticipate the emission of some 1,500 tons of sulfur dioxide, 4,000 tons of nitrogen oxide, 50–100 pounds of mercury and 9,000,000 tons of carbon dioxide, annually.

Given the tremendous economic and environmental value of Prairie Island to our company, we would not, in the normal course, be examining issues related to its closure. However, as most of the members of the subcommittee know, we are facing

the very real prospect of prematurely closing this plant due to the Federal Governments failure to meet its 1998 statutory and contractual obligation to manage the spent fuel generated by the facility. We hope that this issue will also continue to receive attention by Congress.

As Congress considers various multi-pollutant strategies for the utility industry, these principles should serve as a valuable guide. Xcel Energy believes that, if properly designed, such strategies could achieve greater environmental progress at less cost than the current regulatory program. By bringing flexibility and certainty to the construction and operation of power plants, these strategies would also play an important role in a comprehensive, effective and balanced energy policy.

Mr. Chairman, I thank the committee for taking time to listen to me today, and would be happy to answer any questions that you or the members may have.

RESPONSES BY OLON PLUNK TO ADDITIONAL QUESTIONS FROM SENATOR LIEBERMAN

Question 1. Do you believe that CO_2 reductions will be required of your industry in the next decade?

Response. It is very difficult to predict whether CO_2 reductions will be required of the utility industry in the next decade. In order to impose a CO_2 emission reduction program on the utility or any other industry, the country must confront a wide range of difficult scientific, economic and political issues, including the following:

- Any proposed CO_2 emission reduction plan must account for the uncertainty in the existing global climate change models and research. A CO_2 program will ultimately be judged a success only ff.it is based on facts and sound science.
- Unlike regulations addressing pollutants under the Clean Air Act, a CO_2 emission reduction plan has extraordinarily broad implications for the American economy and its reliance on the combustion of fossil fuels for the generation of electricity. An improperly designed CO_2 program could have a significant impact on the reliability of the nation's electric energy supply and consequently a devastating effect on the daily lives of our nation's citizens.
- As the Senate has already made clear in its consideration of the Kyoto accords, a CO_2 program could affect American competitiveness if it imposes greater costs on our Nation than other countries (especially countries like China in the developing world).

These issues make the creation of a CO_2 reduction program applicable to the utility industry a significant political and economic challenge during the next 10 years.

Question 2. I sympathize with your desire for certainty and flexibility. Some contend, however, that we should only proceed with regulation of the first three pollutants. Would your business decisions as a result of such comprehensive regulation differ if CO_2 was or was not included?

Response. In most circumstances, the answer would be "yes," but that answer depends on the nature of the three and four pollutant strategies under consideration. For example, if a proposed three pollutant strategy would require-excessive and infeasible reductions in mercury emissions, many existing power plants would be forced to shut down—thus reducing significantly reducing carbon emissions. In that case, my company might make the same business decisions apart from whether CO_2 were part of the program.

Regardless of whether three or four pollutants are included in a comprehensive approach, Xcel Energy believes that the program should be designed with the following principles in mind: (1) the program should preserve fuel diversity and allow the continued use of coal-fired generation as a necessary component of the nation's energy infrastructure; (2) the program should be technically feasible; (3) for every type of emissions covered by the program, the program should allow both new and existing sources to use emission trading and other flexible mechanisms; and (4) the program should provide the certainty necessary for the industry to make rational investment decisions to insure the reliability of the nation's energy supply during the next 15 to 20 years.

CLEAN AIR ACT OVERSIGHT ISSUES

THURSDAY, APRIL 5, 2001

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON CLEAN AIR, WETLANDS, PRIVATE PROPERTY, AND NUCLEAR SAFETY,
Washington DC.

The subcommittee met, pursuant to notice, at 9 a.m. in room SD–406, Senate Dirksen Building, Hon. George V. Voinovich (chairman of the subcommittee) presiding.

ENVIRONMENTAL REGULATIONS AND ENERGY POLICY

Present: Senators Voinovich, Inhofe, Lieberman, Carper, and Clinton.

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Senator VOINOVICH. The hearing will come to order. I would like to explain in the beginning that we have two votes at 9:30, so we are going to try and stay here until about 9:40, slip out and then come back as soon as soon as we can so that we can continue the hearing. We apologize to the witnesses in advance.

Today is our second hearing on the interaction of our environmental regulations and the nation's energy policy. Two weeks ago we held our first hearing in which we concentrated on our utility issues.

Today, we will concentrate primarily on oil and gas issues. We need to ensure a reliable and dependable fuel supply, while continuing to improve public health and our environment. Today we are too reliant on foreign sources of oil. In January, OPEC decreased production by one million and a half barrels per day. Two weeks ago they decreased production by an additional one million barrels a day. That is two and a half million barrels reduction since the beginning of this year.

Without the Saudis, we could be held hostage to the Middle East and in deep trouble. The same Iraq that we are bombing is selling us oil today.

Our reliance on foreign oil has increased from 1973. At that time when we had our last real problem, we were 35 percent reliant on foreign oil. Today, it is 56 percent. It is projected to be 65 percent in the year 2020. We have a domestic refining capacity problem. There have been no new refineries built in the last 25 years. In fact, since 1983, 33 percent of our refineries have closed. The average annual capacity rate of those refineries is about 92 percent,

while during peak demand periods the capacity rate runs between 95 and 98 percent. So, they are working at probably their top capacity.

The high capacity rate causes us to import more refined products and leave us vulnerable to emergency shutdowns and equipment failures at any of our larger refineries.

This problem will only get worse as our fleet of refineries ages. As Linda Stunt said at our last hearing, we are a fossil fuel based economy and we will be for the foreseeable future.

While I support alternative fuels, such as wind and solar, we should continue research in those areas. But it is not realistic that we can replace fossil fuels today or even tomorrow. I think that is really important that we understand that.

Too often those who emphasize alternatives fail to realize that there is no way that alternatives can meet our energy demands. Demand is increasing not only in our country, but also worldwide. For example, China used to export oil. Today, they import oil. The demand for oil in the world is growing.

On fuel for vehicles, we will continue to be petroleum based. We heard testimony at the last hearing that hybrid vehicles look promising. They are certainly on a shorter timeframe than fuel cells. But hybrids are not quite there yet, and the current technology still uses gasoline.

I met yesterday with Rick Waggoner, the President of General Motors, who told me that the electric vehicle program in California is not proving as feasible as many thought. The problems there have increased with the electricity crisis that they have in the State.

I am, however, in favor of alternative fuels for vehicles. I think ethanol, for example, is very promising. In Ohio, 40 percent of the gasoline we use has an ethanol content to it. Although we need to resolve the problem related to the Highway Trust Fund. Many people are not aware of the fact that two and a half cents from the ethanol tax goes into the General Fund of the United States.

I think, particularly, Senator Inhofe, you will remember last year we had a colloquy on the fact that we need to take that two and a half cents and see if we can't get that money put into the Highway Trust Fund. As more and more people use ethanol, States are going to be impacted because that money is not going into the Highway Trust Fund, but added to the General Fund. I have talked with Senator Grassley about this.

At our last hearing, Senator Carper mentioned an experiment in Delaware where they are mixing diesel fuel with soybean oil. I understand in Oklahoma they are doing experiments making ethanol from switchgrass. So, we need to broaden our fuel base.

For today, tomorrow and tomorrow we are still petroleum dependent and we are going to have problems with price spikes and supply disruptions. We need to address the price and supply issues while continuing to improve the environment and public health.

The question is: How do we harmonize our energy needs and our environmental needs so that we come up with an energy policy for this country? There are three main areas where environmental regulations may be causing problems contributing to fuel price spikes and shortages.

The first is the exploration and production of oil and gas, which has led us to increase our foreign imports. The second is during the refining process, environmental regulations are partially responsible for no new refineries in 25 years and the closure of over 75 refineries.

In addition, the constantly changing environmental regulations and the enforcement practices of the EPA, in particular the changing definitions under the New Source Review Program have led to complications in producing refined products. Because of the uncertainty of EPA's New Source Review Program, people are refraining from essential maintain and repair work which will only lead to more facility shutdowns in the near future.

The program has also created a disincentive for installing the latest pollution control devices and modernizing facilities. Installing one piece of equipment can cause the entire facility to trigger in NSR, which may not be financially viably.

Third, the boutique fuel requirements across the country and the inability to site new pipelines have caused additional problems in getting fuel to the consumers. With our growing dependence on natural gas, this problem is only to get worse.

Now, we had an FTC investigation last year. It is very interesting; the report of the FTC got very little coverage in the media. What did they say? Well, what they said is and at that time, if you recall, it was alleged that there was price gouging and price fixing in the Mid West.

The report is very valuable, and I want it entered into the record today. I want to read a couple of quotes from it. "The current high capacity utilization rates in the oil refining industry leave little room for error in predicting short run demand. Unexpected demand for a certain oil product is difficult to satisfy without reducing the supply of another oil product. Unexpected supply problems can result in temporary shortages across many oil products. Assuming that demand continues to grow, occasional price spikes in various parts of the country are likely unless refining capacity is increased substantially."

The FTC found no evidence "of illegal collusion to reduce output to raise prices. Rather each industry participant acted unilaterally and followed individual profit maximization strategies."

The report found the primary causes were refinery production problems, refinery turnarounds, unexpected refinery disruptions and RFG phase two manufacturing problems, pipeline disruptions and low inventories.

So, it went on. It concluded that the gasoline price spike in the Midwest was short lived. Soon after prices spiked, additional gasoline was produced and imported to the region and prices dropped as quickly and dramatically as they had risen, notwithstanding industry's ability to respond to the short-term problems, the long-term refining imbalance in the United States must be addressed or similar price spikes in the Midwest and other regions of the country are likely.

I thought we got off to a good beginning in our last hearing. We have some outstanding witnesses today. We are going to get another perspective on it. I think the witnesses are balanced. We try

to do that so we just don't hear one side of the story. I am looking forward to their testimony.

[The prepared statement of Senator Voinovich follows:]

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Today's hearing is our second in a series, "Interaction of our Environmental Regulations and the Nation's Energy Policy." Two weeks ago, we held our first hearing in which we concentrated on utility issues. Today will we concentrate primarily on oil and gas issues.

One of the great challenges facing our nation is the need to ensure a reliable and dependable fuel supply while continuing to improve public health and the environment. Accomplishing these goals without a major disruption to our economy or our way of life will be a test to our ingenuity and our resolve.

One of the first hurdles we need to surmount is our over-reliance on foreign sources of oil. The extent that our reliance on foreign oil has increased is astonishing. In 1973, during the Arab Oil Embargo, we imported 35 percent of our oil. In the year 2000, that number had climbed to 56 percent. It is estimated that at our present rate of consumption, we will import 65 percent of our oil needs by the year 2020. Since OPEC has us "over a barrel" so to speak they are able to turn the spigots on or off at their whim.

Twice already this year, OPEC has announced a decrease in oil production by a combined total of 2.5 million barrels of oil per day. This action has driven up prices at the pump in the U.S., much to the consternation of many Americans. If not for the help and friendship of the Saudis to minimize the oil cartel's production cuts, we would be in deep trouble. However, it does not sit well with this Senator that while our military is engaged with Saddam Hussein, he is selling us oil.

One of the issues that we face which keeps our imports high is the fact that we have a domestic refining capacity problem. There have been no new refineries built in the last 25 years, and in fact since 1983 we have lost 33 percent of our refineries. The average annual capacity rate is 92 percent while during peak demand periods the capacity rate runs between 95 percent and 98 percent. This high capacity rate causes us to import more refined products and leaves us vulnerable to emergency shutdowns and equipment failures at any of our larger refineries. This problem will only get worse as our nation's refineries age.

At our last hearing, Linda Stuntz said that we are a fossil fuel based economy and we will be for the foreseeable future. I agree.

With regards to fuel for vehicles, the American and world auto-markets will continue to be petroleum based. While demand for fuel oil is increasing in our nation, it is also increasing worldwide. China, for example has gone from a net exporter of petroleum to a net importer. Having said that, I believe it is imperative that we continue to conduct research into the use of alternative fuels for vehicles.

At our last hearing, we heard testimony about the potential that hybrid vehicles posses. Hybrid vehicles are not quite "there" yet and the current technologies still use some gasoline. Still, they are certainly on a shorter timeframe than fuel cells. I met yesterday with Rick Wagoner, the President of General Motors who told me that the electric vehicle program in California is not proving feasible, and the problems will only increase with the electricity crisis.

I also believe ethanol is a promising fuel source. In Ohio, 40 percent of our fuel contains ethanol. As an aside, I am still concerned that we have not satisfactorily addressed the issue of allocating 2.5 cent-per-gallon ethanol fuel tax into the Highway Trust Fund instead of the general treasury. In a colloquy during the MTBE debate last year there was agreement to put the 2.5 cent ethanol tax into the Highway Trust Fund rather than into general revenues. We need to resolve this issue.

In addition to ethanol, we should look at other alternative fuels. At our last hearing, Senator Carper mentioned an experiment in Delaware where diesel fuel is mixed with soybean oil. I also understand that in Oklahoma experiments are being conducted that make ethanol from switch grass. All of these activities will help broaden our fuel base.

However, while I support the use of alternative fuels, too often those who emphasize alternative fuels fail to realize that there is no way that they can fully meet our current energy demands. We need to address the price and supply issues while continuing to improve the environment and public health. The question is how do we harmonize our energy needs and our environmental needs to achieve a National Energy Policy.

Therefore, today, we must deal in the reality that our nation is still petroleum-dependent and we are going to have problems with price spikes and supply disruptions. We have already discussed the role foreign oil plays in such matters, but we need to explore how they are affected by environmental laws and regulations here in the United States.

There are three main areas where environmental regulations may be causing problems contributing to fuel price spikes and shortages. The first is the exploration and production of oil and gas which has led us to increase our foreign imports.

The second can be traced to the refining process. Environmental regulations are partially responsible for the fact that no new refineries have been built in the last 25 years and that over 75 refineries have been closed in the same time-frame. In addition, constantly changing environmental regulations and the enforcement practices of the EPA in particular the changing definitions under the New Source Review program have led to complications in producing refined products.

Because of the uncertainty of the EPA's New Source Review Program, companies are refraining from essential maintenance and repair work. This will only lead to more facility shut downs in the near future. The program has also created a disincentive for installing the latest pollution control devices and modernizing facilities. Installing one piece of equipment can cause an entire facility to trigger NSR, which may not be financially viable.

Third, the boutique fuel requirements that are in random use across the country and the inability to site new pipelines have caused additional problems in getting fuel to consumers. With our growing dependence on natural gas as an energy source, this problem is only going to get worse.

FTC Investigation

Finally, I would like to say a few words about the Federal Trade Commission investigation into alleged price gouging and price fixing in the Midwest last year. They released their report last Friday. By a 5–0 decision, the FTC found no credible evidence of collusion or other anti-competitive conduct by the oil industry in the causes of the gasoline price spikes in local markets during the spring and summer of 2000.

But the Report itself is very valuable and I am going to enter it into the record and read a few quotes from it. First:

> "The current high capacity utilization rates in the oil refining industry leave little room for error in predicting short-run demand. Unexpected demand for a certain oil product is difficult to satisfy without reducing the supply of another oil product, and unexpected supply problems can result in temporary shortages across many oil products. Assuming that demand continues to grow, occasional price spikes in various parts of the country are likely unless refining capacity is increased substantially."
>
> And: "FTC staff found no evidence of illegal collusion to reduce output or raise prices. Rather, each industry participant acted unilaterally and followed individual profit-maximization strategies."

The report found that the primary causes were:

Refinery Production Problems (refinery turnarounds, unexpected refinery disruptions, and RFG Phase II manufacturing problems), Pipeline Disruptions, and Low Inventories.

The report found that the secondary problems were:

Unavailability of MTBE as a Substitute for ethanol in Chicago and Milwaukee, Unocal Patents, waiver of RFG Phase II Requirements in St. Louis, High Crude Oil Prices, Increase in Gasoline Demand, and Taxes.

The report concludes:

> "The gasoline price spike in the Midwest was short-lived. Soon after prices spiked, additional gasoline was produced and imported to the region, and prices dropped as quickly and dramatically as they had risen. Notwithstanding the industry's ability to respond to the short-term problem, the long-term refining imbalance in the United States must be addressed, or similar price spikes in the Midwest and other regions of the country are likely."

CONCLUSION

I thought we got off to a good start at the last hearing and with this hearing I hope to build on our findings.

There is no doubt that we are dealing with a national energy crisis. The impact of this energy crisis is, and will continue to be, of such a magnitude that I believe what this committee does this year could have more sway over what happens to the

U.S. economy and America's pocket books than at any other time in U.S. history. I maintain optimism that we will be able to deal with these issues in a bipartisan manner. We have a distinguished group of witnesses this morning and I look forward to their testimony.

I would now like to call on Senator Inhofe.

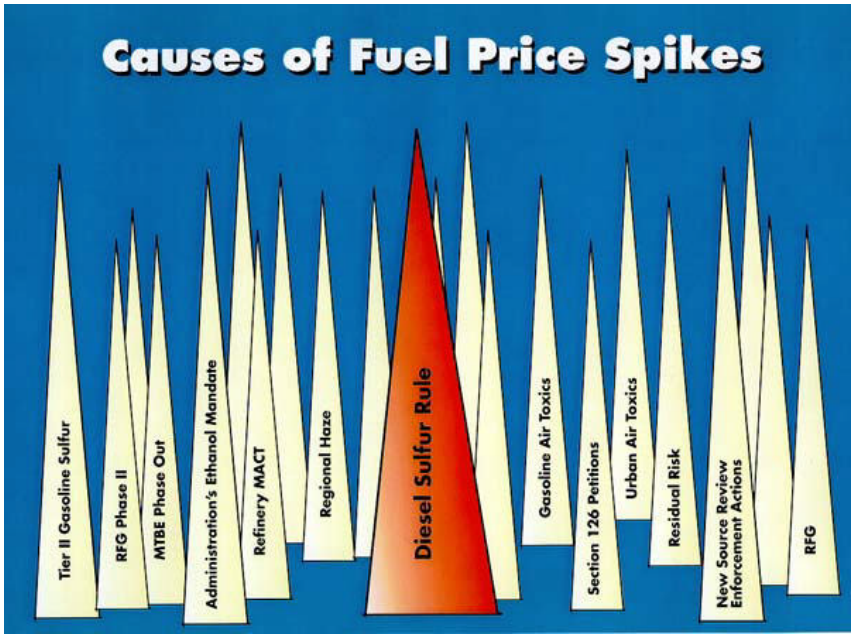
OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Thank you, Mr. Chairman.

By the way, the program that you referred to on the grass is Oklahoma State University. In fact, the person who is heading that up is the former United States Senator Henry Bellmon from Oklahoma. He is very optimistic about that.

You know, so often we look at what might be out there in the future, but our crisis is here now. In a recent report entitled "The U.S. Downstream: The EPA Takes Another Bite Out of America's Fuel Supply," Merrill Lynch concluded that the EPA's clean regulations "will clearly have the impact of reducing existing U.S. refinery capacity."

Now, this is a problem. On this chart back on the price spikes, if you start out with 100 percent refinery capacity, which we have today, everything that is on here will have that effect. Of course, the American people are very sensitive to the cost of energy right now.



I think we as a nation need to rethink the manner in which we approach regulation. We need to keep an open mind. We need not to use some of the terms that we have heard such as "sneak attacks on the environment."

In fact, the opposite is true. If we rethink regulation, we can be in a better position in the future. We can find ourselves in a place

where we can have far greater environmental protection and more reliable and diverse energy sources.

The chairman talked about the problem that we have right now in terms of our reliance upon other nations. I can't say that this is a partisan thing because we have not had a national energy policy. We first tried in the Reagan Administration. He didn't do it. I thought surely when Bush came in out of the oil patch that we would have one. We didn't have one there either. We didn't have one during the Clinton Administration. Now it is time that we do have one.

In fact, I can remember, and this happened in New York State, Senator Clinton, when Don Hodel was Secretary of Interior. He and I had a dog and pony show where we would go to the consumption States and talk about how serious it was because our reliance upon foreign oil at that time was approaching 40 percent.

We were trying to approach it in reality for what it is as a national security issue. Our reliance upon the Middle East for our ability to fight a war is not in our nation's best interest. We were not able to sell it back then, but I think now, because of the events that have taken place people are more sensitive to it.

I think when you look at the refineries, working at 100 percent capacity, it is going to be simultaneously hit with a number of regulations in the next few years such as Tier II of the sulfur-diesel rules and some of the rules and regulations that have already been out there.

As many of you know, Senator Breaux and I recently sent a letter to Vice President Cheney in his capacity as chairman of the National Energy Policy Development Group that the EPA's New Source Review Enforcement, its flawed and confusing policies will continue to interfere with our nation's ability to meet our energy and fuel needs.

I chaired this committee. We swapped committees not too long ago. I chaired this committee. In the last 4 years we have had hearings on New Source Review. We had one hearing out in your State of Ohio. We heard testimony on some of the things. It was really ludicrous. They would change one pipe and all of a sudden that triggers a New Source Review. So, we need to have common sense there.

Finally, there has been a lot of talk and negative press about President Bush's decision on CO_2. But the press and environmentalists have neglected to give him any credit for supporting a streamlined process, which will significantly reduce mercury, which does have a health effect, NOx, which is the precursor to ozone, and SO_2, which causes acid rain.

These are types of initiatives that we have to examine if we as a nation are going to provide an energy supply and protect human health and the environment. So, I think that it is good that we are having this hearing. It is good that we are having the types of witnesses that we have that can give us a balance. I think that the timing is right, too, Mr. Chairman, because everyone is sensitive because of the cost of energy right now. I think maybe we are the ones who are going to be in a position to do something about it in the long term.

So, thank you for having this hearing.

[The referenced document follows:]

March 23, 2001.

The HONORABLE RICHARD B. CHENEY,
Vice President of the United States of America,
The White House,
1600 Pennsylvania Avenue, NW
Washington, DC. 20500.

DEAR MR. VICE PRESIDENT: In your capacity as the chairman of the National Energy Policy Development Group, we are writing to bring to your attention our concerns that, unless addressed, the prior Administration's EPA's New Source Review ("NSR") enforcement policies will continue to interfere with our nation's ability to meet our energy and fuel supply needs. We strongly urge that the Administration take into account these concerns in developing its national energy plan.

As you are very much aware, the nation faces a potential energy supply shortage of significant dimensions. The California energy crisis is receiving the greatest attention in the media. However, major challenges exist in meeting demands for gasoline and other fuels, especially in the Midwest. More troubling, current projections suggest fuel shortages and price spikes—far exceeding last year's problem. These are due to a number of factors including: difficulties in making summer-blend Phase II reformulated gasoline; EPA hurdles to expanding refinery capacity; and the overall increase in energy demand.

Unless reviewed and addressed, EPA's implementation of NSR permitting requirements will continue to thwart the nation's ability to maintain and expand refinery capacity to meet fuel requirements. In 1998, EPA embarked on an overly aggressive initiative in which it announced new interpretations of its NSR requirements that it has applied retroactively to create a basis for alleging that actions by electric utilities, refineries and other industrial sources taken over the past 20 years should have been permitted under the Federal NSR program. We also understand that these new interpretations conflict with EPA's regulations, its own prior interpretations and actions, and State permitting agency decisions.

EPA's actions have been premised heavily on its reinterpretation of two elements of the NSR permitting requirements. First. EPA's regulations specifically exempt "routine maintenance, repair and replacement" activities from NSR permitting. EPA now claims that

projects required to be undertaken by utilities and refineries over the past 20 years to maintain plants and a reliable supply of electricity and fuels were not routine and thus should have gone through the 18-month, costly NSR permitting process. EPA's enforcement officials are asserting this even though, for more than two decades, EPA staff have had full knowledge that these maintenance, repair and replacement projects were not being permitted.

A second ground for many of EPA's claims has to do with whether projects resulted in significant emissions increases. By employing a discredited method for determining whether emissions increases would result from a project-using so called "potential emissions" instead of actual emissions, EPA is asserting that numerous projects resulted in emission increases when in reality they had no effect on emissions or were followed by emissions decreases.

EPA's NSR interpretations have created great uncertainty as to whether protects long recognized to be excluded from NSR permitting can be undertaken in the coming months to assure adequate and reliable energy supplies. Electric utilities and refineries have expected that they could undertake maintenance activities, modest plant expansions, and efficiency improvements without going through lengthy and extraordinarily costly NSR permitting, as long as the project involved either routine maintenance or no significant increase in actual emissions.

Now, in light of the new interpretations, utilities and refineries find themselves in a position where they cannot undertake these very desirable and important projects. This is not an acceptable result when the Nation is faced with severe strains on existing facilities. Against this backdrop, we strongly urge that the National Energy Policy Development Group:

- give investigation of EPA's implementation of its NSR requirements a high priority;
- suspend EPA's activities until such time as there has been a thorough review of both the policy and its implications;
- clarify whether the implications of EPA's new NSR interpretations and its enforcement initiative are being reviewed by the White House Office of Energy Policy and the Secretary of Energy prior to actions that could undermine energy and fuel supply; and

• establish guidelines to assure that EPA's application and enforcement of its NSR requirements will not interfere with the Administration's energy and fuel supply policy. Requirements should be developed, which are consistent with responsible implementation of the statutory NSR requirements.

Specifically, to assist you in assessing the implications of NSR on meeting the nation's energy and fuel supply demands, you may want to obtain the following: (1) all requests since January 1, 1998 for information under section 114 of the Clean Air Act issued to facilities and companies in any sector involved in energy and fuel supply; and (2) notices of violation issued to, and complaints filed against, any such company and/or facility alleging NSR violations during that period. We are submitting a similar request to EPA today.

Thank you for your consideration of this matter. We look forward to working with you in the future to develop environmental policy, which further protects human health and the environment and works in concert with sound energy policy.

Sincerely,

JAMES M. INHOFE, *U.S. Senator.*
JOHN BREAUX, *U.S. Senator.*

Senator VOINOVICH. Thank you.

Senator Clinton?

OPENING STATEMENT OF HON. HILLARY RODHAM CLINTON, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator CLINTON. Thank you, Mr. Chairman. I would like to thank you and Senator Lieberman for holding this hearing today on the future of our environmental and energy policies.

This is a continuation in a series of hearings and I really applaud the committee leadership for bringing the environment and energy together as we debate the important issues before us.

I would like to submit my opening statement for the record and take my time to introduce one of the witnesses who we will be hearing from in just a minute. I would like to welcome both witnesses, Dr. Hirsch and Eliot Spitzer, the New York Attorney General.

Mr. Spitzer is someone who has adopted a very strong and vigorous approach toward the issues that are within his jurisdiction as our State's Attorney General. The environment is at the top of that list.

Last month in Roessleville, New York, which is just southwest of Albany, we co-chaired an environmental roundtable where we had an in-depth discussion about many of the issues that are within the jurisdiction of this committee. I thank him for that discussion last month. I hope we can continue that and perhaps even have some of our colleagues on the committee join.

Since becoming New York's 63d Attorney General in January 1999, General Spitzer has distinguished himself as a leader on environmental protection, public safety, civil rights and consumer affairs.

Most recently, he has helped lead the way in our State, and I think around the nation, in coming with an action plan that I hope he will explain to us, for a balanced electric power policy in New York State.

It is that kind of forward thinking that has brought him to fight to cut pollution causing acid rain and smog in our State, to be on the forefront of pesticide issues and other important public health and environmental issues.

I am delighted that the committee would invite the Attorney General to address us and I thank you for having this important hearing.

[The prepared statement of Senator Clinton follows:]

Senator VOINOVICH. Senator Lieberman.

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. Thank you, Mr. Chairman. It is a pleasure to be working with you on these hearings. We are dealing here with complicated but urgent questions. They can benefit from exactly the kind of open discussion that we had at our last hearing and I am sure we will have this morning.

As others have said, this is all about balance. We need to have a reliable, cost efficient source of energy for our country, but we also need to protect our environment. There are increasingly those who say that we can't have both. Of course, we believe very strongly that we can have both. The most compelling evidence of that, I think, is the record of the 1990's when we had booming economic times and substantial increases in the protection of our environment.

So, I was struck at the last hearing by one of the witnesses who said energy efficiency gains are the second largest source of energy in the United States, after petroleum. It is a good construct with which to approach this. Obviously, energy efficiency doesn't get us everything we want, but when you think about it as a source of energy and one whose limits are not yet known and clearly whose emissions are minimal to zero, it is one to think a lot about.

So, I thank you, Mr. Chairman, as we hold these hearings, hopefully, leading all of us to be part of a debate that is coming in Congress about a national energy policy, but also leading to a reauthorization and amendment of the Clean Air Act.

I do want to make a brief note of one issue that is of importance to my home State of Connecticut, and I know to New York and other States. The Clean Air Act requires reformulated gasoline to contain 2 percent oxygen, a requirement that is satisfied, apparently, about 85 percent of the time by adding the oxygenate, MTBE.

Last year the Blue Ribbon Panel on Oxygenates and Gasoline found that between 5 and 10 percent of drinking water supplies in high oxygenate use areas had detectable amounts of MTBE. The odor, taste and possible health effects resulting from that contamination have created a national movement for its elimination.

In fact, in Connecticut, the legislature responded to concerns last year about MTBE by banning use of the additive effective in 2003.

I hope our witnesses will help us find a way to address this concern while also protecting our air and our water.

I want to welcome Dr. Hirsch and Mr. Spitzer. I want to say a special welcome to Attorney General Spitzer. I always loved being in the company of Attorneys General. One of the hardest transitions I had to make, Mr. Chairman, when I went from being Attorney General of Connecticut to being a Senator was that no one called me "General" any more.

So, General Spitzer, it is great to see you. You are truly a general in the army of those who fight, as one of your distinguished predecessors said, "as the peoples' attorney" for their best interests. It is good to have you here.

Senator VOINOVICH. Thank you, Senator Lieberman.

As I mentioned, I thought we did get off to a good start at the last hearing. We are dealing, I think, with a national energy crisis. It is unbelievable what is happening across the country at this time. No one could have predicted it. We are here with this energy crisis.

I believe that this crisis will continue to be of great magnitude. I really believe that what this committee does this year could have more sway over what happens to the U.S. economy and America's pocketbooks than maybe at any time in the history of this committee.

Recently, I spoke to the Winter Meeting of the Board of Directors of the National Association of Manufacturers. I was just overwhelmed with the anecdotal information that I got in terms of what impact this energy crisis was having on manufacturing in this country.

I can tell you, it is primarily the reason why we have a recession today in Ohio, a deep recession that our State is trying to grapple with in terms of providing services to the citizens of our State.

I would ask that the statement of concern on energy supply policies be inserted in the record from the National Association of Manufacturers.

Senator VOINOVICH. I will say this: I maintain optimism about the fact that we can work on this problem in a bipartisan basis and a bicameral basis. Somehow, we can work together to figure out how we can harmonize the needs of the environmental and the energy needs and really make a wonderful gift to the American people and that is, for once and for all, having a energy policy.

We are lucky to have such great witnesses. We look forward to hearing from General Spitzer and Dr. Hirsch. Without further words, I would like to call on Mr. Hirsch to present his testimony. Thank you for being here.

STATEMENT OF ROBERT HIRSCH, BOARD OF DIRECTORS, ANNAPOLIS CENTER, AND CHAIR OF THE NAS ENERGY AND ENVIRONMENT BOARD

Mr. HIRSCH. Thank you, Mr. Chairman, and distinguished Members.

I am Dr. Robert Hirsch. I am a member of the Board of the Annapolis Center for Science-Based Public Policy, which is a nonpartisan, not-for-profit study group. I am also chairman of the Board of Energy and Environmental Systems at the National Academies and I am a Senior Energy Analyst at the RAND Corporation. I21My experience is in energy technology management and analysis in both government and industry. I have been involved in a number of different areas of energy technology. The views this morning are my own and do not necessarily reflect the positions of my three affiliations.

My messages to you today are as follows: One, we are experiencing a new kind of energy crisis that has only begun and we need to take decisive action.

Two, there is no silver bullet to solve our problems.

Three, the fundamental challenge, as has been indicated, is to balance, balance, balance what we do about it.

Why do I call this a new kind of energy crisis? It is because the problems are more complicated than an oil embargo or a Gulf War. Our challenges involve many different aspects of our very complex U.S. energy infrastructure.

Furthermore, I believe that our problems will take upwards to a decade or more to fix. Why do I feel it will take so long? It is because the problems are large in scale, large in number and large in cost, and because we are simultaneously working, as we should be, to reduce some of the remaining environmental, health and safety risks associated with our energy system.

By now you have probably heard enough about the electricity problems in California, the natural gas price spikes throughout the country, the heating oil problems in the Northeast and the gasoline problems in the Midwest. These problems were predictable. Indeed, there were some unheeded warnings along the way.

Part of the reason we are in such a pickle is that there is no one in the Federal Government responsible for the well being of the U.S. energy system, no one with the authority, responsibility and respect to warn us when potentially significant problems begin to rear their ugly head. The Department of Energy is responsible for nuclear weapons, environmental cleanup and almost incidentally, energy. FERC is responsible for regulating various elements of interstate energy flows. EPA is responsible for environmental care, and the States are responsible for energy matters within their borders. The energy goose has been laying golden eggs for so long that energy is off the radar screen or at least has been off the radar screen of most people until we have the occasional trauma.

Right now we are seeing a number of traumas simultaneously, and there is reason to believe that there are more to come. For instance, as has already been mentioned here, our refineries are running near 100 percent capacity and we have been slowly increasing our imports of refined products, adding yet another dependence on foreign sources.

No new refineries have been built in this country since the 1970's, and a number have been shut down. Furthermore, we are in the process of phasing out an important gasoline additive, MTBE, an action that will further reduce refinery production rates at a time when demand is continuing to increase.

In addition, the EPA has mandated much lower levels of sulfur in gasoline and diesel fuels, necessitating significant new investments in refineries in the United States and offshore to supply us with our increasing needs for fuels.

Refining is historically a low rate of return business. So many companies are naturally reluctant to invest the vast sums needed for the mandated changes. Am I suggesting that we reduce our environmental goals? Absolutely not. In my opinion, we must reduce sulfur levels in our fuels in order to further reduce air pollution.

I just wish we could accomplish our laudable goals with less acrimony.

How about siting and building the new electric transmission lines needed to deliver the higher levels of electric power that people are demanding? That is a not-so-obvious problem in California and in other places around the country.

As you may know, siting new transmission lines has encountered interminable delays in many parts of the country and threatens to choke off the higher power that people demand.

About natural gas pipelines and petroleum product pipelines, both are problems in many areas. Permits for new pipelines are tough to come by and land for right-of-ways is increasingly expensive.

At a meeting in New Orleans 2 weeks ago, a major oil company representative indicated that his company is using drag-reducing agents in some of their pipelines because their pipelines are operating at full capacity. With petroleum product demands increasing, that indicates trouble ahead; and the list continues.

If you want more electric power, you have to build more electric power plants. Natural gas is clean and was very cheap until recently. Over 90 percent of the planned new electric power generation in the United States will be natural gas fired. In one sense that is good because of the environmental attractiveness of natural gas generators with exhaust gas cleanup.

In another sense, it is troubling because the mushrooming dependence on natural gas will make the country ever more vulnerable to future natural gas disruptions and price spikes.

Analysts can run complicated models to tell you about vulnerability, but it is really common sense. If you had, for instance, all of your retirement money in the NASDAQ in the last year, you would have some troubles. If you had all of your money in bonds in the early 1990's, you would have missed some good opportunities.

The answer isn't all gas or all coal or all nuclear or all renewables. Each has its strengths and weaknesses. For instance, many people don't realize that for larger power loads the popular renewables are simply fuel savers for other power plants. So, their ultimate contribution to U.S. energy needs will be limited, even after their prices and their costs come down.

Energy efficiency is extremely important and must be part of the equation. However, making a major difference, a major national difference in energy usage would require much higher energy prices to motivate people to buy more efficient appliances, cars, et cetera, or there would have to be heavy Federal Government intervention, and it would still take a decade or more to work out the problems.

Be wary of anyone who tries to sell you a silver bullet in energy. There are none. A diversity of approaches is essential.

Where does all of this lead? To me, we need, as indicated, a more balanced, a better-balanced approach. We need a diversity of energy sources and energy efficiency if we are to minimize our costs and our vulnerabilities. However, that would require Federal intervention, which is not universally welcomed.

Let us not forget energy research and development. Our Federal investments at the Department of Energy and its predecessor agencies have yielded very important technologies, some of which are in use today and others are on the shelf, ready to go when we need them.

Also, it may be that we need to be temporarily flexible in some of our near term environmental goals to help us get back on an even keel. They are doing that in California now. I, for one, on the other hand, do not endorse permanently turning back the clock on pollution reduction.

Finally, let us not be afraid to have open, honest dialog on our options. Every one of them has advantages and disadvantages. Let us discuss the options objectively and strive to minimize the extremism and misinformation that so often characterizes such discussion.

Let us put somebody in charge of overseeing our nation's energy system. If it is to be the Secretary of Energy, let us make that clear by law and give him or her the authority and the budgets needed for the task.

Thank you.

Senator VOINOVICH. Thank you very much.

Attorney General Spitzer?

STATEMENT OF ELIOT SPITZER, ATTORNEY GENERAL STATE OF NEW YORK

Mr. SPITZER. Mr. Chairman, Senators Lieberman, Clinton and Inhofe, thank you for those kind words. Thank you for inviting me to testify before this subcommittee concerning the interaction between our environmental regulations and our nation's energy policy.

Let me be crystal clear: There need be no conflict between environmental protection and a sound energy policy. Indeed, careful attention to environmental and health protections will enhance, not harm, our energy security.

Our energy supply must be reliable and affordable. I agree that it must be expanded. However, it must not only be superficially inexpensive, appearing cheap because of hidden costs borne elsewhere.

An energy supply that is provided at the cost of harm to the public health or the environment—imposing enormous, but usually unquantified costs on the American public through health care costs, lost productivity, premature mortality or lost enjoyment of health or natural resources—is not in the nation's best interests.

Proposals for such a policy will backfire. By contrast, proposals for clean energy and energy conservation will garner public support and confidence and provide the path to a balanced energy future.

I urge you to work together, as we are trying to do in New York, to move the country toward a balanced energy policy and to reject the claim that environmental protections are the cause of the energy squeeze we are seeing today. Environmental protections are not the cause of, but part of the solution to the energy challenge.

It was the lack of perceived demand, not environmental regulations that led companies not to build new power plants over the last decade. Indeed, many environmentalists support new plants

that if linked with strong efficiency programs will take the place of our dirtiest existing plants.

My office investigated air pollution problems facing New York. Neighboring States, in particular Connecticut and New Jersey, joined in this. Asthma is on the rise in urban areas. Indeed, pediatric asthma in New York City is two to five times the national average and double what it was 20 years ago.

Numerous studies have shown that thousands of people in New York alone and tens of thousands in the country die prematurely due to particulate air pollution.

Over 20 percent of the lakes in the Adirondacks are dead, so acidic that fish cannot survive in them. Without dramatic additional reductions in air pollution, that figure will rise to 40 percent within several decades.

Every summer, portions of the Long Island Sound bordering New York and Connecticut and many other estuaries throughout the country become eutrophic, so devoid of oxygen that fish cannot survive.

New York's and our nation's cultural heritage, our buildings and our monuments are corroding under onslaught of acid rain. Mercury contaminates most of our waters, rendering fish unsafe to eat and threatening human health. These harms of pollution are quite real. They are not merely a matter of environmental preferences. Asthma, premature mortality and other respiratory diseases cost Americans billions of dollars every year. The loss of recreational jobs, tourism and commercial fishing, plus the increased expense of water treatment, cost the nation billions every year. The loss of our architectural history is priceless and it costs many millions each year just to stem the destruction.

To address the harms caused by pollution, my office sued the coal-fired power plants that are the source of much of this air pollution. These lawsuits are premised on clear violations of the New Source Review provisions of the Clean Air Act, which required that old plants be upgraded to modern standards when non-routine modifications are made.

These suits are based on well-settled interpretations of statutes and regulations that date from the Reagan and first Bush Administrations. The law is clear and industry documents prove beyond any doubt that the industry understood the types of investments at issue in this litigation were covered by the statutes and regulations. Companies were evading the New Source Review provisions and expanding or upgrading their plants without installing the necessary pollution controls. Our lawsuits simply seek to have these controls installed.

We filed notices of Intent to Sue against 17 coal-fired electricity plants located in upwind States in September 1999. You should know that we play fair in New York and do not only pursue out-of-State sources. With the State Department of Environmental Conservation, we also commenced enforcement actions against eight coal-fired plants in New York.

Shortly after we filed our notices of intent, the Federal Environmental Agency commenced legal action against a number of coal-fired plants as well. A number of other northeastern States joined our actions.

I should note that Governor Whitman, acting through her appointed Attorney General, was very supportive of this effort.

We have now reached agreements in principle with two companies, Virginia Electric Power Company and Cinergy Corporation. These agreements will lead to enormous reductions in the emissions from the coal-burning plants from these companies. They will spend approximately $2.8 billion in support of these emission control systems, an agreement they entered voluntarily because they understood the weight of our legal argument.

In addition, we are in active discussions with several of the owners of several of New York's coal-fired plants.

In discussing resolution of these lawsuits with the companies, we recognized the need to ensure the nation's energy supply. We gave the companies significant time to install the needed controls. These lawsuits will have absolutely no detrimental effect on our energy supply. We ensured that the upgrades could be implemented consistent with the operating and financial needs and abilities of the companies.

We expect that pursuant to the settlements some facilities will be repowered and expanded. Moreover, these settlements provide the regulatory certainty these companies need to invest. By providing clear guidelines for the future these settlements delineate a path through the environmental laws, allowing the companies to invest in their coal plants.

The result is to improve our energy diversity, increase our energy supply and improve the environment, a win-win result. These lawsuits are achieving major environmental improvements while helping, and not in any way harming, our energy security.

For that reason, I disagree, respectfully but vehemently, with the request by Senators Inhofe and Breaux that these cases be suspended.

Indeed, it is the uncertainty created by the effort to suspend the New Source Review program, not any uncertainty created by the litigation, that is jeopardizing progress in this area.

Senator Voinovich asked how to harmonize our environmental and energy policies. We can harmonize these two critical needs by addressing not only how much power we have available, but how the power is generated.

We can achieve a sustainable energy portfolio by enacting policies that promote clean, distributed generation, renewable power, and energy efficiency and at the same time ensuring that the necessary new supply can be brought on line promptly.

Recent studies demonstrate that even in northern States such as New York solar power which is best generated on hot summer days can already be cost effective in reducing peak electricity demand which also comes on hot summer days.

We also have significant wind resources if the electricity can be properly distributed. Finally, we can achieve significant gains in energy efficiency even in New York, which ranks second among the States for the most efficient use of energy today.

One important way to achieve these gains is to implement as soon as possible the appliance energy efficiency standards, which the new Administration has put on hold. They are critical to a sound energy policy.

If we were to improve efficiency by an achievable 10 to 20 percent, we would be solidly on the path to resolving the energy challenge and we probably, just by that measure, would go most of the way toward meeting even the most aggressive climate change goals. Finally, we would reduce our dependence on foreign fossil fuels.

In sum, the Clean Air Act, as well as other environmental regulations, should not be viewed as hindering a sound energy policy. The American people will not accept energy production that poisons their air and their water, any more than they will accept blackouts. Indeed, it is a false dichotomy to suggest that people must choose one or the other. An environmentally sound energy policy is the only sustainable future. Fortunately, it is achievable if we demonstrate leadership and foresight.

Thank you very much.

Senator VOINOVICH. Thank you, Attorney General Spitzer.

I would like to start off quickly. I do not want to debate the issue of the lawsuits that we have. Frankly, I did not expect that we would be getting testimony on it. I would like to ask two questions, Attorney General Spitzer, that are relevant because "I am the Governor of Ohio." I am proud of the fact that while I was Governor of our State that we did achieve the current ambient air standards.

I would like to point out that New York is not in attainment of the current ambient air standards. It is interesting say, if they are not in current attainment, how are they going to attain the new standards?

Second of all, more important that New York is expected to have power outages this summer, at least brownouts and possibly blackouts.

I understand the main problem for the city is an adequate transmission capacity, not necessarily the generation problem. In your opinion, are there any environmental impediments to increasing the transmission capacity for New York? This is going to be a big problem this summer for your State and particularly for the city.

Mr. SPITZER. Let me address each of those questions. I think they are very well framed questions. First, you are correct, New York State has not complied with the attainment standards. Part of the problem, even though it is not the exclusive answer, is that we have an inflow of pollution from out of State. That indeed was the rationale for our lawsuits.

I think it is very poignant that the power plants in Ohio and elsewhere—and I don't say this to cast blame, but I think it is just a fascinating fact—built smokestacks that were in excess of 700-feet tall. The reason for that, and I think it was a very wise policy by the energy companies because they like to be good neighbors for those in the immediate vicinity of the plants, was they do not want the emissions from their plants to fall on their neighbors.

Unfortunately, what these smokestacks do is send the emissions up into the air stream where they come down farther to the east, which means New York, New Jersey and Connecticut, which is precisely why we have such an overwhelming interest in ensuring that the plants in the Midwest comply with the Clean Air Act.

So, I think that yes, Ohio was to a certain extent able to satisfy its statutory mandate——

Senator VOINOVICH. Not to a certain extent. We did achieve it.

Mr. SPITZER. To a certain extent because it was able to shift the burden eastward. I applaud you for caring enough to reach and satisfy the attainment standards, however, I think part of the reason you were able to do that is that we are now caught with the very emissions that come from the Ohio plants and that is the predicate for our lawsuit.

Senator VOINOVICH. We could close down our plants and you would still have a problem in terms of achieving your emission standards. I ought to get off this subject. It is one that I have been dealing with for a long time.

How about the issue of transmissions?

Mr. SPITZER. I agree with you entirely about the T&D systems. I applaud you, and I say this very sincerely, for getting Ohio into compliance. We are working aggressively within New York State. As I said, we play fair. We are pursuing New York emissions as well. That doesn't mean we will ignore out-of-State emissions.

With respect to transmissions and distribution, in the report that I issued we focus a great deal upon transmission and distribution constraints. New York State has not invested adequately. It is an interesting figure. Ten years ago we invested over $300 million annually to improve our transmission and distribution systems.

In 1998, it was down to $90 million. We have load pockets downstate—New York City and Long Island—that make it very difficult to move the energy from those regions where we have an energy surplus, Western New York where we have access to hydropower from either Quebec or elsewhere, down to New York City. We have to improve more in our T&D systems.

I disagree a little bit with the second part of your question. I don't think we will have, there is no certainty, certainly, to the notion that we will have either brownouts or blackouts in New York City this summer.

I think that if we make the necessary adjustments and put in place, and I support putting in place, some of the turbine generation in New York City and on the Island that we need, we will avoid that concern this summer.

Senator VOINOVICH. Dr. Hirsch, here is a big question. You say that we are not organized to have an energy policy. Have you given any thought to how you would organize the Federal Government so that we do have an energy policy? Where would you put the overseer of this program?

Mr. HIRSCH. The logical place would be in the Department of Energy, in my opinion. It should be the Secretary of Energy. As indicated, he does not now have responsibility for overseeing the well being of a very complicated energy system that we have in the United States.

That, I think, needs to change. As I said before, a number of the issues that we are facing today were predictable. Indeed, if somebody was looking at the details of what was happening in the oil patch in terms of drilling for natural gas, you could have predicted that there would have been a problem coming.

Could we have done somebody about that? It would have taken heroic action, but we could have, I think.

In terms of the problems with transmission and distribution of electric power, there needs to be somebody seriously looking at these issues and reporting so that you all and we all listen and pay attention to the problems before they get to the point that they are today.

The same thing with oil, natural gas pipelines and so forth.

Senator VOINOVICH. Thank you.

Senator CLINTON.

Senator CLINTON. I think we have to go vote; don't we? I think this is such an important discussion. I would only add that the interchange between the chairman and General Spitzer is important in several respects.

You know, I have a great deal of admiration and respect for our chairman and for our Attorney General. I honestly believe, going along with what Dr. Hirsch just said, that we can give real leadership to this. We can, in this Congress, in this Session, in a bipartisan way, by getting people around the table and honestly discussing our differences and trying to figure out how to bring about the changes that we all seek. To that end, of course, I am hopeful that there will be sufficient funds left in our Federal budget to provide some of the carrots that we need, some of the incentives that we need so that our utility companies have the incentives that are required to move toward efficiency and controlling emissions and that we also make the kind of investments Dr. Hirsch is speaking of that need to come from the public sector, as well as the private sector, in a partnership.

I honestly believe if we did this right now, and I would respectfully ask the Administration whom I am sure must have representatives in the audience, to think carefully about what we could do in a bipartisan way to achieve these ends with the kind of incentives that are possible.

Senator VOINOVICH. I think we will recess now for 15 minutes and then get back. We will catch the last of the first vote and do an early vote on the second one.

[Recess]

Senator VOINOVICH. The committee will come to order.

I would like to call on Senator Inhofe. I would also like to make note of the fact that Senator Corzine stopped by and although he cannot be here, he has asked that his statement be inserted in the record. He would appreciate the witnesses responding to several questions that are in his opening statement.

Senator VOINOVICH. Senator Inhofe.

Senator INHOFE. Thank you, Mr. Chairman.

Let me just make a comment rather than ask a question. I think, Mr. Spitzer, you probably will have a response to it. You implied in your testimony that the NSR Program is quite clear. I would like to submit for the record a March 12, 2001 letter and attachment from Russ Harding, Michigan's DEQ Director, to Administrator Whitman. In this letter he is representing the DEQs of six States.

These directors state, and I am quoting now that "They understand the complexity of the current air permit program, referring to NSR, and the roadblocks to administer it fairly and consistently."

The attachment to the letter then outlines proposals for much needed true reforms. Based on this letter and discussions I have had, it doesn't sound like your opinion of the NSR is shared by everybody or by many of them.

Mr. SPITZER. Sir, I appreciate the comment. I think you said that they described it as complex. I don't think "complex" and "clear" are necessarily opposites. It is complex, certainly, but the tax code is complex but also I think it is quite clear how we pay taxes, in most instances.

I think that the NSR guidelines and regulations, certainly the ones that we have invoked in our litigation, are, we believe, very clear. I would suggest what we could submit to you—and we would be happy to respond precisely to that letter—but what I will also send to you is our motion for partial summary judgment in our litigation against AEP, which is one of the pending litigations.

We will have to redact some of it because some of it is based upon internal documents from the company that are filed under seal. But I think you will see that we rely upon almost entirely regulations and interpretations of regulations that were issued during the Presidents Reagan and Bush Administrations.

I think that we are not invoking either new interpretations or trying to put a gloss on new interpretations. We are using very stable, accepted interpretations of an NSR structure that the companies, and again the internal documents demonstrate this, understood.

Senator INHOFE. My staff just reminded me that we went through this in another hearing, that this is a 20-page regulation with 4,000 pages of guidance documents.

I do want to submit this letter for the record. You can respond specifically to the letter.

Mr. SPITZER. We would be pleased to do that, sir. Senator Inhofe. I neglected to ask, and I would ask now unanimous consent that the letter from John Breaux and myself be inserted in the record right after my opening comments and this letter at this point.

Senator VOINOVICH. Without objection.

Senator INHOFE. Dr. Hirsch, there have been no new refineries sited in almost 20 years. Do you want to tell us why?

Mr. HIRSCH. Well, it is a low margin business. It is not attractive for people to get involved from the outside in most cases. A lot of refineries that are there now, particularly with the large oil companies, have been expanded over time. The economics are not unreasonable for folks like that.

Also, to try to get permits to site a new refinery would be a bear, just an absolute bear. People would object to that the way they object to power lines and other things. So, it would be a daunting task. It is easier to expand existing refineries.

Senator INHOFE. You know, I have talked to a lot of refineries and some in my State of Oklahoma. They say it is not just the regulations, but it is the uncertainty and the interpretations and it is a moving target. There are huge costs of compliance, only to find out that they are complying with the wrong thing.

Mr. Spitzer, do you have any thoughts about that?

Mr. SPITZER. Absolutely. I think you focus on the word "uncertainty." I agree with you. I think uncertainty is a risk that busi-

ness does not like to assume. So, one of the things we have sought to accomplish in our settlements with both Cinergy and VEPCO is certainty with respect to the nature of the investments they have to make to ensure compliance. We believe that is an unalloyed good.

With respect to your larger point about the failure to get additional supply on line, again, the report that we issued a few weeks ago addresses that very clearly. We need new supply. I agree with Dr. Hirsch. He and I were chatting during the break. We have to improve the siting process. We have to invest in transmission and distribution lines so that we have a grid that works, that permits energy to flow into load pockets right now that are cutoff.

We make some very specific recommendations in my report, though they are specific to New York State, about how we can improve the siting process and how we have to also work to overcome what we all understand is local opposition to plants that are not necessarily desirable neighbors.

So, I think I agree with you with respect to the cost of uncertainty. I don't think that is the underlying reason that we have not had new investment. I think that in the market, in its regulated context for many years there was not an understanding of the pent-up demand. I think that goes to the California crisis as well.

Senator INHOFE. OK. Now, we are running the clock here. Can I get one more question in here since the other people have not come in?

Senator VOINOVICH. Surely.

Senator INHOFE. I wanted to ask you to respond, if you would, Dr. Hirsch. In the statement of General Spitzer, "Environmental protections are not the cause of, but a part of the solution to our energy challenge."

You saw the spike chart which we have used now for a couple of years. Would you respond to that statement and also what role the regulations play in the future costs of energy, of gas and fuel?

Mr. HIRSCH. That is a tough question. The reason why it is a touch question is that it depends on who you talk to.

Senator INHOFE. We are finding that out.

Mr. HIRSCH. Yes. There are people who are trying to run businesses and work hard for pennies, in particular going back to refiners. They worry about fractions of a penny. Environmental regulations come along and cause them to have to put in equipment and change the way they operate, causing their costs to go up by two, three, four or five cents. Now, that is not only difficult for them personally, but it is tough from a competitive standpoint unless everybody is treated equally.

It is important that we reduce a number of our air pollutants. You and I, our kids, and our grandkids are breathing them. We have to do something about that, but we ought to be able to do it in a way that works a little better than it is working now, where people are dragged kicking and screaming, in a number of cases.

you will always have some people who will hold out, but it seems to me there must be a better way to do it.

Senator INHOFE. Thank you. Thank you, Mr. Chairman.

Senator VOINOVICH. Thank you. I really don't know whether Senator Lieberman and Senator Clinton are coming back. I would like

to thank the panel for being here this morning. I appreciate your testimony. We will be submitting some other questions to you if you would be willing to respond to them.

Thank you very much for being here.

Mr. HIRSCH. Thank you, sir.

Senator VOINOVICH. I would like to apologize to the next panel for the long wait that they have had.

Testifying today will be Mr. Thomas Stewart, Executive Vice President of the Ohio Oil and Gas Association. Following Mr. Stewart will be Mr. Jason Grumet, Executive Director of the Northeast States for Coordinated Air Use Management; Mr. Bob Slaughter, Director of Public Policy for the National Petrochemical and Refiners Association; and Mr. Carlos Porras, Executive Director of the Communities for a Better Environment; and Mr. Taylor Bowlden, Vice President of Policy and Government Affairs at the American Highways Users Alliance.

I understand that Mr. Bowlden worked for Senator Symms on the EPW Committee for 10 years.

I would like to particularly welcome Mr. Steward from Ohio, the Ohio Oil and Gas Association. I have worked with that organization during my years as a legislator and then as Governor of Ohio.

Now, I would like to begin the testimony. Mr. Stewart, will you start?

STATEMENT OF THOMAS STEWART, EXECUTIVE VICE PRESIDENT, OHIO OIL AND GAS ASSOCIATION

Mr. STEWART. Good morning. I am Tom Stewart and I serve as the Executive Vice President of the Ohio Oil and Gas Association, a trade association representing over 1300 oil and gas producers in the State of Ohio and allied support industries.

I am also testifying on behalf of the Independent Petroleum Association of America who represents thousands of independent producers throughout the nation and who I am proud to say is a fine advocate for our issues here in Washington, DC.

The exploration and production industry is distinguished by its breadth and diversity. Oil and natural gas are found in 33 States, 12 of which are represented on the committee. There are over 850,000 oil and gas wells in the country in areas ranging from arid plains and forests to wetlands. These wells produce from reservoirs that are shallow to ultra-deep. Production levels range from the very prolific to wells that produce less than one barrel of oil per day.

The operation of these wells has been regulated since the 1920's, with an increasing emphasis on environmental controls since the 1960's. Because of the diverse conditions associated with production, the regulatory process must be flexible in reflecting the unique conditions in each State and the areas within the States.

It requires the technical expertise which has been developed in each of these States and which does not exist within the Federal EPA. For this reason, Federal law and determinations issued by EPA have generally deferred regulation of the industry and the various States.

Furthermore, many studies catalogued by interstate oil and gas compact commissions have established that environmental regula-

tion at the State level results consistently in higher standards of protection than does Federal regulation.

Complying with environmental regulation remains a significant cost for my industry, with estimates of annual costs ranging from $1.6 billion to more than $2.6 billion.

Equally important is understanding that independent producers, who range from large publicly traded companies to small business operations, drill 85 percent of the wells within this country. The common factor for these independents is that their revenues and hence their ability to meet environmental costs come solely from exploration, production, and sale of crude oil and natural gas from the wellhead.

So, unlike large major producers, the integrated oil and gas industry, the independents have no means of passing on production and regulatory costs through other operations such as refining and marketing.

Consequently, we place great emphasis on cost-effective regulation, limited paperwork burdens and avoiding duplicative regulatory requirements.

In general, the unique problems associated with the diverse nature of the E&P industry have been addressed, making the burden of regulation manageable. However, there are some exceptions. For example, the most compelling environmental issue confronting my industry is the movement to have U.S. EPA regulate hydraulic fracturing under the Save Drinking Water Act.

Hydraulic fracturing is a common and necessary procedure used by producers to complete the majority of domestic crude oil and natural gas wells. A producer performs the fracturing procedure to increase the flow of oil and gas from rock known to contain oil and gas, but the rock's natural characteristics do not allow oil and gas to reach the well bore in sufficient volumes.

The process involves pumping fluid, often fresh water, down the well and into the reservoir to create drainage ditches deep within the reservoir of the rock.

Since 1951, massive numbers of hydraulic fracturing jobs have been performed in Ohio and throughout the United States, dramatically increasing the nation's oil and gas resource base. This process revolutionized and made modern the Ohio oil and gas industry.

At the time that the Safe Drinking Water Act was enacted, the States had already developed extensive underground injection control programs to manage liquid waste resulting from operations. Congress recognized the States' efforts by modifying the Safe Drinking Water Act to allow States primacy based upon comparable State oil and gas UIC programs.

In so doing, Congress recognized that State UIC programs were well structured and that an overall Federal program would not be sufficiently flexible enough to deal with the varying circumstances from State to State.

At no time during these debates has there ever been a suggestion to increase hydraulic fracturing in the UIC waste management requirements. This is because fracturing is a temporary injection of fluids designed for well stimulation and is not underground injection designed for waste control.

Because of this and the purposes for which it was designed, it does not create an environmental problem.

Nonetheless, in the mid–1990's, the Legal Environmental Assistance Foundation, after years of failing to make and environmental case against coaled methane development, petitioned the U.S. EPA to regulate fracturing under the UIC program.

EPA rejected LEAF, arguing that Congress never intended UIC to cover fracturing. LEAF appealed this to the 11th Circuit Court, which in 1997 issued a decision, but did not address the environmental risk, but merely spoke to the plain language of the statute, saying that it should include it as underground injection. Initially, EPA responded to the LEAF decision by requesting that the Groundwater Protection Council study coal bed methane wells, which was the prime focus. After evaluating 10,000 wells, they found one complaint, the LEAF case Alabama well that EPA had already concluded was not a fracturing problem.

LEAF now returned to file a second case against EPA, likely to be decided this year, arguing that EPA should implement nationwide rules. If EPA loses this case, all hydraulic fracturing jobs could be federally regulated.

Simply stated, EPA's original rejection of LEAF's complaint implements the balance Congress struck between protection of drinking water while also encouraging the continued development of gas and oil resources.

However, LEAF would have EPA carve out fracturing for Federal regulatory oversight for steep, inactive and other injection methods.

The National Petroleum Council estimates that 68 percent of the wells drilled in the next decade to meet natural gas demand would require fracturing.

To regulate fracturing under Federal regulation, as LEAF suggests, would drastically impede domestic recovery of oil and gas reserves. It would contravene the very purpose of the Safe Drinking Water Act.

Even if EPA wins the LEAF case, the likely result will be a rash of lawsuits of similar nature.

Not considered an issue at the time, the Safe Drinking Water Act was passed, Congress did not specifically excluded fracturing. Two decades later, the court ignored the facts of the issue and changed the scope of the law on a technicality.

We would hope that Congress would address this issue by legislation. We appreciate Senator Inhofe's efforts in this regard during the last session.

One other issue I would like to bring up of the many that are in my written testimony is the Endangered Species Act. While Federal land managers, principally the Bureau of Land Management, develop resource management plans, one of their most important concerns is habitat management. However, balance needs to be struck.

Endangered species is not a very big issue in Ohio, but it has had an impact. For example, in the Wayne National Forest of Ohio, a small oil and gas producer for an extended period has been seeking to obtain a permit from the Bureau of Land Management to drill a development well on a Federal lease tract.

Since applying for the permit in February 2000, the producer has been waiting for the Forest Service to perform an environmental assessment taking into account new information, if any, regarding endangered species.

It is ironic that the producer already operates two wells on the same property. It is even more ironic that continuous oil and gas operations have existed in this area since 1860. While this producer has been waiting for the Federal process to resolve itself, his requisite permits issued by the State have been issued and expired. Needless to say, he is frustrated with the process that stymies the drilling of a simple development well in what is the most mature oil and gas-producing basin in the United States.

Senator VOINOVICH. Mr. Stewart, I think you will have to wrap it up.

Mr. STEWART. I could not agree with what the other witnesses have said before, Senator. We do agree that there has to be a harmony brought between environmental regulation on a wide scope and the nation's energy supply. We encourage Congress to drive toward that by national policy or by separate issue.

Senator VOINOVICH. Thanks very much. We appreciate your being here.

Our next witness is Mr. Jason Grumet, Executive Director, Northeast States for Coordinated Air Use Management.

Mr. Grumet?

STATEMENT OF JASON S. GRUMET, EXECUTIVE DIRECTOR, NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT

Mr. GRUMET. Thank you, Chairman Voinovich, Senator Inhofe and Senator Carper.

My name is Jason Grumet. I am the Executive Director of NESCAUM, which for over 30 years has been assisting the Northeast States in establishing a coordinated approach to our common air quality goals.

On behalf of those eight States, I would like to express our appreciation for the opportunity to testify before you here today.

The issues before the committee, Mr. Chairman, are clearly numerous and complex. I would like to, at the outset, commend you and Senator Lieberman for bringing this opportunity forward so we can understand better and explore the necessary connection between sustainable energy and environmental policies.

Mr. Chairman, the current focus on our energy situation in this country, presents clear challenges and also obvious opportunities, it is understandable and yet regrettable that our body politic tends to focus on energy issues during moments of scarcity, whether they are real or perceived.

At these moments of scarcity, the fundamental vulnerability of our nation's dependence on a monoculture of imported oil is most obvious. It is also at these moments of scarcity where long-term strategies which look at the environment's impact on energy and energy policy's impact on the environment, as well as strategies that understand the need to focus on more energy efficient demand side policies are often eschewed in favor of quick fix strategies

which try to provide immediate relief at the pump, socket and switch.

It is worth noting, Mr. Chairman, that Congress has boldly grappled with our country's hydrocarbon dependence in the past. The 1992 Energy Policy Act set forth ambitious but reasoned goals to try to break this monoculture of dependence on foreign petroleum.

By 1999, 75 percent of the vehicles purchased by our government were supposed to operate on non-petroleum alternative fuels. By the year 2000, a full 10 percent of our motor fuels used in this country were slated to be non-petroleum and by 2010 that number was slated to rise up to 30 percent.

The best description of our success and approach to this effort has been sadly woeful, Mr. Chairman. Presently, less than 1 percent of the fuels used on our nation's highways are non-petroleum.

The Energy Administration indicated that the 20 million barrel per day use of oil is projected to rise to 26 million barrels per day by 2020. Last year, $100 billion of U.S. money was spent on imported oil. The trade deficit on the basis of that vast expenditure surged to the highest ever of $135 billion.

Mr. Chairman, as a founding member of the Governors' Ethanol Coalition, I know that you appreciate the need to diversify our energy stock to a more reliable, diverse and domestic feedstock.

However, I would respectfully submit to you and the rest of this panel that had our nation devoted the resources and innovation to achieve the goals of EPACT over the last decade, both the mood and the options available to us today would be far improved.

Mr. Chairman, I also agree with the statement you made initially that our economy today and tomorrow is going to rely on petroleum. I hope to take issue with that next tomorrow. It is my sincere hope that tomorrow's tomorrow will in fact enable us to have an economy that also relies on clean and renewable energy like fuel cells and electric vehicles.

We in the Northeast States are working diligently to try to bring that about.

I would like to focus on three regulatory policies, if I may, that deal with the issues that we must grapple with today to harmonize our existing dependence on petroleum with our very legitimate environmental needs.

I will try to touch on these quickly. I will not mention NSR at all because I think Attorney General Spitzer did a fine job on behalf of the Northeast States position.

First, Mr. Chairman, is the question of mobile source toxics. In 1990, this body adopted Section 202(l) of the Clean Air Act which "directs the agency to promulgate regulations to control hazardous air pollutants from motor vehicles and motor vehicle fuels."

These standards, at a minimum for benzene and formaldehyde should "reflect the greatest degree of emission reduction achievable for the application of technology which would be available."

Mr. Chairman, EPA's efforts in this regard have been uninspired at best. While we recognize that motor vehicles are responsible for known carcinogens that are emitted in excess of health standards throughout the country, we finally got a rule under court order from U.S. EPA that does nothing to actually reduce the emissions of these mobile source toxins.

At best, Mr. Chairman, EPA's role could be described as what we used to call on the kickball court a "do-over." They identify many of the inadequacies in their understanding of the problem and have committed to a regulatory response in 2003.

I would ask this committee to work with these States to see that that in fact is achieved.

Next, Mr. Chairman, I would like to mention briefly the issue of diesel. Diesel is the lifeblood of our transportation technology. But our failure to control diesel emissions have led to an unacceptable toll on our environment and public health.

Moreover, the inability to control diesel effectively over the last 30 years has created a vulnerability in our diesel supply because we simply can't rely on a fuel that is going to exact that kind of public health harm.

There are two issues underway which would address this. First are the consent decrees entered into by diesel manufacturers to address the fact that over one million engines were sold in this country which violate the environmental standards that they were committed to achieve.

Second is the 2007 rule, recently promulgated by this agency, which for the first time would make the words "clean and diesel" rightfully belong in the same sentence.

I would ask that this committee work to help us oversee the consent decrees, which sadly are beginning to unravel. The very companies that signed these decrees are now seeking relief from their very commitments, which causes us great concern in the Northeast.

With regard to the 2007 rule, the agency should be commended and the Administration from moving forward to implement this regulation.

I would like to submit for the record a letter signed by a number of States and industries supporting this rule and noting one concern. That concern is that there are suggestions that the Administration is going to impose a third-party review to kind of look over the shoulder of EPA and determine whether this rulemaking should go forward.

We think that would actually provide much more harm than good by undermining investment decisions and undermining the very certainty that industry needs to comply with these regulations.

Senator VOINOVICH. Can you wrap it up?

Mr. GRUMET. Any review that is done should be done within the FACA.

Finally, Mr. Chairman, Senator Lieberman mentioned the issue of MTBE. Congress and only Congress can get our country out of this fix by lifting the oxygen mandate. Presently it is not possible to protect air quality, water quality and maintain a reliable fuel and low-cost fuel because of the oxygen mandate.

We are left between the rock of MTBE contamination and the hard place of an ill-designed ethanol mandate.

I would like to thank Senator Inhofe and Senator Smith for their efforts last year to address the oxygen mandate. I commit to work with this and other issues in the coming days.

Thank you very much.

Our next witness is Bob Slaughter who is the Director of Public Policy for the National Petrochemical and Refiners Association.

Mr. Slaughter?

STATEMENT OF BOB SLAUGHTER, DIRECTOR, PUBLIC POLICY, NATIONAL PETROCHEMICAL AND REFINERS ASSOCIATION

Mr. SLAUGHTER. Thank you, Mr. Chairman. I want to thank you for the opportunity to comment on national energy policy and environmental regulation's impact. NPRA represents almost 500 companies, virtually all domestic refiners and most petrochemical manufacturers.

It has been many years since we have had serious national debate on energy policy. For the last two decades, low prices and plentiful supplies have allowed policies and policymakers to take energy for granted.

As a result, programs with great impact on energy have often been pursued in an isolated fashion. Important national goals such as environmental improvements have not been balanced with the need for reliable domestic energy supplies. The tradeoffs inherent in policy decisions have not always been recognized.

Our national energy policy thus far has resulted in declining domestic oil production, domestic natural gas production is still below levels in the early 1970's, increasing imports of crude oil and products and refining capacity stretched to its limit with further expansion limited by regulatory policies.

Domestic refiners are increasingly challenged to meet demand. Since 1983, the number of U.S. refineries has decreased from 231 to 152. Total capacity has been relatively stable, but energy demand has risen dramatically, by 20 percent.

For much of 2000, refineries ran near their operational maximum. Utilization peaked at 97 percent last summer. As this graph from a recent National Petroleum Council study shows, U.S. demand for petroleum products exceeds domestic refining capacity resulting in increased product imports.

For the last 20 years, there was excess U.S. refining capacity. This chart says that is gone. Due to financial and regulatory constraints, it is unlikely new refineries will be constructed in the United States. No new refinery has been built here in about 20 years. Hence, the importance of expanding capacity at existing sites. That is where the NSR regulations will come in and I will discuss them later.

Rates of return for refineries averaged only about 5 percent in the last decade, roughly the return from a passbook savings account, but with much greater risk. Refiners had to make large investments to meet environmental requirements. The National Petroleum Council estimated these costs exceeded the book value of the entire refining industry during the last decade.

Refiners now again face substantial challenges. As my second chart shows, an avalanche of environmental requirements is coming, all within the same narrow implementation period. Investment requirements will be substantial. We think as much as $20 billion over the next decade.

The recent closure of one Midwest refinery providing 9 percent of Midwestern supply reminds us that some existing refineries may

not be able to continue to operate. The product distribution structure is also challenged. The complicating factor has been the addition of various area-specific fuels to the fuel mix.

The next chart, prepared by Exxon-Mobil, identifies current fuel requirements across the nation. Assuming three grades per category, there are almost 50 distinct gasolines on this chart. Pipelines and terminals have the same problem keeping these fuels separate. They, too, are faced with constraints on their operations and find it difficult to expand.

As we saw in the Midwest last summer, differing fuel specifications severely limit the ability to move supplies to areas that become short. Some ongoing initiatives merit a second look because they threaten future energy supplies.

The first is EPA's New Source Review Enforcement Program in which EPA has retroactively reinterpreted its permitting rules long after modifications to refineries were made, amounting to "regulation through enforcement" rather than through public rulemaking.

The companies acted in good faith to modify existing facilities to keep up with existing demand. They had the knowledge of regulators and now face millions of dollars in fines and additional costs as a result of their efforts.

Bear in mind, if refiners had been unable to make the expansions at existing refineries, the first chart showing the balance between demand and refining capacity in the U.S. would be even farther out of balance than it is today.

The refining industry is not arguing against enforcement, but we are arguing for fairness and equity in ensuring compliance by everyone.

We commend Senators Breaux and Inhofe for their recent letter to the Vice President questioning EPA's approach. Permitting uncertainties will discourage capacity expansions and slow necessary modifications. In many cases these modifications are necessary to produce cleaner burning fuels like Tier II low sulfur gasoline.

The choice that America has to make is between these expansions or increased imports of petroleum products. We support market-based incentives as we move forward with new NSR requirements, but fuel supplies will be further strained unless we get a new, streamlined and flexible permitting process.

We urge the Administration to review EPA's current enforcement initiative and to include permitting process improvements in national energy policy.

To be fair, future action on enforcement will also need to consider those who have already settled with EPA in order to avoid disadvantaging them.

Another EPA initiative that concerns us is the ultra-low sulfur diesel program. An important study commissioned by Charles River Associates indicated that there will be a 12 percent shortage in national supplies of highway diesel in the first year of that program. That program, despite our recommendations, was put right on top of the EPA's gasoline sulfur reduction program.

The National Petroleum Council recommended very strongly against that move and found that there was increased danger of supply disruptions if those rules were not appropriately sequenced.

Contrary to others on this panel, we think the rule would be improved by an independent analysis by a third party, the National Academy of Sciences. This rule's timeframe should be adjusted to reduce the potential for supply problems without foregoing its environmental benefits.

I would just like to say on MTBE, Mr. Chairman, we know that there is another concern for future energy supplies regarding MTBE. As you know, oxygenates assist in the production of cleaner-burning fuels. Several States have legislated an end to MTBE use due to groundwater concerns. But we ask the panel to bear in mind that MTBE does significantly supplement gasoline supplies. It is about 4 percent of the nation's gasoline supply, but is 11 percent of the gasoline supplies in RFG areas on the coasts. So, it is an extremely important component of gasoline supply and we ask you to bear that in mind in moving forward on that issue.

Thank you very much.

Senator VOINOVICH. Our next witness is Mr. Carlos Porras, Executive Director, Communities for a Better Environment.

Mr. Porras?

STATEMENT OF CARLOS J. PORRAS, EXECUTIVE DIRECTOR, COMMUNITIES FOR A BETTER ENVIRONMENT

Mr. PORRAS. Thank you, Mr. Chairman and distinguished members of the committee.

My name is Carlos Porras and I am Executive Director of a nonprofit organization based in California with offices in Oakland, and the Los Angeles area, Huntington Park.

I am very grateful to be able to present to you today a slightly different version of, I think, the impacts and considerations that are currently before you with this very pressing issue of energy policy in the United States which we are feeling very much so in the State of California and in particular in the communities that we do our work in. In urban areas of Los Angeles County it has very much come to fruition for us with some brownouts, blackouts, and the proposed siting of a new power plant in one of our communities, the city of Southgate.

The city of Southgate is approximately 85 to 95 percent Latino. I think this is very important to weigh in your considerations as we move forward with our considerations on energy and in particular the impact it has on regulation and environmental regulation which has a direct health impact in many communities, those which unfortunately not at the table when considerations and decisions are made.

I want to note that we have documented in the Los Angeles area some of these environmental problems and the disproportionate burden that it has in certain communities in a report that we published in 1998.

One of the things that is critical, I think, in looking at the regulatory impacts is to note that certain people, sub-populations are disproportionately impacted historically by what are policies, programs, enforcement or in many cases lack of enforcement has on the health of certain communities.

What we have done here to illustrate in this map of Los Angeles County, what you see is the color-shaded areas. The yellow areas

are zero to 40 percent people of minority, by 1990 Census data. The red-shaded areas are 80 to 100 percent communities of color. The green dots that you see in this map are one data base, toxic release inventory sites. That was gathered by the Federal Government. This shows the disproportionate impact.

What I would like to point out on this map, which is very important to note, is that as the doglegs of race by demographic in the county go, there is a pattern also with toxic release inventory sites.

Now, this has a very critical effect on health. One other thing to note is that that was one data base. In the communities that we are working in, Southgate being one, there is not just one source of pollution. This map indicates eight data bases which shows the huge impact, the cumulative effect of which is not being considered in the regulatory process.

Coming back to the issue at hand, it is very much an issue of health for us. A New Source Review has a direct correlation with the problems in our communities, the health effect. Recent studies coming out of the University of Southern California School of Medicine and another study at Occidental College and UC-Santa Cruz looks at the health effects of children in schools from these sources, point sources.

The impacts are having a direct effect on our children's learning abilities. So, I think it is important to keep that in consideration of any amendments to the Federal Clean Air Act, in particular New Source Review. In one of our struggles in our communities there is a refinery, Powerine Oil Company historically was built in 1936 and closed in 1995. it is currently seeking to reopen.

Under the Federal Clean Air Act that refinery should go through New Source Review and install best available control technology. Why? Historically, this refinery was documented as being the dirtiest in the State of California. The land use and development around the refinery has changed since it was built in 1936. There is a State mental health hospital within a few hundred yards, an elementary school within an eighth of a mile, a senior citizens center two blocks downwind from the refinery.

This refinery has repeatedly violated the air quality management district's permits.

Senator VOINOVICH. Mr. Porras, could you wrap soon? Thank you.

Mr. PORRAS. Yes. It is currently, as I said attempting to open without going through New Source Review. We have a significant problem with any type of operation given the history of historical violations that this refinery has had. A New Source Review is really the only method by which the community can attempt to protect their health and have a voice in the decisionmaking.

I would like to finally offer what we believe are some suggestions for public policy. That is that first and foremost toxic use reduction must be incentivized and prioritized by regulation.

Pollution prevention should be incentivized and required by regulation. Last, due to the fact that many of the substances that are generated and emitted into our environment causing serious health problems are yet unknown. We offer that the precautionary principle of "First do no harm" should be a public policy model that merits your consideration.

I thank you and thank you for the opportunity to speak to you.

Senator VOINOVICH. Mr. Bowlden?

STATEMENT OF TAYLOR BOWLDEN, VICE PRESIDENT, POLICY AND GOVERNMENT AFFAIRS, AMERICAN HIGHWAY USERS ALLIANCE

Mr. BOWLDEN. Good morning, Mr. Chairman and good morning, Senator Inhofe and Senator Carper.

I am Taylor Bowlden, Vice President of the American Highway Users Alliance. We appreciate the opportunity to talk to you today about how motor fuel consumption fits into our energy policy debate.

Today I want to discuss three specific issues that fall within the purview of this committee's jurisdiction. First is the importance of easing traffic congestion in order to reduce fuel consumption.

Second is the need to streamline the environmental review process to expedite congestion-relief projects.

Third is the adverse impact on highway improvements associated with legislative proposals to mandate ethanol use in motor fuels.

Let me begin with the connection between traffic congestion and fuel consumption. As most Americans could attest, traffic congestion has grown worse in the past decade. Just a few statistics will illustrate the crux of the congestion problem. Since 1970, American's population has grown by 32 percent, but the number of licensed drivers is up by 64 percent.

The number of vehicles has increased by 90 percent. The miles we drive those vehicles has jumped by 132 percent. Yet, during the same period of time road mileage has increased by just 6 percent.

It is no wonder that traffic congestion is a source of public frustration and concern like it never has been before. The Texas Transportation Institute estimates that in 1999 traffic delay cost more than $75 billion in the 68 cities included in their biennial report and wasted approximately 6.6 billion gallons of fuel.

What can be done to ease congestion? There are a variety of solutions depending on the particular circumstances, but there is no doubt that a program focused on eliminating the worst traffic choke points would produce significant fuel and time savings.

Cambridge Systematics, a highly respected transportation consulting firm, found that improving traffic flow at our nation's 167 worst bottlenecks would reduce gasoline and diesel consumption by 19,883,000,000 gallons over the next 20 years. That is one billion gallons of fuel a year, roughly one-seventh the cost the Texas Transportation Institute estimates for their 68 cities.

Fuel savings are just the beginning of the benefits that could be realized from improving those bottlenecks. The Cambridge Systematics report also says that we would prevent 290,000 crashes. We would nearly halve the pollution at those bottlenecks. We could slash emissions of carbon dioxide at those sites by 71 percent and we would reduce truck delivery and motorist delays by an average 19 minutes per trip.

Mr. Chairman, this is a win-win approach to energy policy because it would accommodate the public's need and desire for greater mobility while simultaneously reducing the amount of fuel needed to meet the demand for transportation.

Now, let me mention the environmental streamlining issue. Today, it takes approximately 12 years for a major highway project to move through the stages of planning, design, environmental review and right-of-way acquisition. That is 12 years before construction begins.

Typically, one to 5 years of that time is spent completing the environmental review. Congress made a serious attempt to deal with this issue in TEA–21, but I think it is fair to say that the work of the Federal agencies to date has not met the expectations of the members of this committee and in the House who crafted that statutory provision.

Given the time and expense involved in the current review process, we urge Congress to renew its effort at reform. Specifically, we encourage you to consider giving States the opportunity to play a greater role in interacting with Federal resource agencies.

In addition, we believe Congress should designate the transportation officials as the official arbiters of the transportation purpose and need of a proposed project and give those officials authority to set appropriate deadlines for comment by Federal resource agencies.

Finally, Mr. Chairman, I want to mention quickly the impact of ethanol-blended fuels in the Highway Program. As members of the subcommittee know, gasoline blended with ethanol is taxed at a lower rate than regular gasoline, resulting in a revenue loss to the Highway Trust Fund.

In addition, as the chairman noted in his opening statement, a portion of the tax that is imposed on ethanol is deposited in the General Fund rather than the Highway Trust Fund.

In combination, the General Fund diversion and the ethanol tax subsidy cost the Trust Fund $1.2 billion in lost revenues last year.

Toward the end of the last Congress, this committee considered and approved legislation that would phaseout MTBE in gasoline simultaneously establishing a nationwide renewable fuels program, essentially mandating a large new market for ethanol-blended gasoline.

We estimated that had that legislation been enacted, the Trust Fund's total subsidy to ethanol would have been $2.5 billion annually by 2007. Lost tax revenues attributable to ethanol-blended fuel would inevitably reduce the amount of highway funds distributed annually to the States and the loss of highway funding means less money available for projects to reduce congestion and conserve fuel.

I do want to commend you, Mr. Chairman, for taking the lead in addressing part of that problem. As you mentioned, you had a colloquy last year with other members about getting that portion of the tax that is going to the General Fund put back into the Trust Fund. We hope you will pursue that initiative and we commend you for it.

Thank you again for inviting me to testify.

Senator VOINOVICH. Thank you very much.

I would like to welcome Senator Carper here to the hearing this morning.

One of the things that has bothered me recently with regard to this discussion of a national energy policy is the fact that a bill that I am cosponsoring with Senator Murkowski and Senator Lott

is that there is a lot of emphasis on the issue of ANWR. It seems that is being kind of the lightning rod of the bill, and it really deals with so many other things.

I would like anyone to comment on what other sources of oil supply are available within our control in terms of the U.S. Government and how reasonable is it for us to be able to get our hands on it?

I know, for example, from reading and talking to people that a lot of sources of oil in this country just have been kind of abandoned. Even the people who are doing the work of extracting it have abandoned it because the price of a barrel of oil went so low that it wasn't reasonable for people to go at it.

What is available in terms of oil supply in this country and what would it take for us to get at it? Let us not talk about ANWR. Let us talk about somebody else and some others areas that are available and how long would it take us to get it out.

That doesn't ignore what you just said, Mr. Bowlden. I think it is very important that when we put our energy policy together we have to look at some other practical things that are out there. We have cars just sitting there in traffic jams and all the other stuff that we have out there that is incredible. It just defies common sense.

Even the issue of, you know, you drive down the highway every day and you see one person behind the wheel. There is not enough emphasis on alternatives. There are a lot of things that we can do.

Specifically, what is available out there? If we opened it all up, how much would we be relying on foreign oil?

Mr. STEWART. Senator, I think it is undoubtedly a fact that we are always going to be relying upon foreign sources for oil. The oil base in the United States is one of the most mature in the modern era of oil extraction.

On the other hand, the natural gas resource base in North America is vast. It is frustrating because if you go out to the Rocky Mountains or into the Gulf of Mexico, on both shores, there are vast resources out there that have been blocked off from access for reason unknown.

For instance, the coal bed methane resources in the Rocky Mountains that are tied up in the LEAF case that I talked about earlier. I personal don't understand how we are ever going to get away from foreign reliance for crude oil without taking into consideration just the mature base that we have.

Senator VOINOVICH. Are you saying that but for large tracts like ANWR, what else is available won't make a dent in our reliance on foreign oil?

Mr. STEWART. I think you need to keep in mind what happened at the end of 1997 when the crude oil prices collapsed to near $8, posted price to the wellhead. That was a direct attack on foreign producers on the margin of well base which supplies about 450,000 barrels a day to this country.

That resource base was knocked down, substantially never to be recovered. That in itself is a national petroleum reserve that has been supplemented, as we talked earlier in our opening statements, for instance by Iraqi oil.

I think the national energy policy needs to take into consideration the mature characteristics of oil production in the United States. To recognize that and come up with ways to sustain and underpin that oil base is the best means we have of controlling foreign encroachment into our marketplace, and then drive toward natural gas, which is apparently what everybody wants to drive toward.

Senator VOINOVICH. I would like if some organization could give me a report on that, just really to define what is available. The natural gas thing I understand. I know there are just tremendous reserves out there.

From my perspective, my narrow Ohio perspective, our natural gas costs have skyrocketed. It is negatively impacting, as you know, our businesses in the State. I had hearings with the elderly and others. It is just driving people into our soup kitchens. People are giving up food and clothing because of the fact that they can't pay their energy bills. We have to do something about it.

Mr. STEWART. Well, it is frustrating because the resource base of natural gas is there. It is a matter of getting the molecules into the ground and into the marketplace.

Mr. GRUMET. Mr. Chairman, just to say briefly, I very much appreciate your invocation of the notion that we are focused far too much on ANWR. I think the reason now, however, is that it symbolizes the fundamental debate between supply and demand approaches to addressing this problem.

We are existing in an energy house with a cracked foundation. ANWR is about a new paint job. I think the conflict we have and the challenge we have is that while trying to exploit these resources to balance that with better efficiency.

It is worth knowing that some work we did suggests that it will take about 50 years to extract the full breadth of the reserve in ANWR.

In 10 years, if we increase the fuel economy of light duty trucks and SUVs to be the same a passenger cars, we would reduce as much oil as is available in that 50-year reserve.

So, it is part of a balanced package that looks both at the demand side as well as the supply side. I think we could diffuse a lot of the misdirected focus that, I agree with you, is being focused on ANWR.

Senator VOINOVICH. Thank you.

Senator Inhofe?

Senator INHOFE. Thank you, Mr. Chairman.

I know the national energy policy is not really the purview of this hearing, but you brought this up with Mr. Stewart. Let me just kind of followup and give you a different perspective or ask for a response.

It happens that in the early 1950's I started out in that business. I was a tool dresser in a cable tool rig. No one knows what that is nowadays. You do? OK.

We went after the shallow stuff. Our wells were marginal. I remember so well coming back, and this happened in 1970, the same year that EPA started, so it wasn't the result of that. I remember going back to the owner of these rigs. We had about 25 cable tool rigs and they were really producing oil. He said, any more I have

been producing cheap oil of Oklahomans for many years, but I can no longer comply with all the regulations. This wasn't even EPA regulation.

I think it is pretty well established that if we had in production the oil from plugged wells for the last 15 years it would equal close to what we import from Saudi Arabia.

I am not going to ask you a question, but I would like to ask you a question for the record, since it would be unfair to ask you now.

Our energy policy, the bill that our chairman mentioned, the only criticism I have, even though I am a sponsor of that bill, is that it doesn't get to these reserves. I think that there are reserves out there. I know they are trying to avoid any messing around with the tax policy, because it is going to require that. I don't know of any other way to make this happen.

So, for the record, I would like to have you let me know if there is any idea you have where we could add predictability in there. This is the problem these guys have. Any time you go from $8 to $40 in the period of a year, it can go the other way.

These guys are not going to be in a position to go out and venture their capital unless there is some predictability. I would like to have you address that from your vast experience and those with whom you work to see if there are some ideas that we can up with in this legislation, if you would do that.

Mr. STEWART. Well, Senator, the predictability of the price of oil, as you well know from Oklahoma, is certainly an issue. My own State, Ohio, is the largest oil producer in the Appalachian Basin. You do not see producers going out and drilling for oil right now, even though they have had oil prices——

Senator INHOFE. That is my point. It is hard to sell here in Washington. They are thinking about the price. They don't understand. What is the price going to be if we are fortunate enough to have something to sell a year from now?

Mr. STEWART. Well, if you go back to the 1980's, adjusted for inflation, in real dollars, the price of oil was $50 back then. So we are getting half of what we got. That may be an unfair comparison in some circumstances, but when you need to attract capital to this industry and you go out to the investment community and say, "I want to drill for oil"M and then show them the price of oil curve——

Senator INHOFE. I think we are making the same point here. I would also just like to mention, when you say we are going to be dependent upon foreign sources, this is true. What percentage—and I believe this should be a part of this legislation, a cornerstone—what percentage are we going to be willing to be dependent on foreign sources? That is just a thought.

I don't want my time to expire. I had a question I wanted to ask Mr. Slaughter. You know, I very much appreciate the environmental goals of sulfur and diesel regulation. My major concern has been, before this committee and several hearings even already this year, fuel shortages and price spikes.

I know that the Administration is going to have an external and independent review. I had something to do with that. But I am concerned about the time lines now because if a review takes 2 years

to start, then you are going to have 6 months or 8 months of a year for this to take place.

Yet, we are looking at a deadline of 2006. So, I would like to get from you, in terms of having this resolved and in place by you folks and the people you represent, I would like to have you share with us and get into the record here how the timeline affects what we want to ultimately achieve after this review takes place.

Mr. SLAUGHTER. The industry generally needs 4 years, Senator, in order to adequately make all the preparations, get permits, do the construction work and bring a new fuel on line. So, we believe that we are going to need some resolution and know where we are headed on diesel sometime probably in 2002, perhaps the middle of that year.

As you know, the rule requires at least 80 percent, and we think quite more likely closer to 100 percent of diesel meet ultra-low sulfur levels in June of 2006. So, we are concerned about the timeframe. This is one of the reasons why we were urging that an independent study be done before the rule was taken final. We are absolutely convinced that is the way it should have been done.

Then we would not be up against this mid–2006 timeline, which may cause a significant shortage, which I talked about.

Senator INHOFE. You heard me mention that we had the hearing. I think you were even there at the Ohio hearing. We went into some of the problems with these new policies from the Administration. In some instances the Administration retroactively applied new policies or issued reinterpretations applicable to the changes in facilities.

How would the New Source Review enforcement initiative impact the ability of the refining industry to produce and supply sufficient quantities of clean fuels to the public?

Mr. SLAUGHTER. It is an impediment to making the changes in the facilities that are necessary to make those fuels, Senator. The uncertainty over the exact meaning of the New Source Review requirements at this time by this reinterpretation has caused considerable confusion in the refining industry. We simply don't know what the requirements are going forward. The agency has decided to try to basically reinterpret all the rules through enforcement actions dealing with individual companies rather than follow the Administrative Procedures Act and issue rules that are common to all.

As you pointed out, these were 20 pages of rulemaking which have now become 4,000 pages of interpretation. As part of this 4-year lead time that I talked with you about earlier on diesel sulfur, a lot has to be done, but permits are the key matter that has to be taken care of in making these fuel changes for both gasoline and diesel.

If more certainty isn't brought to this matter, then it will be difficult to make all the changes necessary to have all these mandated new fuels in the market on time. The industry has been trying to work with EPA to make sure that they will be in the market on time, particularly gasoline sulfur. But the results so far are not all that encouraging.

Senator INHOFE. I know I have gone over my time. Let me just give the assurance to Mr. Stewart that I had legislation last year on hydraulic fracturing that we are going to reintroduce this year.

I have already talked about it to some members that I think will support it.

Senator VOINOVICH. It is interesting. To followup on the diesel thing, we have a manufacturer in Ohio who has an emulsion type of additive for gasoline and he can't get that thing through the EPA currently.

They are using it in Europe right now. In fact, the European nations are encouraging people to use it. It reduces pollution from the current diesel fuel by about 40 percent. You know, from a logic point of view, I am not sure just how much it adds to the cost, but I think it is not that much an increase. Maybe that would be a way of maybe helping to transition later on to reducing the sulfur and at the same time during that period make a dramatic reduction in the pollution from diesel fuel.

I talked to another major manufacturer of automobiles who said we ought to be using a lot more automobiles in this country that use diesel fuel, that Europe is increasing the number of diesel automobiles.

There are a lot of inconsistencies here that we need to look at.

Mr. GRUMET. Mr. Chairman?

Senator VOINOVICH. Do you have a comment? Sure, Mr. Grumet.

Mr. GRUMET. I would like to comment for just a moment on this diesel question. I thank you.

There is a bit of irony in this exchange because what we need, I think, is clearly certainty for the industry to invest in the infrastructure necessary to meet these challenges. We have that certainty. We have a final rule that had 370 comments and numerous public hearings that were initiated by the last Administration and finalized by this Administration.

Now we are in essence seeking to undermine that certainty with a third-party review, which will deprive us of the ability to invest with confidence. It becomes a self-fulfilling prophecy for failure if we stretch out this uncertainty and disable the investment that is going on.

I have to tell you that I didn't make it to the NPRA conference, which is always very informative, held a couple of weeks ago. But let me read you to titles of three papers presented.

"Unipure's ASR–2 Diesel Desulfurization Process: A Novel, Cost-Effective Process for Ultra-Low Sulfur Diesel Fuel."

"Sulphco—Desulfurization Via Selective Oxidation—Pilot Plant Results and Commercialization Plans."

Finally, "Application of Phillips' Zorb Process to Distillates—Meeting the Challenge."

I don't begin to suggest that I know what the Zorb process is, but the people at Phillips do, Mr. Chairman. I think we should let these companies now work within the 5-year lead time that we have provided and make sure that we can in fact harmonize these affluent diesel standards.

Senator INHOFE. Mr. Chairman, let me at least respond.

Obviously, you and I don't agree on this review. I think it is important that you not necessarily have the last word in this.

Mr. GRUMET. That is your prerogative, sir.

Senator INHOFE. I would like to have Mr. Slaughter respond to your objection to the review process.

Senator VOINOVICH. Senator Inhofe, I would like to respond, too. I think to clarify this, I think what we are talking about here is to look at this and just see from a practical point of view what impact this would have if you put it into effect when they anticipate putting it into effect in terms of the reliability of a resource to the people.

I want you to know something, I went through, this last year in Ohio, a situation where the supply wasn't there. We went to reformulated gasoline and gasoline prices went up to over $2 a gallon.

You know, it is common sense. I am not in favor of saying you don't get it on "x" date. But I want to tell you something, I am interested. I think some of the environmental groups have got to understand that the public now is at the table; OK? I am the one who got the telephone calls last year about "What about the gasoline? Why is this happening?"

We had the FTC thing and everybody was saying, "Oh, those oil companies are out there gouging."

The fact of the matter is they weren't. We don't have the refinery capacity. We don't have the transmission lines. We don't have a lot of things that are out there. So, somewhere long the line we have to balance up the consumer, you know, the person in my city today who is going to the soup kitchen, hunger center, can't do things because their energy costs are up there.

We don't burn coal any more. We are not burning enough of it. We have to get to the point where we have one group saying, "Well, yeah, yeah, yeah." But we have to get to common sense. That is the trouble today in this country. Everybody is off on their own thing. One special interest group here. Another special interest group here.

It is about time we got in the same room and started to be concerned about the people out there, yes, their environment and their health, improving the environment. But some how figuring it how, how do we work together? You just say, "Well, this is the way it is and if you don't like it—tough."

Then, boom, you don't have the diesel fuel that is out there. You have truckers that are working. We are in a recession right now. The people are looking at us. We are debating about this stuff. They are saying, "What is going on?"

I am sorry.

Senator INHOFE. I am not.

Senator VOINOVICH. Anyhow, I think that is where we are. We are just trying to use common sense here.

Mr. GRUMET. Mr. Chairman, I am not seeking the last word for a moment. I would suggest, though, that there is a Clean Air Act Advisory Committee created by Congress that has full involvement of industry, academia, environmental groups, and private citizens.

There is a Mobile Source Technical Subcommittee that is already in the process of reviewing these rules. So, I couldn't agree with you more, with the sentiments, the frustration, the concern. I am merely suggesting that we have a process in place that could provide that review without undermining the investment certainty we need so we don't have the shortages that we both fear.

Senator VOINOVICH. I have one question. You are talking about refineries.

Mr. GRUMET. Yes.

Senator VOINOVICH. And you are telling me you have to increase the capacity of the refineries. You are saying that New Source Review has something to do with that, and I understand that, because of the uncertainty and so forth.

The issue I have is: Why can't we build more refineries? Why aren't you building more refineries? You are saying we can improve the capacity of the refineries. But the statistics that I have say they are at 95, 94, and 98 percent. You said one went down at 9 percent. How do we get more refineries?

Mr. SLAUGHTER. Well, it is extremely difficult to build a new refinery and this is because the regulations are extremely strict. It is very difficult to get local support for heavy manufacturing to be sited in any area.

So, therefore, you know, the industry has reluctantly reached the conclusion that we are more likely to be able to use existing sites and expand capacity at existing sites than start new refineries. There hasn't been a new refinery built in the U.S. for over 20 years.

So, the real question is: Will we be able to increase the capacity of our existing plants enough to at least meet a large part of growing demand?

The problem with this retroactive enforcement campaign is that essential it has jumbled all of the rules for adding capacity at existing sites. So, even that very promising area where we might be able to increase refining capacity may well be closed off to us.

I think it is extremely important that you make some comments like the ones that you just made because one of the difficulties is that when the industry tries to make what are really very reasonable and rational points about supply considerations, we are essentially denounced for opposing the goals of regulations, the goals of which we support.

I think that unless policymakers like yourselves make statements such as you have just made and refocus this debate on the choices and balancing that have got to be made and done in these rulemakings, it is not going to happen any more.

Senator VOINOVICH. Well, the issue is this: It is like what do we do specifically? Is it rulemaking that is the problem? Is it legislation that needs to be changed so that we butt up against what is the problem so you can sit in the room and say, if this is changed, this will happen?

Then Mr. Grumet knows what they are and says, "Well, let us talk about these things."

Do you specifically have a list of five things or six things that would give you the ability to increase your refining in a short period of time, which we need, and then maybe get at the issue of a new facility?

When you give us those things, then we can get the environmental people and sit down with them.

Senator INHOFE. Where on that list would "uncertainty" be?

Mr. SLAUGHTER. "Uncertainty" would be right up at the top because the major problem is you have to have an effective process to get permits and be able to build new capacity and make changes to comply with the mandates that have already been put on us.

The New Source Review regulations, the regulations that we have to follow increasingly whenever we do anything to our refineries, EPA says even when we change our catalysts, are so confused and in such a mess. Everyone agrees on that point. No one agrees as to what the fix should be. But everybody wants one and the country needs one. The only way, I think, we are going to get one is being brought to a table.

Someone is going to have to exercise leadership because not everyone is going to get what he or she wants in a resolution of these questions.

Senator VOINOVICH. I am concerned about New Source Review, as you know, as certainty and changing the rules and so forth. It would be really nice if the people who are concerned about New Source Review would get into a room and come back with some recommendations for this committee.

I don't think that Senator Murkowski's legislation deals with that. It is a big problem. Then, again, if we could then get the environmental groups in there to say here is what they are planning on doing and seeing if something can be worked out so that we move forward and at the same time protect and improve our environment.

Mr. Grumet.

Mr. GRUMET. Mr. Chairman, thank you. I appreciate being thought of as an environmental group, but I should stress that actually I represent the air pollution programs in the eight Northeast States.

There is a concept that I think is a pathway through much of this. You have talked about it before. That is that we should set clear and comprehensive environmental limits and then get out of the way and let industry figure out how to do the rest.

That concept applies to almost everything we have talked about today. There are innovative efforts in Oklahoma and other States to adopt plant-wide applicability limits, which is in essence a permit on the entire facility.

Within that real cap on that facility's emissions then regulators could become responsibly disinterested in exactly what and how the facility meets those standards.

In reformulated gasoline, if we could maintain the performance standards but lift the prescriptive oxygen mandate and give refiners the flexibility to achieve those performance standards without telling them how to do it.

Broadly put, if we could set comprehensive multi-pollutant caps like those envisioned in the legislation that Senators Lieberman, Jeffords and many Northeast State Senators have supported for utilities that ensure that the environmental benefits on mercury, on sulfur, on NO_2, on carbon were addressed, we could then become responsibly disinterested in how industry decides to meet those standards. We can use market-based mechanisms.

The option is there. It is on the table. There have been, I fear to tell you, meetings of people talking about NSR for 7 years. I would be happy to try to see if we could help summarize some of that.

The pathway through this, I firmly believe, is a combination of clear and comprehensive environmental standards and then letting industry figure out how to achieve those standards.

Senator INHOFE. Mr. Chairman, he had mentioned several things that are our responsibilities in new compliances over the years. The chart that I had here, each one of these has had a direct effect.

It seems to me, in looking at it in terms of supply and demand, we have not always been at that 100 percent refinery capacity. Right now, you can argue between 94 and 100 percent. But when you reach that point, everything that is new is passed on.

That is where the chairman gets the telephone calls and I get the telephone calls. That is what doesn't seem to be addressed. To me, maybe it is not that simple, but certainly supply and demand is the major concern here and the major problem in terms of the costs.

Mr. SLAUGHTER. Yes, Senator. I might just add that one of the problems with all the flexibility programs, and everyone agrees that we need more flexibility and set performance goals and don't tell people what to do but just give them goals to meet.

The devil is always in the details. There is a host of fine print that has come along with all of those supposedly flexible programs that basically often turns them into nothing more than a copy of the existing system.

So, this again is why you do need everyone to come together and for a fair result to be reached. But I think it does require a good dose of leadership.

Senator VOINOVICH. I am going to ask my staff people to identify them. We have to get on with this. One of the things that bothers me about being a Senator is that I am a former Governor and Senator Inhofe is a former Mayor. We have all these hearings and all this testimony and I really appreciate this. Mr. Porras, you came from California here. I really appreciate what you are trying to do in your community and your people live in a lot of areas where you have some bad stuff and you are getting a lot more than they should be getting. I am concerned about that.

I am just saying, we just talk and talk and talk. We are running out of time. We have to get started. So, I would like to start drafting multi-emissions. We have talked with some of the environmental groups in New York. They said they are interested in mercury. They are interested in NOx. They are interested in SO_2. They said, "If you really took care of those things and we could see quicker activity in this area, we would be willing to sit at the table."

They didn't say you have to do the carbon thing. They said, "You could really guarantee that."

So, we are going to start drafting our legislation and see where people are. The NSR thing, we have to start looking at that. That covers the whole gamut of just about everything. But we need to get on with this. We are going to get on with it, put some meat on the bones and start talking about this thing and see if we can't get something done this year.

Mr. PORRAS. Mr. Chairman, may I make one comment?

Senator VOINOVICH. Mr. Porras, we will finish on your comments.

Mr. PORRAS. I would just like to thank you first of all for the leadership of convening this discussion on the issue of New Source Review.

I think what is important is to go back and look at the spirit of the Federal Clean Air Act, what was intended. Now interpretations may have been confused along the way. But on the point of New Source Review there was significant debate when the act was promulgated.

Now, the compromise at that time, and again because of the health implementations of the environmental degradation that results from these facilities, because of that the compromise that was reached was that New Source Review would be transitioned into, best available control technology would be transitioned into the industry through the course of time, lessening the burden of the capital outlay of requiring it all at once. I think the spirit of that is what needs to be focused on so that the future policy will recognize that rather than just throw the baby out with the bath water, let us find something that works, something that still retains the spirit of the Federal Clean Air Act to protect public health.

Senator VOINOVICH. I think that is a real good consensus. I want to tell you one example and I will just finish on this. In Lorraine, Ohio, USS Colby wants to put in a brand new blast furnace, $100 million. Twenty-five million dollars of that is going to be used to reduce pollution.

They are going to close down this other blast furnace that is terrible, you know. It is still operating because of the fact that it is grandfathered in. They were told that you can't open the new one because the new one, which is the most modern technology, is going to violate the new ambient air standards that we set for the Lorain area. When we set the standards that plant was just about shut down.

That is the kind of thing that I think doesn't make sense. We need to start to look at it. "Gee, they are going to put in a new plant. They are going to reduce substantially; close down this other thing that is polluting the air. That is kind of a sensible thing."

Then some bureaucrat comes along and says, "Oh, I am sorry, but the standard we set, your new blast furnace is not going to reach that new standard."

There is some kind of common sense that we need to insert in the way this operates. If we can do that, I think we are going to have a cleaner environment and I think we are going to have an energy policy.

Thank you very much for being here. The hearing is adjourned.

[Whereupon, at 11:37 a.m. the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. BEN NIGHTHORSE CAMPBELL, U.S. SENATOR FROM THE STATE OF COLORADO

Thank you, Mr. Chairman. I would like to welcome all of the witnesses for appearing before the committee today. I am looking forward to the testimony that you all will be providing us shortly on aspects of environmental regulations and our energy policy. As you know, I sit on the Energy Committee which oversees energy policy, and now I sit on this committee which has jurisdiction over the Clean Air Act and other important environmental issues. Being on both of these committees enables me to help forge a responsible balance between environmental protection and

adequate energy supply, which is the scope of this hearing. Let me stress that we have to find a balance between the two, especially since we are experiencing this dire energy crisis.

I believe the Bush Administration has it just right—to maintain our economic health, we must have a dependable energy policy. We need an energy policy that makes the best use of both coal and natural gas. We are a long way from a point where a majority of our energy supply is not from these two fuel sources. So, we need to focus on coal and natural gas now.

Many utilities have refused to invest in new coal-fired generation plants because of the regulatory barriers they have to scale. These are the reasons we have to revisit and sometimes recall regulations for a short period of time. Coal is our main fuel for electricity generation, and we need to be able to produce this type of power in an economically sound manner.

Another set of regulations to reduce the sulfur content in diesel fuel will have unintended consequences too. Trucks today run on diesel, not wind or solar power. Everything we buy to eat and wear comes on a truck. If the trucks stop rolling, this nation stops rolling. Over 95 percent of all commercial manufacturing goods and agricultural products are shipped by truck at some point. 9.6 million people have jobs directly or indirectly related to trucking.

In addition, trucking contributes over 5 percent of America's gross domestic product.

Also, several Federal hydroelectric dams are constrained by Endangered Species Act restrictions. Some of the restrictions are needed, but we have to consider any possible way to reverse our current energy trends, even if that means revisiting some of the regulations.

Many will say that we are sacrificing the environment for energy, but that is not the case. Strict regulations and standards have been set for sulfur dioxide which causes acid rain and nitrogen oxide which causes smog. But, when one regulation was not put forth to limit emissions of carbon dioxide, many started to say that the Bush Administration was attacking the which is just plain wrong. environment,

Caps on carbon dioxide would be so expensive that coal fired generation plants, which now provide over half the nation's electric power, could be forced to shut down. This would further strain our electricity grids and put the entire country into a position where rolling blackouts would be common, which we cannot allow to happen. We need to revisit which ever regulations need to be looked at. No one is going to take away a regulation on a whim; there is always a reason. The main reason is to get our nation out of this energy crisis. Then once we get a hold of the crisis and we are not in immediate danger of repeating it, we can revisit the regulations again.

I ask Unanimous Consent that a white paper written by the Assistant Director of the Colorado Department of Natural Resources, entitled "The Impact of Environmental Regulations on Hydropower Generation," be included in the Record. This document gives a good view of how some regulations are affecting hydropower in my home State of Colorado.

I will have some questions that I would like the witnesses to address so that we can further explore this issue during the time for questions.

Thank you Mr. Chairman.

[February 15, 2001]

THE IMPACT OF ENVIRONMENTAL REGULATIONS ON HYDROPOWER GENERATION

(By Kent Holsinger, Assistant Director, Colorado Department of Natural Resources)

Introduction

The value of electrical power is immeasurable. It heats our homes, offices and schools, lights our way in the dark, delivers us the news, and allows us to produce goods and services. The United States, at least until recently, was the envy of the world when it came to electric power generation. The cost of our power was 37 percent lower than in Europe, 49 percent lower than in Germany, and 73 percent lower than in Japan. What happened?

Population migration to the West, increasing reliance on computers, the Internet, and cellular phones, among other things, has propelled the demand for energy to epic proportions. Meanwhile, increased regulation and environmental demands on water in the West have created an alchemy of issues and a poignant contradiction: Consumers want more power at affordable prices; Environmentalists want fewer dams and more restrictions on existing dams.

Hydroelectric Power

The Western Area Power Administration (Western) markets and delivers hydroelectric power from 55 dams in the West, the vast majority of which are owned and operated by the Bureau of Reclamation (the Bureau). The Bureau is the nation's second largest hydroelectric producer. Hydropower, has been, and continues to be, critical to the nation and the West.

In 1941 Franklin Delano Roosevelt tasked his countrymen to build an arsenal of ships, boats and planes capable of defending the United States and the world from Hitler's advancing forces. The buildup required huge quantities of aluminum, which, in turn, required staggering amounts of energy. Roosevelt's goal was achieved because of nearly unlimited, cheap hydropower production in the Northwest.

Today, hydroelectric power produces roughly 13 percent of the nation's generating capacity (nuclear power accounts for 14 percent and fossil fuels generate 62 percent). But hydropower has many advantages over other power sources. Not only are hydroelectric plants more reliable and durable than other sources, they are inexpensive to operate, clean and extraordinarily efficient.

Hydroelectric plants operate at 85 to 90 percent efficiency—more than twice that of fossil-fueled plants. Water storage in reservoirs serves as the best means to store large amounts of electricity. Need more power? Release some water. Simple as that. No mining; no transportation costs period. Hydroelectric plants are also flexible in meeting peak power demands. Their ability to start quickly and adjust to load changes make hydroelectric dams invaluable during times of high energy demand.

The Western Area Power Administration depends on hydroelectric power to serve millions of consumers in 15 western States (Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah and Wyoming). In 1999, Western generated $886 million in revenues and repaid an estimated $149 million of investments in Federal water projects. Power marketing administrations, such as Western and the Bonneville Power Administration, (Bonneville) were built to market and deliver affordable power to rural communities while paying the debt service on Federal water projects. They were doing just that until the U.S. Fish and Wildlife Service started demanding flows for endangered fish over and above irrigation and power production needs.

Environmental Restrictions on Hydroelectric Power

There are environmental impacts when rivers are harnessed to produce power: siltation and barriers to fish migration are among the foremost, but at what cost do we forego power production? In recent years, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service have been directing the Bureau to run hydroelectric plants not for power generation, but for environmental needs including species listed under the Endangered Species Act.

In the Colorado River Basin, when the U.S. Fish and Wildlife Service demands flows from the Bureau in the spring to mimic natural flooding this depletes critical summer supplies and releases stored water when power usage and demand is lowest. With low reservoir levels, power marketing administrations are then poorly equipped to deal with peak power demands during hot and dry summers.

Take last summer: its dry as dust, the temperature soars and so does the demand for energy. But the Aspinall Unit, a series of three hydro-producing reservoirs in Colorado, had no water for peaking power. To make matters worse, the U.S. Fish and Wildlife Service forced the Bureau to decrease reservoir releases to minimum levels so the Federal Government could study the effects of drought on fish. Western, in turn, had to purchase power on the open market (when costs were 3.6 times higher than just 1 year before). In sum, the U.S. Fish and Wildlife Service caused Western to release water when there was no market for power and to purchase power when the market was at its highest. The potential cost in lost power generation has yet to be quantified. Cold comfort for consumers.

Impacts

Several Federal hydroelectric dams in the Upper Basin of the Colorado River are constrained by Endangered Species Act restrictions. In 1996, the Department of Interior issued a Record of Decision that slashed capacity at Glen Canyon by 456 megawatts for environmental reasons primarily fish flows and sand bars. One megawatt is roughly the energy required to supply one thousand homes. The Environmental Impact Statement alone cost $104 million to complete. Today, reoperations cost an estimated $100 million annually! Moreover, in the Spring and Summer of 2000, a 6-month test operation for additional endangered fish benefits was conducted at a cost of $3.5 million. The cost to replace 6 months of lost electricity was between $16 and $24 million.

Other examples abound. Since 1991, Flaming Gorge Dam has been subject to ESA requirements at an estimated cost of $7.2 million annually (based on today's prices). Operations of the Navajo hydroelectric plant in New Mexico have also been hindered. The Bureau is now doing an EIS on Navajo reoperations that should outline some of these problems.

Things are even worse in the Pacific Northwest. The U.S. Army Corps of Engineers and the Bureau own and operate 29 hydro projects on the Columbia and Snake Rivers in the Northwest. Those dams generate the least expensive electricity in the country. Unlike the Colorado River Basin, peak demands in the Northwest occur due to heating demand in the winter. The Bonneville Power Administration markets and distributes power from these Federal dams. Power revenues pay for the operation of the projects, debt service to repay initial investments in the system, and flow and habitat improvements for endangered fish.

In a recent report, the Northwest Power Pool, a seven-State coalition of power interests in the Pacific Northwest, warned that cold snaps in the region will trigger blackouts should dry conditions continue. Reservoir storage in key hydroelectric facilities is only 63 percent of average in part because of dry hydrology and releases for fish last summer. Historically, BPA managed the system to supply power throughout the duration of a 4-year drought. Since the application of the Endangered Species Act, the system can only supply power for a 10-month drought.

While salmon runs are at all time highs, the National Marine Fisheries Service (NMFS) has listed up to 40 distinct subspecies under the Endangered Species Act. These fish have different spawning runs and different needs at different times. Some biologists protest on the grounds Northwest salmon should be lumped into much broader categories as salmon have been in the Northeastern United States. Overall, salmon numbers are very high in most of the Northwest. But Federal biologists are unwavering. In fact, they advocate killing, yes killing, up to one-third of the hatchery raised salmon that have successfully migrated above the Bonneville dam because they are not the "right" fish.

Federal biologists also insist on hugely controversial flow programs for the salmon and steelhead. Fish flows affect power generation in two ways: forced spills and flow augmentation. Last week, electricity prices reached over 30 times the price Bonneville sells to its customers. The difference in prices cost the agency $50 million over 4 days in January. Should the National Marine Fisheries Service continue to run the hydroelectric plants for fish, Bonneville will have to purchase $1.3 billion to $2.6 billion in electricity to meet its power supply obligations. Should dry conditions persist, those numbers could increase by a factor of ten. Such a devastating blow could hurl an already uneasy economy into the abyss. Some utilities are already teetering on financial ruin.

Bonneville has declared a power emergency to release water slated for 12 spring and summer runs of Columbia Basin salmon to generate electricity. But there is no lasting authority to disregard fish flows and without significant precipitation even that won't be enough.

Conclusion

In today's computer-driven society, dependable supplies of electrical power are more important than ever. Power marketing administrations are already purchasing power on the open market and passing along outlandish price increases to consumers. The cost for Endangered Species Act and environmental protections is breathtaking. Yet, some environmental groups that clamor to remove dams for fish habitat have been strangely quiet amidst the recent crisis. Could they be contemplating whether or not to expend the energy on their e-mail networks?

Should the U.S. Fish and Wildlife Service and the National Marine Fisheries Service continue to force power marketing administrations to operate for the benefit of fish rather than power, the West could be cast into darkness and the nation propelled into a bleak economic future. Truly, balancing economic benefits with environmental protection is a monumental task. But when the stakes are this high, policymakers must question how best to achieve that balance. Only through sound science and truly collaborative efforts may stakeholders and Federal decisionmakers achieve these goals. If they do, the power marketing administrations will continue generating so that supply is strong and prices are low and all utilities (and consumers) will benefit.

Kent Holsinger is the Assistant Director for water issues at the Colorado Department of Natural Resources. He can be reached at (303) 866–3311.

STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Mr. Chairman, Thank you for holding a hearing on this very important topic. As we are all aware, our nation's energy policy and our global environment are closely interconnected. That is why we must remain vigilant in ensuring that we pursue an energy policy that meets our short-term needs, while taking into account the legacy that we, as stewards of our nation's environment, leave behind.

I am particularly grateful that the witnesses appearing today have spent many long hours preparing to inform us and the public on this very important issue.

The air we breathe, the water we drink and the land upon which we live are precious resources. To that end, I hope that, in pursuing an energy policy, we keep in mind not only ways to keep those natural resources clean with existing sources of energy but also invest in finding newer, cleaner and renewable energy sources.

STATEMENT OF DR. ROBERT L. HIRSCH, MEMBER, BOARD OF THE ANNAPOLIS CENTER FOR SCIENCE BASED PUBLIC POLICY

Mr. Chairman and distinguished committee members: I am Dr. Robert Hirsch, a Member of the Board of the Annapolis Center for Science Based Public Policy, a non-partisan, not-for-profit study group. I am also chairman of the Board on Energy and Environmental Systems at the National Academies and a senior energy analyst at RAND. My experience is in energy technology management and analysis in both government and industry in many areas of energy technology. The views expressed here are my own and do not necessarily represent positions of my three affiliations.

My messages to you today are as follows:

1. We are experiencing a new kind of U.S. energy crisis that has only begun, and we need to take decisive action.
2. There is no silver bullet to solve our problems.
3. The fundamental challenge that we face is balance, balance, and balance.

The U.S. Energy Crisis

Why do I call this a new kind of energy crisis? It's because the problems are more complicated than an oil embargo or a Gulf war. Our challenges involve many different aspects of our very complex U.S. energy infrastructure. Furthermore, I believe that our problems will take upwards of a decade or more to fix. Why so long? Because the problems are large in number, scale, and cost, and because we are simultaneously working to reduce some of the remaining environmental, health and safety risks associated with our energy system.

By now you've probably heard enough about the electricity problems in California, the natural gas price spikes throughout the country, the heating oil problems in the Northeast, and the gasoline problems in the Midwest. These problems were predictable, and, indeed, there were some unheeded warnings along the way. Part of the reason that we are in such a pickle is that there was no one in the Federal Government responsible for the wellbeing of the U.S. energy system—no one with authority, responsibility and respect to warn us when potentially significant problems began to rear their ugly heads. The Department of Energy is responsible for nuclear weapons, environmental cleanup and, almost incidentally, energy. FERC is responsible for regulating various elements of interstate energy flows. The EPA is responsible for environmental care, and the States are responsible for energy matters within their borders.

The energy goose has been laying golden eggs for so long that energy is off the radar screen of most people, until we have the occasional trauma. Right now, we are seeing a number of traumas simultaneously, and there is reason to believe that there are more to come.

For instance, in addition to the problems I just mentioned, our oil refineries are running at near 100 percent capacity, and we have slowly been increasing our imports of refined products—adding another dependence on foreign sources. No new refineries have been built in the U.S. since the 1970's, and a number have been shut down. Furthermore, we are in the process of phasing out an important gasoline additive, MTBE, an action that will further reduce refinery production rates at a time when demand is continuing to increase. In addition, the EPA has mandated much lower levels of sulfur in gasoline and diesel fuels, necessitating significant new investments in refineries in both the U.S. and offshore to supply the U.S. with our increasing needs.

Refining is historically a low return-on-investment business, so many companies are naturally reluctant to invest the vast sums of money needed for mandated changes. Am I suggesting that we reduce our environmental goals? Most certainly

not. In my opinion, we must reduce sulfur levels in our fuels in order to further reduce air pollution. I just wish that we could accomplish our laudable goals with less acrimony.

How about siting and building the new electric transmission lines needed to deliver higher levels of electric power? That's a not-so-obvious problem in California and elsewhere. As you may know, siting new transmission lines has encountered interminable delays in many parts of the country and threatens to choke off higher power demands in a number of locations.

What about natural gas pipelines and petroleum product pipelines? Both are problems in many areas. Permits for new pipelines are tough to come by, and land for right-of-ways is increasingly expensive. At a meeting in New Orleans 2 weeks ago, a major oil company representative indicated that his company is using drag reducing agents in some of their pipelines because their pipelines are operating at full capacity. With petroleum product demands increasing, that indicates trouble ahead! And the list of energy problems goes on.

No Silver Bullets

If you want more electric power, you must build more power plants. Natural gas is clean and was very cheap until recently. Over 90 percent of planned new generation in the U.S. will be natural gas fired. In one sense, that's good because of the environmental attractiveness of natural gas generators with exhaust gas cleanup. In another sense, it's troubling because that mushrooming dependence on natural gas will make the country ever more vulnerable to future natural gas disruptions and price spikes. Analysts can run complex models that can demonstrate that overdependence on a single fuel will increase national vulnerabilities. But in fact it's common sense. For instance, if all your retirement money was in the NASDAQ over the past year, you'd have problems. If all your money was in bonds in the early 1990's, you would have missed some golden opportunities.

The answer isn't all gas or all coal or all nuclear or all renewables. Each has its strengths and weaknesses. For instance, many people don't realize that for large power loads, the popular renewables are simply fuel savers for other power plants, and so their ultimate contribution to U.S. energy needs will be limited, even after their costs are brought down further.

Energy efficiency is important and must be part of the equation. However, making a major difference in energy usage on a national scale would require much higher energy prices or heavy Federal Government intervention and a decade or more of large investments.

Be wary of anyone who tries to sell you a silver bullet in energy. There are none. A diversity of approaches is essential.

Balance, Balance, Balance

Where does all of this lead? To me, we need a better-balanced approach. We need a diversity of energy sources and energy efficiency, if we are to minimize our costs and vulnerabilities. However, that would likely require Federal intervention, which would not be universally welcomed.

And let's not forget energy research and development. Our Federal investments at DOE and its predecessor agencies have yielded very important technologies, some of which are in use today and others that are on the shelf, ready when we need them.

Also, it may be that we will need to be temporarily flexible on some of our near-term environmental goals to help get us back on an even keel in energy. They're doing that in California now. However, I, for one, do not endorse turning permanently the clock back on pollution reduction.

Finally, let's not be afraid to have open honest dialog on our options. Every one of them has its advantages and disadvantages. Let's discuss our options objectively and strive to minimize the extremism and misinformation that so often characterizes such discussions. Let's put someone in charge of overseeing our nation's energy system, please. If it's to be the Secretary of Energy, let's make that clear by law and then provide the authority and budgets needed for the task.

Postscript: When Federal agencies or the Congress need expert, non-partisan, non-biased analysis, the three institutions with which I am involved have often been of help. The National Academies draw on the nation's most experienced and capable experts and provide the nation's highest level, most respected, in-depth studies of the full range of technical and technology-related matters. The Annapolis Center for Science Based Public Policy also draws on national experts and has provided relatively quick, brief, lay-level perspectives on narrower topics. RAND has in-house expertise across the spectrum of technical, environmental, economic and behavioral

disciplines, and has provided analysis on small to very large issues, often relatively rapidly.

STATEMENT OF ELIOT SPITZER, ATTORNEY GENERAL, STATE OF NEW YORK

Thank you for inviting me to testify before this subcommittee concerning the interaction between our environmental regulations and our nation's energy policy. This is a critical issue, both in the short-term and over the longer term.

Introduction

While we usually take for granted the electricity that permeates our life and fuels our modern society, we cannot do so any longer. Recent events in California have forced us to look carefully at our energy supply and examine it critically. We must ensure Americans with a reliable and reasonably priced power supply. Moreover, to be reliable over the long term, the supply must be diverse, so that shortages or price spikes in any one fuel do not cause excessive dislocation.

Yet while we seek a secure energy future, we now know that we must also consider the environmental and health impacts of power generation and use. This panel has correctly noted that the two issues are closely linked, given that the power sector is the industrial sector that causes by far the most air pollution. A sound and balanced energy plan will help us to achieve a reliable and clean energy future.

As many of you have noted, we have not been able to implement a comprehensive energy policy at either the Federal or State level. Federal programs have been at best sporadic. In New York, energy policy has also been largely sporadic, addressing issues, if at all, on a one-by-one basis. The State Energy Office was abolished 8 years ago and any efforts to create and implement a comprehensive State energy plan were dropped. I recently released a report, entitled Attorney General's Action Plan for a Balanced Electric Power Policy in New York State. It can be found at our web site at http://www.oag.state.ny.us/press/reports/power—policy.pdf. I incorporate it with this testimony because I think it represents a comprehensive blueprint at the State level for considering and balancing the needs for electricity and the need to protect our health and environment. I suggest that the Federal Government could do well to consider such an approach, and I urge you to review the report carefully.

Let me be crystal clear: there need be no conflict between environmental protection and a sound energy policy. Indeed, careful attention to environmental and health protections will enhance, not harm, our energy security. Our energy supply must be reliable and affordable. However, it must not be only superficially inexpensive, appearing cheap because of hidden costs borne elsewhere. An energy supply that is provided at the cost of harm to the public health or the environment—imposing enormous, but usually unquantified, costs on the American public through health care costs, lost productivity, premature mortality, or lost enjoyment of health or natural resources—is not in the nation's best interests. Proposals for such a policy will backfire.

I urge you to work together, as we are trying to do in New York, to move the country toward a balanced energy policy and to reject the spurious claim that environmental protections are the cause of the energy squeeze we see today. Environmental protections are not the cause of, but part of the solution to, our energy challenge. It was the lack of demand, not environmental regulations, that led companies not to build new power plants over the last decade; indeed, some environmentalists would support some new plants that, if linked with strong efficiency programs, would take the place of our dirtiest existing plants.

I will not repeat all of the details set forth in the report. Instead, below, I will focus on the clean air litigation that has been the subject of some scrutiny and controversy, in an effort to dispel many of the misperceptions concerning those cases.

Environmental and Health Impacts of Energy Choices

It is critical that any discussion of energy policies not underestimate the impacts of electricity generation. The level of impacts is simply not acceptable. As Senator Voinovich said, we want to go forward, not backward. We cannot go forward, however, if we either weaken or ignore existing clean air laws. It was this realization that led New York to its power plant litigation initiative.

Electric utility plants collectively account for about 70 percent of annual sulfur dioxide (SO_2) emissions and 30 percent of nitrogen oxide (NOx) emissions in the United States, pollutants that have significant health and environmental impacts. SO_2 interacts in the atmosphere to form sulfate aerosols, which may be transported long distances through the air. These transported sulfate aerosols are both acidic and respirable, contributing to acid rain and smog. Particulate matter (PM) is the

term for solid or liquid particles found in the air. Particulate matter composed of particles with diameters of 10 micrometers or less is referred to as PM_{10}, while particles with diameters of 2.5 microns or less are referred to as $PM_{2.5}$. Coal fired power plants are a major source of both PM_{10} and $PM_{2.5}$. Not only do power plants emit PM directly, but emissions of NOx and SO_2 from these plants lead to the formation of fine nitrate and sulfate particles that are particularly harmful to the respiratory system.

Numerous studies, from an EPA acid rain study to a National Oceanic and Atmospheric Administration back trajectory analysis, to many private studies, demonstrate conclusively that emissions from coal-fired power plants in the Midwest and mid-Atlantic travel on prevailing winds to the Northeast. One 1985 New York study found that over 80 percent of the sulfate deposition in New York's Adirondack Park came from sources outside New York.

In the eastern United States, sulfate aerosols make up 25 to 50 percent of the inhalable ($PM_{2.5}$) particles on average and cause up to 75 percent of the aerosol pollution during extreme transport episodes. People exposed to sulfur dioxide can suffer a variety of respiratory ailments. Nitrogen oxides contribute to the formation of ozone in locations downwind from the source of the pollution. Ground level ozone also contributes to respiratory illnesses. Particulate matter is an extremely harmful pollutant that contributes to a number of respiratory difficulties, ranging from bronchitis to asthma and even premature death. At least one study performed for the Federal Government has attributed 30,000 premature deaths nationwide each year to fine PM attributable to power plant emissions.

Emissions of NOx and SO_2 also cause extensive harm to natural resources. In the atmosphere, NOx and SO_2 are converted into nitric and sulfuric acids, which fall to the ground as acid particles, rain, and snow. Power plant emissions are largely responsible for damage to forests, lakes, and wildlife throughout the northeast. For example, acid deposition has caused 20 percent of the lakes in New York's Adirondack Park region to become too acidic to support fish life. Federal studies conclude that the percentage of acidified lakes is expected to increase or even double over the next four decades unless upwind emissions of NOx and SO_2, primarily from coal-fired power plants, are reduced extensively. Similar impacts are seen in the lakes and streams of other northeastern States such as Vermont and New Hampshire. This year, when the record snow pack in northern New York and New England melts, the streams and lakes will suffer a lethal acid shock.

In addition, acid deposition contributes to the widespread death of spruce forests in high elevation areas of the northeast. According to a recent study, more than half of large canopy trees in the Adirondack Mountains of New York and the Green Mountains of Vermont and approximately one quarter of large canopy trees in the White Mountains of New Hampshire have died since the 1960's. Moreover, ozone, which is also a product of NOx emissions, causes foliar injury (injury to plant leaves) and can reduce plant growth and reproduction.

Visibility in Class I national parks and wilderness areas has suffered severe deterioration from manmade haze created in large part by sulfate particles resulting from power plant emissions. Sulfate particles swell up in the often humid weather conditions of the northeast and scatter more light (thereby reducing visibility more) than most other kinds of particles. In Vermont, for instance, sulfates cause about half of the fine particle pollution, but closer to 75 percent of the visibility impairment obscuring the landscape for visitors and residents.

Nitrogen deposition also contributes to the eutrophication of coastal bays and estuaries, which occurs when an excess of nitrogen causes algae growth that threatens the survival of other aquatic species. For example, the Chesapeake Bay, which has severe eutrophication problems, receives twenty-five percent of its nitrogen from sources of NOx emissions, primarily from power plants located to the west of the Chesapeake Bay watershed. Long Island Sound suffers similar problems, in large part from nitrogen falling onto New York and Connecticut lands, and from there flowing into the Sound.

Finally, New York's and our nation's cultural heritage—our buildings and our monuments—are corroding under the onslaught of acid rain. Some of our finest buildings in the Northeast are losing their detail and beginning to look as if they were melting.

These harms of pollution are quite real; they are not merely a matter of environmental preferences. Asthma, premature mortality, and other respiratory diseases cost Americans billions of dollars each year. The loss of recreational jobs, tourism, and commercial fishing, plus the increased expense of water treatment, cost the nation billions each year. The loss of our architectural history is priceless, and it costs many millions each year just to stem the destruction.

New Source Review Law and Regulations

To address these harms of pollution, my office sued the coal-fired power plants that are the source of much of this air pollution. We filed notices of intent to sue against 17 coal-fired electricity plants located in upwind States in September 1999. We play fair in New York and do not only pursue out-of-state sources, so shortly thereafter we, with the State Department of Environmental Conservation, commenced enforcement action against eight coal-fired plants in New York as well. Shortly after we filed our notices of intent, the Federal Environmental Protection Agency commenced legal action against a number of coal-fired plants. A number of other northeast States joined our actions. We have now reached agreements in principle with two companies—the Virginia Electric Power Company and Cinergy Corporation. In addition, we are in active discussions with the owners of several of the New York coal-fired plants to resolve their liability.

The aim of the Clean Air Act litigation brought by New York, other northeast States, the Federal EPA and various environmental organizations is to address these harms by going to their source. Whereas in the past citizens and States had looked entirely to the Federal Government to address interstate pollution, we decided to confront the power plants themselves. While some have argued that the interpretation of the New Source Review (NSR) provisions in these lawsuits was new, in fact the interpretation stays entirely within EPA interpretations and court rulings over a decade old. We rely on EPA memoranda and court decisions from the previous Reagan and Bush Administrations. There was nothing new about the interpretation. What was new was only the fact that we decided to investigate and identify violations.

Congress created the NSR provisions (including the related Prevention of Significant Deterioration (PSD) provisions) to insure that increased pollution from the construction of new emissions sources or the modification of existing emission sources be minimized, and to ensure that construction activities would be consistent with air quality planning requirements. Generally, the NSR program requires such sources to obtain permits from the permitting authority before the sources undertake construction projects if those projects will result in an increase in pollutants above a *de minimis* amount. In addition, the NSR regulations usually require that sources install state-of-the-art controls to limit or eliminate pollution. Congress required and fully expected that those older existing sources would either incorporate the required controls as they underwent "modifications," or would instead be allowed to "die" and be replaced with new, state-of-the-art units that fully complied with pollution control requirements.

The Clean Air Act defines "modification" as a physical change or change in the method of operation that increases the amount of an air pollutant emitted by the source. 42 U.S.C. § 7411(a). Courts for many years have interpreted the Clean Air Act term "modification" broadly. Alabama Power Co. v. Costle, 636 F.2d 323, 400 (D.C. Cir. 1979) (the term 'modification' is nowhere limited to physical changes exceeding a certain magnitude"); Wisconsin Electric Power Co. v. Reilly, 893 F.2d 901, 905 (7th Cir. 1990) ("WEPCO") ("[e]ven at first blush, the potential reach of these modification provisions is apparent: the most trivial activities—the replacement of leaky pipes, for example—may trigger the modification provisions if the change results in an increase in the emissions of a facility.") The WEPCO court noted that Congress did not intend to provide "indefinite immunity [to grandfathered facilities] from the provisions of [the Clean Air Act]," id. at 909, and that "courts considering the modification provisions of [the Clean Air Act] have assumed that >any physical change' means precisely that." Id. at 908 (emphasis added) (citations omitted). EPA recognized, however, that the sweeping statutory definition of "modification" to include "any physical change" could have nonsensical results if carried to an extreme ("the definition of physical or operational change in Section 111(a)(4) could, standing alone, encompass the most mundane activities at an industrial facility (even the repair or replacement of a single leaky pipe, or a change in the way that pipe is utilized)"). 57 Fed. Reg. 32,314, 32,316 (July 21, 1992). Thus, since 1977, Federal regulations have exempted routine maintenance, repair, and replacement from the definition of modification. 40 CFR 52.21(b)(2)(iii). EPA historically has analyzed and applied the "routine maintenance" exemption to modification by using a common sense test that assesses four primary factors—(1) the nature and extent; (2) purpose; (3) frequency; and (4) cost of the proposed work. See, e.g., Memorandum from Don R. Clay, EPA Acting Assistant Administrator for Air and Radiation, to David A. Kee, Air and Radiation Division, EPA Region V (Sept. 9, 1988). Our cases follow these standards.

The NSR provisions also apply only if there is a significant increase in pollution due to the modification. Methods for calculating emissions increases generally compare the emissions prior to the modification and those after the modification. For

post-modification emissions, however, a company undergoing NSR review at the time of the modification would have to project the emissions after the modification in its permit application. While the analysis of emissions is still being refined in the cases under litigation as documents are being made available by the defendants, in the Tennessee Valley Authority case, the Environmental Appeals Board found that emissions did increase under methods favorable to industry at all units at which violations were alleged.

As noted above, the standards for these cases derive from EPA memoranda and litigation dating from the Reagan and Bush Administrations. They are not new interpretations. They do not address true "routine" maintenance; indeed, industry documents indicate that industry did not consider the modifications at issue to be routine maintenance. Rather, the modifications were large-scale capital projects that required significant advance planning. They were intended to address problems that routine repair or replacement had been unable to address. Nor were the upgrades modest; in most cases they cost millions of dollars. By contrast, activities considered by industry to be "routine" include more mundane actions such as the day-to-day repairs of leaky or broken pipes. Industry documents further show that industry officials were aware of the potential applicability of the NSR provisions to their power plant life-extension projects.

Clean Air Act Litigation Settlements

In discussing resolution of these lawsuits with the companies, we and EPA recognized the need to ensure the nation's energy supply. We gave the companies significant time to install the needed controls. These lawsuits will have absolutely no detrimental effect on our energy supply. We ensured that the upgrades could be implemented consistent with the operating and financial needs and abilities of the companies. Indeed, we expect that pursuant to the settlements, some facilities will be repowered and expanded. Moreover, these settlements will provide the regulatory certainty that companies need to invest. By providing clear guidelines, these settlements delineate a path through the environmental laws by allowing the companies to invest in their coal plants so long as they invest in state-of-the-art controls. The result is to improve our energy diversity, increase our energy supply, and improve the environment, a win-win result.

While the actual agreements in principle that we have reached are still confidential—we are working to finalize the language of the consent orders now—the outline of those settlements is public. Those outlines provide sufficient detail to see that, far from harming our energy supply, the settlements will enhance it.

In the first case, with Virginia Electric Power Company (VEPCO), we had alleged that VEPCO made modifications to its plant that significantly increased emissions, without installing concomitant pollution controls. For instance, VEPCO rebuilt the boilers at several plants, changing their design, and expanded the coal yard at its Mount Storm plant by 50 percent. (VEPCO also doubled the height of the smokestack at Mount Storm to 730 feet to ensure that air pollution from the facility did not fall on nearby communities. The result is that much of the plant's emissions now drift hundreds of miles on prevailing winds to distant States such as New York.)

The agreement in principle covers eight plants in Virginia and West Virginia (Mount Storm, at Mount Storm Lake, West Virginia; Chesterfield, in Chester, Virginia; Bremo, in Bremo Bluff, Virginia; Chesapeake Energy Center, in Chesapeake, Virginia; Clover, in Clover, Virginia; North Branch, in Bayard, West Virginia; Possum Point, in Dumfries, Virginia; and Yorktown, in Yorktown, Virginia.). In the agreement in principle, VEPCO agreed to cut pollution of sulfur dioxide and nitrogen oxides by approximately 70 percent over the next 12 years. (Of course, the primary beneficiaries of these pollution reductions will be people in Virginia and West Virginia near the plants.) Capacity, however, will not be decreased. It will install pollution controls at its largest units on a schedule consistent with its rate restrictions. The consent order will also provide for VEPCO's funding of certain energy efficiency and renewable energy projects in New York and several other States. Finally, the settlement will provide VEPCO with clear guidelines for changes and upgrades acceptable to EPA that can be made in the future.

The settlement with Cinergy Corporation addresses 10 power plants (Cayuga, Cayuga, IN; Gallagher, New Albany, IN; Wabash River, West Terre Haute, IN; Beckjord, New Richmond, OH; Gibson, Owensville, IN; Miami Fort, North Bend, OH; Zimmer, Moscow, OH; East Bend, Rabbit Hash, KY; Edwardsport, Edwardsport, IN; and Noblesville, Noblesville, IN). This agreement in principle requires substantial pollution reductions and allows Cinergy to use new technology if appropriate so long as the new technology meets certain emission limitations. Like the VEPCO settlement, this agreement should not result in a decrease in Cinergy's

generating capacity; in fact, with the repowering of several units, Cinergy's generating capacity should increase. The consent order will also provide for the funding of energy efficiency and renewable energy efforts.

There is no question, finally, that these companies can easily afford the settlements. As others who have appeared before you have testified, coal is by far the least expensive fuel now. These power plants, being very old, have been fully depreciated. The fixed and variable costs of running them are exceedingly low. Yet, while their costs are remaining low, the price consumers are paying for electricity is increasing dramatically. This revenue increase is a windfall for these old coal-fired plants. Our estimates are that rates will have to increase very little, or not at all, for the companies to afford the clean air pollution upgrades the settlements will require. Certainly, the rates will remain well below rates in the Northeast. In short, these lawsuits, while they will cost some money, in no way jeopardize either the financial health of the companies or the burdens on the ratepayers.

The VEPCO and Cinergy settlements are not legal straight-jackets as some have unfairly portrayed them. In the enforcement context, we, along with officials from EPA and the Department of Justice, can weigh and have weighed numerous issues that may be unique to each company. We have allowed technological flexibility. We have recognized financial constraints and provided ample time for planning and implementation. These lawsuits and settlements represent an extraordinary accommodation of clean air and energy needs. I find it nothing short of amazing that efforts to enforce the law—really no different from the myriad of other law enforcement efforts my office and many other prosecutors undertake ranging from drug crimes to fraud investigations—have been so criticized. Rather, they should be applauded.

There has been some discussion before this subcommittee of the PowerSpan technology that is being developed by several companies, including some we have sued. We are meeting next week with PowerSpan representatives to investigate and understand this technology better. We have also been discussing other innovative technology with the private sector and with EPA. We are open to and enthusiastic about new technologies, particularly ones that may control mercury or carbon dioxide emissions. It would be a big mistake, and completely unjustified, to think that we are locked into old technologies. At the moment, of course, this PowerSpan technology appears promising, but not proven on a large scale; it is not yet as good as others for most pollutants. We intend to keep following its development and give it, and the power companies that will use it, appropriate opportunities for deployment. In sum, these lawsuits are achieving major environmental improvements while helping, and not in any way harming, our energy security. For that reason, I emphatically disagree—respectfully but vehemently—with the request by Senators Inhofe and Breaux that these cases be suspended. Regardless of what the Administration decides, we intend to pursue our cases both within and outside of New York.

Economic Value of Clean Air

Some have taken issue with the value of clean air, suggesting that it is merely a matter of convenience and not a matter of dollars and cents. Of course, anyone who has seen a child suffering an asthma attack, an older person struggling for breath on a smoggy day, or an adult friend wheezing, would recognize the absurdity of drawing this distinction. But lest there be any doubt, studies demonstrate that clean air is good for the American economy. A study done for the Federal Government found that the net benefits of the Clean Air Act over the last 20 years, ranging from increased crop production to decreased health care costs, totaled over $22 trillion. Other studies demonstrate the same: clean air is good for the American economy.

Moreover, the claim that the cost of clean air requirements has made new power plant construction unprofitable has little if any basis. Few power plants were sited during the early 1990's because there was ample supply. Once it appeared that new supply was needed, new proposals appeared very quickly. In New York, we have dozens of proposed new power plants. The regulations that apply to them are clearly within the financial plans of the many companies proposing such plants.

As others have noted, there will be an extraordinary market for clean technologies over the next decade. You were told it would be a $25 trillion market. New York, like its sister States, wants, deserves, and should have a substantial share of that market. Yet if we do not insist on clean air ourselves, we will not find the clean air technology developed here. By insisting on clean air, we continue to provide opportunities for our thriving business community.

Finally, it is important to note that, while clean air has tremendous value, so does dirty air. Dirty air consists of free waste disposal for a few privileged companies. Any normal company, particularly power companies in the deregulated and highly competitive market, looks for ways to reduce costs. Free waste disposal, if allowed,

is one such method. Because of the significant cost advantage such unloading of costs can provide, we cannot rely on a purely voluntary system to cut emissions. A voluntary approach will not work any better in the electric power market than it does or would in other waste discharge programs. We have seen repeatedly, that absent fair but strong limits, pollution will be discharged into the public's air or water or land in order to cut costs. We need a strong air pollution system, and we need it to be enforced.

The Importance of the State Role

While air pollution is a classic example of a problem that requires a Federal presence, it is critical not to underestimate the role of States in confronting this inherently interstate problem. States have been actively involved in the litigation concerning many of EPA's recent air quality rules. Many northeastern States have joined in New York's lawsuits against the Midwestern power plants. Let me remind you that New York, for example, filed its lawsuit against VEPCO before the EPA filed any lawsuit. This litigation, and its success, owes a great deal to State enforcement efforts.

Indeed, the structure of environmental laws gives States a large and important role. As you know, it is the States that develop the State Implementation Plans that govern how we will actually achieve the ambient air quality standards set by EPA. The northeast States have gone beyond those minimum actions and have taken many other measures on their own to reduce air pollution, such as imposing stricter controls on in-state sources. I urge you to work in partnership with the States—both the State environmental agencies and the State attorney general offices—when considering the issues before you.

I also urge you to support and encourage strong Federal enforcement as part of a true Federal-State partnership. There are several reasons why this is important. First, Federal enforcement levels the playing field in two distinct areas: (1) between companies that willingly comply with environmental and other rules and those that do not, and (2) between States that aggressively enforce the law within their own borders and those that do not. While at times States can bring enforcement actions concerning out-of-State sources, such as we did with the power plants, that is unusual. A State doing a good job protecting the health of its citizens should not be at a disadvantage with respect to less conscientious States. Second, Federal enforcement provides a solid back-drop to State enforcement, playing a role in unusually difficult or troublesome cases. Finally, Federal enforcement often brings with it the tremendous technical resources and expertise of the Federal agencies that oversee the entire program. In the case of clean air, EPA's expertise and experience is extraordinary and very helpful both to us in the States and, I believe, the regulated industries. Reducing Federal enforcement does not create a vacuum that States fill; rather it hinders State enforcement. In contrast, strong Federal enforcement actually enhances the State role.

Steps to a Sound and Diverse Energy Supply

Senator Voinovich asked about how to harmonize our environmental and energy policies. We harmonize these two critical needs by addressing not only how much power we have available, but how that power is generated. I discuss this at length in my report. We can achieve a sustainable energy portfolio by enacting policies that promote clean distributed generation, renewable power, and energy efficiency and, at the same time, ensuring that the necessary new supply can be brought on line promptly. If we were to improve efficiency by an achievable 10B20 percent, and increase renewable energy to provide 10–20 percent or more of our nation's energy needs, which is also quite feasible, we would largely, if not completely, resolve the current energy challenge. Moreover, we probably, just by those measures, would go most of the way toward meeting even the most aggressive climate change goals. Finally, we would reduce our dependence on foreign fossil fuels.

While not all aspects of my recent report detailing how New York can achieve both its energy and its environmental goals are necessarily relevant to Federal policymaking, I suggest that certain of my New York recommendations offer a sound strategy for the nation.

First, we must embark on an immediate effort to reduce dramatically demand through conservation and efficiency. We are confident that we can achieve significant gains in energy efficiency even in New York which ranks second among the States for the most efficient use of energy today. (New York ranks second in large part due to the efficiencies of the mass transportation that is so extensive, particularly in the New York City region. This energy efficiency provides yet another reason, in addition to air and water quality and traffic congestion reasons, for significant Federal support for mass transit.) Specific measures include:

- immediate adoption of the Department of Energy efficiency standards for residential air conditioners and heat pumps, residential clothes washers, residential water heaters, and commercial heating and cooling equipment;
- government funding for efficiency improvements, such as through programs like New York's System Benefit Charge, a small non-bypassable charge added to the electricity rates that, our experience proves, more than pays for itself within a couple a years in reduced consumer bills;
- utility portfolio mandates, modeled after the renewable portfolio standards in effect in many States, to bring utilities (particularly those in deregulated States where there are no longer rate hearings and conditions on rate increases) back into the efficiency effort;
- pricing policies to encourage flexible demand (such as time-of-day or day-night rates that encourage people to use power at off-peak times) and policies to ensure that people have a direct price signal for their energy use (such as conversion of master metered multiple unit dwellings to individual meters);
- changing regulations so retailers of electricity are rewarded for reductions in demand;
- State sales tax credits for efficient appliances and vehicles; and
- measures to provide consumers with better information about their energy choices (such as the excellent Energy Star program).

The Federal Government should increase, not decrease as has been proposed by the new Administration, its spending on these measures.

Second, we must increase the supply of clean electricity. In New York, we have created a new siting board to review applications for new power plants. In my report, I suggest that the existing process is too slow and can be improved by giving earlier review to those applications that, because of a variety of factors, deserve a preference and through other procedural changes. While such siting issues are generally left to the States, the Federal Government can assist in bringing clean new sources of supply on line by promptly passing the Clean Power Act, S. 556, and other measures to establish the certainty necessary for private investment. The Federal Government's role must not be, as some recommend, to suspend environmental rules; that will only lead to additional years of uncertainty. In addition, as was mentioned at this subcommittee's first hearing on March 21,2001, the Federal Government can help by stopping the rhetoric about environmental requirements interfering with our energy supply. We have spent years trying to get beyond the simplistic "environment versus economy" argument; it has been rebutted by innumerable studies. When the Federal Government revives such myths, it makes people believe that new power plants will poison them. So they resist them in every available forum. If instead, the Federal Government reassures Americans that they can have a clean environment and a secure energy supply, then the siting process everywhere will be easier and faster.

Third, we must improve the transmission system so that available power can reach the places where it is needed. For example, in New York, we have an ample wind resource upstate while our greatest demand is in New York City. Improvements to the transmission system should allow us to take advantage of clean supply opportunities wherever located.

Fourth, we need to increase clean distributed energy sources. Small scale sources, such as fuel cells, wind generators, small-scale hydro, solar cells and cogeneration facilities (but not including uncontrolled diesel generators), can provide significant new supply while avoiding any incremental strain on the distribution system and without creating significant emissions.

Finally, we need an all-out effort to expand renewable power sources, especially wind and solar. Recent studies demonstrate that even in northern States such as New York, solar power—which is best generated on hot summer days—can already be cost-effective in reducing peak electricity demand—which also comes on hot summer days. We also have significant wind resources—enough to make a significant contribution to our future needs if properly distributed. We urge both research efforts and the enactment of a renewable portfolio standard that would create a market for renewable energy facilities.

I believe that many of these issues are addressed in the "Comprehensive and Balanced Energy Policy act of 2001" which is now being considered. I urge your careful attention to these recommendations.

Oil and Gas Issues

The second of today's panels will focus on oil and gas issues. Many of the clean air questions there are similar to those raised by the electric utility sector. Indeed, the clean air litigation brought by EPA on refiners is based on the same NSR provi-

sions of the Clean Air Act. I suggest that the explanation I gave above as to why my clean air litigation is sound and proper applies to those refinery cases as well.

More broadly, the oil and gas sector again demonstrates that careful attention to environmental concerns can enhance, and does not harm, our energy future. EPA's recently promulgated diesel fuel rule, which has been challenged by certain industries and which my office will help defend, is a good example. This rule, on its own, will dramatically improve urban air quality since diesel exhaust is one of the largest pollution sources in urban areas. In addition, the use of low-sulfur fuel allows the use of traps and other devices to reduce particulate pollution. These traps could lead to significant reductions in $PM_{2.5}$, the finer particles that can lodge in the lung, since diesel exhaust is composed of 90 percent $PM_{2.5}$ and, according to a California study, contains numerous carcinogenic compounds.

Another issue of great importance in this area is methyl tertiary-butyl ether (MTBE). Many drinking water wells in New York, particularly in Long Island, have been found to be contaminated by MTBE. The costs of remediating such contamination are usually significantly greater than the costs associated with uncontaminated petroleum spills. In part to address this concern, New York has passed a law that will ban MTBE in 2004. This law, however, has been challenged by MTBE manufacturers on Federal preemption grounds. Federal action to allow the elimination of MTBE would be welcome.

Conclusion

In sum, the Clean Air Act, as well as other environmental regulations, should be viewed as helping, not hindering, a sound energy policy. The American people will not accept energy production that poisons their air and their water any more than they will accept blackouts. Indeed, it is a false dichotomy to suggest that people must choose one or the other. An environmentally sound energy policy is the only sustainable future. Fortunately, it is achievable if we demonstrate leadership and foresight.

STATE OF NEW YORK: ATTORNEY GENERAL'S ACTION PLAN FOR A BALANCED ELECTRIC POWER POLICY IN NEW YORK STATE

INTRODUCTION

Electric power is in the news and on everyone's mind these days, with good reason. While we usually take for granted this invisible but vital force that permeates our daily lives and provides the power without which our modem society could not exist, recent events in New York and elsewhere demand our close attention and immediate action.

As the economy has grown rapidly in New York over the last decade, so has the demand for electricity. Demand has risen so dramatically over the past several years that it is now outstripping available supply in New York, particularly in New York City and Long Island where transmission constraints require most power to be generated locally. Moreover, in New York's restructured market—where the price of power no longer reflects a regulated price, but rather a market price—the current supply/demand imbalance has caused dramatic price spikes in electncity bills For example, Con Edison's customers saw their bills increase an average 30 percent last summer, even though it was the coolest summer in years. California's forced rolling blackouts, soaring energy prices, and threatened bankruptcy of several major utilities have also heightened New Yorkers' concerns.

At the same time as New York confronts price spikes and potential shortages, we are faced with continuing reports of the impacts of electncity generation Power plant emissions contribute greatly to acid rain and urban smog, which, in turn, cause tremendous damage to our health and our environment. Urban smog exacerbates asthma, which is increasing rapidly in New York City and other urban areas—especially among children. Acid rain is killing entire ecosystems in the—Adirondacks and other treasured natural areas. Mercury emitted by coal-fired plants contaminates fish, and greenhouse gases such as carbon dioxide change the climate. Power plant cooling water intake systems injure fisheries upon which many New Yorkers depend.

Clearly, New York needs to find better ways to meet its electricity demands at a reasonable cost while also protecting its citizens' health and the State's natural resources. To meet growing electricity demand, the State has had to rely largely on existing power plants, many of which are old, inefficient, highly polluting, and insufficient to meet projected demand. New York policymakers would be foolhardy to ignore the lessons of California, and our own experience, in developing energy policy.

We must move now on two fronts to develop a sustainable, balanced energy policy that ensures customers a reliable and reasonably priced power supply and that preserves our environment and protects our health. We must meet our immediate short-term needs by increasing clean supply and reducing the growth in demand through conservation and efficiency. We must also secure the longer term by using electricity more efficiently and shifting our dependence on fossil fuel toward renewable sources of electricity.

For the short term, New York must plan for the summer of 2001. Summer is when the demand for power is the greatest in our region, as more air conditioning is used in response to hot weather. We must have enough power supply available downstate to meet expected demand without skyrocketing prices. The power generators the New York Power Authority ("NYPA") is placing downstate—among the cleanest and most efficient available—are a sound approach to accomplish those goals. At the same time, investments in energy efficiency must be significantly increased. The New York Independent System Operator ("NYISO") must enhance the design—and operation of the State's electricity markets to avoid, price spikes based on abusive market power, and to ensure the integrity of the wholesale power market. Unless these markets work competitively, deregulation cannot achieve its goals, and consumers, the economy, and the environment will suffer as windfalls are reaped by the few at the expense of the many.

For the longer term, we must address not only how much power we have available, but how that power is generated To protect our health and natural resources, the State must move to a cleaner electncity supply and contain the ever-expanding growth of demand Relying more on renewable energy and using electricity efficiently should also lower bills for consumers.

To assure reliable electricity at steady prices we must build new sources of electric power, expand transmission capacity to reach more existing sources of power, and create more flexible demand during peak demand periods through demand-side management, conservation and more efficient consumption We can achieve this new, balanced energy portfolio by improving the plant siting process, by enacting policies that promote clean distributed generation and the use of renewable energy sources, and by increasing transmission capacity to allow market sited plants to serve the entire State. We must also ensure that new clean generating capacity displaces older, dirtier, and less efficient power plants.

These goals are achievable if we work together and act with care and speed New York is one of the largest energy users in the United States, which is the largest energy user in the world Thus, our choices can have a major influence on global as well as local energy policies and environmental impacts. The following recommendations are a first step toward a balanced strategy on electric power.

EXECUTIVE SUMMARY

The demand for electricity in New York has grown dramatically over the past several years, primarily due to a rising economy. Supply however, has not kept up, raising reliability concerns for the future. New York has also recently restructured its electric power markets, and the current supply/demand imbalance has been reflected in the price of power, sometimes leading to dramatic price volatility in electricity bills downstate. As we confront our energy needs, we must recognize the impacts of electricity generation. Power plant emissions contribute to acid rain, smog, toxic pollution and climate change, all of which have a serious deleterious impact on our health and environment. These facts raise both short-term and long-term concerns for New York about the price, reliability, and impacts of electric power. New York needs to find better ways to meet its electricity demands at a reasonable cost while also protecting its citizens' health and the State's natural resources.

Recommendations

The Attorney General's Bureaus of Telecommunications & Energy and Environmental Protection recommend the following measures:

A. Short-Term Measures

Currently, New York's growing imbalance in supply and demand is greater downstate than upstate, due to the nature of transmission constraints, which make it difficult for significant power to be sent downstate. We must be sure we have enough electric power supply this summer to meet the anticipated peak demand downstate by increasing clean sources of electricity generation and by reducing demand through aggressive conservation and efficiency measures. Not only must we make sure that the lights stay on this summer, but also that there is enough supply so that electricity prices do not skyrocket.

1. New supply is needed, particularly in downstate areas Estimates of peak supply shortfall downstate in the summer of 2001 require the additional generation proposed by the New York Power Authority ("NYPA") and others.

2. Immediate efforts to reduce demand will improve reliability, lower price and reduce the need for more supply Funding for the three existing State programs that promote energy efficiency, conservation and renewable energy must be increased The Attorney General is directing a portion of its future power plant settlement funds—totaling approximately $20 million—to the New York State Energy Research and Development Authority ("NYSERDA") for efficiency, conservation and renewable energy programs Funding for NYPA efficiency programs should be increased immediately from its current level of $60 million annually to $160 million per year, with an emphasis on projects to reduce peak demand in New York City and Long Island Funding for Long Island Power Authority ("LIPA") efficiency programs should be increased this spring from $32 million per year to $50 million per year With increased funding for these demand-reducing programs, it is estimated that over 600 MW of generation capacity needs could be avoided statewide over the next 2 years.

B. Long-Term Measures

In the longer term, we must address not only how much power we have available, but how that power is generated and used. To ensure environmental protection, a reliable electricity system, and reasonable prices for electricity, we must develop policies today that (1) improve the siting process for new power generation, (2) upgrade the transmission and distribution system, (3) increase renewable energy and clean distributed generation sources, (4) protect the consumer, and (5) contain the growth of demand and protect the environment.

1. We must increase our supply for the long term

The State needs to recognize that an increase in supply is necessary to keep up with demand. We need to be innovative and forward-looking in considering how to increase supply while protecting our environment.

a. The siting process must be improved. The Siting Process must be improved to ensure that necessary new generating facilities come on line expeditiously, with the least possible impact on the environment and public health:

- The Legislature should require the Siting Board and New York State Department of Environmental Conservation ("DEC") to decide which siting applications merit a preference for earlier review.
- The Siting Board should designate a project manager for each application.
- The Siting Board should require applicants to file environmental permit applications with DEC before filing a siting application.
- The Siting Board should establish a 30-day time limit to negotiate voluntary stipulations.
- The Siting Board should appoint an ombudsman for each project to be a focal point of contact for community groups and to mediate disputes.
- The New York State Independent System Operator ("NYISO") should set deadlines for Transmission and Distribution Owners to contribute to system reliability impact studies.
- The PSC and the NYISO should assign responsibility for transmission system upgrades necessary for new generating capacity.

b. New and upgraded transmission lines are needed. New York needs additional high voltage transmission capacity to move large quantities of power from places with surplus power to areas that currently contain limited generating capacity. For decades, transmission bottlenecks have restricted the efficient use of New York's overall existing generating capacity as well as access to supplies from out-of-state. Despite these infrastructure flaws, investment in transmission has declined significantly since 1988. Steps have been taken to establish a federally sanctioned regional transmission organization ("RTO") to address New York's transmission needs However, whether or when such an RTO will begin operations remains uncertain The PSC and the NYISO have the authority to begin the work needed to relieve New York's transmission bottlenecks, and should begin immediately.

c. Renewable generation and clean distributed generation sources should be increased. Until recently, solar and wind generation were not economically competitive with fossil fuel power generation. New technologies for solar and wind generation, combined with increased fossil fuel costs, have narrowed the cost gap considerably. The Legislature should join New Jersey, Massachusetts, Connecticut, Texas, and many other States by adopting a Renewable Portfolio Standard ("RPS") requiring retailers of electricity to include in their portfolio of supply an increasing percentage of renewable generation.

Policies are also needed to increase clean distributed energy sources. The need for large power plants and the strain on the transmission system could be lessened by distributing smallscale generation units (L? fuel cells, wind generators, small-scale hydro, solar cells, and cogeneration facilities)' that use minimally polluting technologies directly on the site where the electricity is to be used. The Legislature should (i) expand tax credits for the purchase of clean distributed generation technologies, and (ii) expand the Solar Net Metering Law to include wind and small hydro power—allowing owners of such generation to sell excess power generated back to the grid. In addition, NYPA should work with local governments across the State to install fuel cells at landfills and wastewater treatment facilities, which produce large quantities of methane that can be used to power fuel cells.

2. The consumer must be protected during the transition to competitive markets

a. The NYISO must enhance its market monitoring and price mitigation functions. Electricity prices must not be permitted to soar during the transition to competitive markets for this vital service. The NYISO has made significant progress toward developing competitive power markets and in monitoring the markets for potential abuses of market power. However, more needs to be done to ensure stable prices for the summer of 2001 and beyond, whenever supply and demand are severely out of balance. The NYISO must implement its proposed "automatic" mitigation, which seeks to ensure that prices reflecting potential abusive exercise of market power do not set the market-clearing price. The NYISO must also strengthen its current forward-looking market mitigation, by obtaining approval from the Federal Energy Regulatory Commission ("FERC") to order retroactive refunds when abuses of market power are timely identified. The current $1,000 per megawatt-hour cap on the price of wholesale power should be retained, and should be kept in line with any price caps in adjoining markets, until a judgment is made that New York's markets are reasonably competitive, especially during times of peak demand.

b. Consumers must be protected from extremely volatile electricity prices while receiving necessary market price signals. During the transition to deregulation, utilities should 'bear some of the risk of high wholesale market prices with customers, rather than completely passing through such prices to consumers. This will incentivize utilities to better manage their risk, while affording consumers price signals upon which to make decisions about electricity use.

3. Demand must be contained over the long term and the environment must be protected

As the economy and population grows, so will demand. We must meet growth without increasing degradation. Aggressive measures to reduce demand, together with construction of clean and renewable power plants, will greatly increase the probability that older, highly polluting power plants will be displaced.

The NYSERDA, NYPA and LIPA programs that fund efficiency and renewable projects are not required by law. NYSERDA's funding expires in 2006, NYPA's funding is year-to-year, and LIPA's funding expires in 2004 The Legislature should mandate that these programs be funded at a higher level for at least the next 10 years. In addition, the Legislature should enact other financial incentives to reduce demand, such as exempting the most energy efficient products from sales tax.

The PSC should improve pricing and revenue signals to encourage flexible demand and conservation. Utilities should promote offers for different time-of-day rates to residential customers to encourage load shifting, and master-metered buildings in New York State should be converted to direct metering or submetering. The PSC should also consider changing the way it regulates the price of electricity distribution If the rate structure rewarded retailers for reductions in demand, energy conservation would more likely become a priority.

State government can bring utilities into the State's energy efficiency efforts by enacting an Efficiency Portfolio Standard, requiring retail sellers of electricity to achieve certain levels of demand reductions in their service area. The Federal Government can similarly act to implement stringent minimum energy efficiency standards for appliances and other electrical products to reduce demand for electricity nationwide.

No one proposal within this report stands alone. This package of proposals recognizes the need to address both supply and demand. In so doing, the State will best promote the growth of competitive electric power markets while also protecting both consumers and the environment. Taken together, these recommendations are a balanced approach to address the State's short-term and long-term electric power needs and to lay the foundation for a sustainable energy policy for the future.

I. New York Must Address its Growing Imbalance in Electric Supply and Demand

A. Electricity Supply and Demand are Out of Balance

The recent rapid and welcome growth in New York's economy has spurred a dramatic increase in demand for electricity statewide, peak demand for electricity is estimated to be increasing at an annual rate of 1.4 percent, with demand increasing in some regions at more than twice the state-wide rate.[1] Growth in generating capacity and investments in efficiency have not kept pace. Indeed, addition of new electric power sources in New York State has slowed dramatically over the last 5 years, even compared to the limited amount of capacity built between 1990 and 1995,[2] and state-mandated demand-side management investments (and their associated savings in needed generating capacity) have declined from a high of $330 million in 1993[3] to approximately $170 million in 2000.[4] This growing imbalance between supply and demand, if unaddressed, can lead only to ever-soaring electric power prices and eventual blackouts. However, increasing capacity without regard to environmental considerations, will exacerbate our State's air pollution problems.

The present facts are stark. New York State has a geographical mismatch between generating capacity and where electricity is used.[5] Physical limitations on the amount of electricity that can be transported from one part of the State to another over the existing high voltage transmission system mean that western New York has surpluses of power whereas eastern New York, particularly downstate in New York City and Long Island, are short. Moreover, additional capacity is required to ensure that the lights can be kept on even if a major generating unit or transmission line fails. These reserve levels are required to be 18 percent above the projected peak demand for electricity statewide and in given areas.

New York City is projected to have a summer 2001 peak demand of 10,535 MW,[6] up 4.6 percent from the record peak demand of 10,076 MW during the July 1999 heat wave.[7] The NYISO estimates that New York City will be a glaring 397 MW short of required capacity during the upcoming summer Electricity supply on Long Island is only slightly better For Long Island, the NYISO projects a summer 2001 peak demand of 4,733 MW and a capacity shortfall of 131 MW.[8]

For 2001 NYISO forecasts a 1.7 percent annual increase for New York City and a 2.3 percent annual increase for Long Island.[9] Thus, projected summer peak demand in 2002 and 2003 for both New York City and Long Island may well exceed available generating capacity unless supply and demand are quickly aligned.[10] As shown in Table 1, if current demand growth continues unchanged for the next 2

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[1]See, NYISO Installed Capacity Load Forecast Study for Summer 2001. Http://www.nyiso.com/markets/icapinfo.html#summer 2001.

[2]Only 308 MW of power were added between 1996–2000, compared with 3,410.7 MW added between 1990 and 1995. This data is based on NYISO registration dates for New York power plants currently operating.

[3] New York State Energy Planning Board ("NYSEPB"), New York State Energy Plan and Final Environmental Impact Statement. November 1998. p. 3–60, 3–62.

[4] State-mandated DSM Funding in 2000 came from three sources: 1) SBC, See 'Order Continuing and Expanding the System Benefits Charge for Public Benefit Programs, Case NO. 94-E–0952, et. al., (January 26, 2001); 2) NYPA, see NYPA press release, November 30, 2000; and 3) LIPA, see LIPA, Clean Energy Initiative, May 3, 1999.

[5] New York State's total summer electric generation capacity is 35,098 MW. NYISO 2000 Load And Capacity Data Report, July 1, 2000, Table 111–2, p. 55. Seasonal effects change capacity levels for certain generators, resulting in a state-wide winter capacity of 36,649.8 MW. One megawatt is the amount of power required to light 10,000 100-watt light bulbs. Because demand for electricity peaks in the summer, the winter capacity has less significance for system reliability concerns. The summer peak electricity demand for New York State in 2001 is projected to be 30,620 MW. See, NYISO Installed Capacity Load Forecast Study for Summer 2001. Http://www.nyiso.com/markets/icapinfo.html#summer—2001.

[6] NYISO February 15, 2001 Locational Installed Capacity Requirements Study.

[7]The power outages experienced in parts of New York City and Westchester County that began on July 6, 1999 were caused by failures in Con Edison's distribution network, not insufficiency in supply. See, New York State Attorney General's report, Con Edison 's July 1999 Electric Service Outages, March 9, 2000.

[8] These estimates do not take into account the proposed NYPA generating units or additional projected capacity increases on Long Island. NYISO February 15, 2001 Locational Installed Capacity Requirements Study. See also, NYISO, Power Alert: New York's Energy Crossroads, March 2001, p. 19, and NYISO March 14, 2001 press release, Expedited Power Plant Development & More Customer Choices Needed To Avoid California-Type Energy Crisis, Says NYISO Report.

[9]See, NYISO Installed Capacity Load Forecast Study for Summer 2001. Http://www.nyiso.com/markets/icapinfo.html#summer—2001.

[10] See, NYISO Piess Release, New York Independent System Operator Finds That New York City Faces Electricity Shortage, February 14, 2001. See also, NYISO, Power Alert: New York's Energy Crossroads, March 2001, p. 19.

years, no more generation capacity is added, and efficiency and conservation are not improved, both New York City and Long Island risk being unable to supply sufficient power.

Table 1

Downstate New York Shortage Without More Generation Or Reduced Demand[11]

(MegaWatts)

Zone	2001 Zone Capacity Required	2001 Current Capacity	2001 Current Deficit	2002 Zone Capacity Required	2002 Projected Deficit	2003 Zone Capacity Required	2003 Projected Deficit
NYC	8428	8031	−397	8560	−529	8680	−649
LI	4638	4507	−131	4709	−202	4776	−269

AAAAAAAA[11]Source: NYISO, Power Alert: New York's Energy Crossroads, March 2001, p. 19.

In addition to these estimates, the Public Service Commission ("PSC") has identified a "statewide need for 600 MW plus per year of capacity additions to satisfy the demands of a growing economy" and "an immediate need for 300 MW [of added capacity now in New York Cityj, and an additional 200 MW each year thereafter."[12] PSC Chairman Helmer has also stressed that New York must use effective strategies to cut demand, comparing building power plants alone to trying to clap with one hand.[13]

While electricity conservation and demand management programs could substantially reduce the amount of additional generation needed, it is clearly imperative that clean supply be increased, both for the short-term downstate, and for the long-term throughout the State. Indeed, new clean and efficient power plants, combined with aggressive demand-side management and renewable energy investments, should displace older, dirtier power plants and yield reduced emissions and increased generating capacity.

B. Supply Must be Greater than Demand, to Avoid Power Outages, and Keep Electricity Prices from Skyrocketing

In competitive markets, when demand is inflexible and approaches the limits of available supply, the price paid for a product will climb dramatically. This characteristic is especially salient in the case of wholesale electricity markets, where demand currently is relatively inflexible, and where the physical properties of electrical generation and flow are such that electricity cannot be stored in any significant quantity, but is generated, transmitted, and used virtually instantaneously.[14] The amount generated and put into the transmission grid must be balanced with the amount consumed second by second, or the entire system could break down.[15]When demand threatens to outstrip supply during periods of peak use, price spikes will occur. Electricity will be less expensive if surplus capacity is sufficient not simply to keep the lights on, but to keep wholesale prices competitive.

Once a sufficient number of private sector new generation projects are approved to be brought on line, market forces can be expected to bring supply into better balance with demand, yielding greater wholesale market price stability.

Until we have more experience with market participant behavior, it is difficult to ascertain what specific amount of capacity would provide sufficient surplus to not only assure reliability but also stabilize market prices during peak demand periods. As much as 10–20 percent surplus during peak demand may be required to avoid the steep end of the price curve. The NYISO projects that by 2005, if no new genera-

[12]See, August 2, 2000 testimony of PSC Chairman Maureen Helmer before the Assembly Standing Committee on Energy, Http://www.dps.state.ny.us/testimony—8—2—2000.htm, p.3.

[13]See, Albany Times Union, Demand the Key to Power Supply, March 6, 2001, p. E1.

[14]Buyers in other power markets, including natural gas, can ride out peak demand periods by drawing down storage supplies and avoid paying volatile spot prices.

[15]Different generation plants have vastly differing production costs, according to their size, design, operation, and fuel source. Large steam powered generators and nuclear power plants (in the 500–1,000 MW range—called "base load" units), cannot be activated quickly, nor can they rapidly adjust electricity output. Therefore, owners of such units normally offer their power into the market at relatively low prices, to ensure that it will be dispatched and they will not have to dump excess output. At the other end of the spectrum, small gas turbines (ranging from 20 to 60 MW) are designed to allow for quick startup and output adjustment and, due to their high operating costs, are most often used during peak hours. Peaking units, including gas turbines, experience greater wear and maintenance costs if run for extended periods. To recover their investment and operating expenses over a relatively limited number of unpredictable hours of use, owners of such units usually offer power at high prices.

tion is added in New York, "statewide prices could be expected to increase by about 14 percent from present levels", but "[i]f supply is allowed to grow statewide prices should actually decrease and could be 20–25 percent lower than if no new generation is added," resulting in statewide "savings of over $1.4 billion annually in 2005." [16] Because the mix of generator types and sizes varies in each of the 11 zones where NYISO administers market prices, the surplus capacity needed to avoid volatile prices will necessarily differ for each zone.

C. NYPA's Proposed Generators for New York City are Necessary to Meet Peak Demand for Summer 2001

For the immediate term, by the summer of 2001, we have no choice but to increase the available power downstate by at least 528 MW, i.e., 397 in New York City and 131 MW in Long Island. The NYPA has received approval to construct 11 new gas turbines in New York City with a combined output of 443.5 MW, most of which are expected to be operational at the start of the upcoming summer cooling season. In addition, the Astoria No. 2 plant (a former Con Edison-generator fueled by natural gas) is expected to be repowered by Orion Power Holdings, Inc. and available sometime during summer 2001, which would add 170 MW. Another 60 MW to the generating capacity in New York City is anticipated from Con Edison's planned reactivation of the Hudson Avenue No. 10 plant (Brooklyn). [17] These new NYPA and repowered units, if completed in time, should address the risk that New York City might otherwise have insufficient power supply if demand peaks at forecast levels. [18]

The NYPA units, which burn natural gas as a fuel, are considered relatively clean in terms of emissions [19]—they emit virtually no sulfur dioxide ("SO_2") and less nitrogen oxide ("NOx") than oil or coal-fired plants. Thus, the potential air quality impact of this supplemental generation capacity should be limited. [20] In addition, the NYPA has committed to reducing air emissions at other New York City plants so overall air emissions will not increase. [21] Each new unit is comparatively small in scale, which should minimize impact on local communities. [22]

On Long Island, the NYPA is installing one 44 MW capacity gas turbine at the former site of Pilgrim State Hospital. In addition, Keyspan is upgrading its Holtsville unit to increase output by 5 MW, and other gas turbines that will add 35 MW more generating capacity on Long Island. A merchant generator turbine is slated for Far Rockaway with 44–50 MW of capacity. Together, these planned additions will barely satisfy the 131 MW capacity needed for Long Island reliably to meet forecast demand. Some of these new units are not expected to be operational by the May 1, 2001 start of the peak season, but instead may not be available until July 1. Even with the anticipated new generating unit upgrades and additions, Long Island electric power resources are likely to be stretched to their limit during peak demand periods this summer.

D. Current State Programs that Promote Energy Efficiency and Renewable Energy Should be Expanded

Several programs in New York State currently encourage energy efficiency and renewable energy. Most are implemented by the New York State Energy Research and Development Authority ("NYSERDA"), the NYPA, and the Long Island Power

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[16] See, NYISO, Power Alert: New York's Energy Crossroads, March 2001, p. 9. This NYISO projection assumes that 8,600 MW would be added to New York's supply, and does not include inflation or fuel cost increases.

[17] While a number of other small-scale potential capacity additions to existing units in New York City are being pursued at various sites, it is difficult to determine with certainty which efforts will be brought en line and whether they will meet the need when demand peaks.

[18] The Attorney General supports this effort, but takes no position on the particular sites selected for the NYPA generators.

[19]Power plants emit significant quantities of pollutants, especially sulfur dioxide, nitrogen oxides, particulate matter, carbon dioxide, and mercury. These emissions contribute to acid rain and regional haze, and are dangerous to human health as well as to the health of fish and wildlife.

[20]The NYPA has stated that they will use the best available emission control technology to reduce NON, particulate matter, sulfur dioxide and carbon monoxide emissions. In addition, the NYPA performed an analysis of the turbines' fine particulate (PM2.5) pollution and determined the increase to be insignificant. The DEC has issued air pollution control and acid rain permits limiting emissions for each of the sites.

[21]DEC Press Release, dated January 12, 2001. The State's Department of Environmental Conservation ("DEC") and the NYPA should formalize an agreement on reduction of overall area emissions.

[22]The NYPA has also committed to noise mitigation measures at some of the new sites.

Authority ("LIPA")[23] They have proven to be highly successful and offer a good starting point for an expanded State efficiency effort.

1. The Attorney General is Directing Power Plant Settlement Funds to Supplement NYSERDA Programs

The Attorney General, through his authority to enforce Federal and State environmental protection laws, has embarked on a number of clean air initiatives. The Attorney General sued out-of-state coal-fired power plants that upgraded or expanded their old power plants without installing the pollution controls required by the Clean Air Act The Attorney General, with the DEC, is also pursuing legal action against similar plants in New York. Recognizing the priority the people of New York have assigned to clean air and a balanced energy policy, the Attorney General is negotiating to ensure that settlements are directed to enhancing renewable energy development and efficiency.

The Attorney General is working with the NYSERDA and DEC to ensure settlement funds are spent most effectively to promote energy efficiency and renewables The settlement funds may also be used to fund some of the transmission infrastructure needed to make available additional wind resources. While agreements-in-principal have not been finalized—and other cases are in negotiation or litigation—the lawsuits are likely to yield $20 million or more that can provide the catalyst for an additional 10–30 MW of renewable energy and perhaps 10 MW of savings through efficiency.

2. The Legislature Should Ensure Funding for NYSERDA Programs by Extending the System Benefits Charge

The NYSERDA's programs, under the umbrella of the New York Energy Smart program, are designed to improve energy efficiency through education, improved operations, purchases and use of energy efficiency equipment and services, and technology development and demonstration. The 38 New York Energy Smart programs, range from market transformation (e.g., ensuring retail stores offer efficient products to their customers) to low-income assistance (e.g., direct installation of efficiency measures in low-income households) and renewable energy development (e.g., production incentives to wind farm developers).

The NYSERDA's programs are funded by the System Benefits Charge ("SBC").[24] The SBC is a small, non-bypassable charge per kilowatt-hour to all customers buying electricity transmitted and distributed by the State's investor-owned utilities. Currently, the SBC rate is just over one-tenth of one cent per kilowatt-hour and collects $150 million per year.[25] The existence of the SBC derives from a PSC Order that expires in 2006.[26] The Legislature should codify the SBC and extend it 5 years to ensure a long-term, reliable source of funding for energy efficiency and renewables. In addition, the Legislature should make permanent programs funded by the SBC that improve efficiency in low-income households.

The NYSERDA has used over $71.8 million SBC funds since 1998 to encourage efficiency and renewable power investments. These investments have resulted in estimated electric savings of 486,000 MWh annually; demand reduction of at least 125 MW; reductions to electric, fuel oil, and natural gas bills of $54 million annually; reductions to annual air emissions of 464 tons of NOR, 774 tons of SO_2, and nearly 335,000 tons of CO_2 and the creation of over one thousand jobs.[27] While the $71.8 million was paid out once, the savings are annual. Based on this experience, a one-time investment of $100 million in energy efficiency reduces consumer bills by about $75 million per year. This annual savings accumulates over the lifetime of the efficiency measure, yielding' a net savings of $375 million over the first 5 years for just the first year's investment.

The NYSERDA estimates that the total effect of SBC expenditures through the summer of 2002 will reduce peak demand between 600 and 660 MW and between

[23]The NYPA and LIPA are publicly owned not-for-profit utilities, whose programs are funded by rates charged their customers.

[24]In Opinion and Order Regarding Competitive Opportunities for Electric Service, Case NO. 94-E–0952, et. al., (May 20, 1996), the PSC created the SBC to mitigate the potential adverse environmental impact of restructuring the electric industry.

[25]See, Order Continuing and Expanding the System Benefits Charge for Public Benefit Programs, Case NO. 94-E –0952, et. al., (January 26, 2001), p. 12. A small percentage of the funding is administered by the utilities.

[26]Ibid.

[27]NYSERDA, New York State Energy Smart Program Evaluation and Status Report, Report to the System Benefits Charge Advisory Group. Interim Report, September 2000.

1,200 and 1,300 MW through 2006.[28] These programs, so critical to New York's energy and environmental future, should be codified.

3. NYPA Should Work With its Customers to Reduce Demand by an Additional 200 MW Over the Next Two Years Beyond Its Current Goals

The NYPA currently provides about $60 million annually to its customers for demand-side management projects and recovers its costs by sharing in the electric bill savings. These projects cost taxpayers nothing to implement, but realize approximately $65 million annually in energy bill savings, and save enough energy each year to service 300,000 people, and avoid 360,000 tons of CO_2 emissions[29] While the NYPA's demand-side management initiatives currently achieve capacity savings of between 20 and 60 MW per year,[30] significant opportunities exist for greater savings.[31] The NYPA's customers, many of which are public entities, consume over 20 percent of the State's electricity, making this agency well situated to advance the State's need for more aggressive energy efficiency efforts. By reducing the government's demand for electricity, The NYPA can save taxpayers hundreds of millions of dollars in electricity costs. The NYPA should work with its governmental and business customers to reduce demand and increase clean distributed generation and renewable energy by at least an additional 100 MW per year over the next 2 years and commit to fund its demand-side management programs at an increased level over the next 10 years.

Because of the dual benefit of reducing demand and reducing the electricity bills of public entities, the Governor should direct all State agencies to report on energy use and recommend how to reduce both base and peak demand within 6 months. The NYPA should work closely with the State agencies to develop and implement those recommendations, including providing the financing necessary to obtain technical assistance, conducting energy audits, and purchasing and installing more efficient motors, lights, and other appliances or devices.

The NYPA should also expand its existing efficiency programs to include more local governments and school districts statewide, further reducing electricity costs for taxpayers The Legislature should direct the NYPA to provide funding for local governments to assess their energy efficiency opportunities within 6 months (for New York City and Long Island) or 12 months (for upstate areas) and reach agreements for their implementation.

The NYPA sells approximately 40,000,000 MWh of electricity per year, much of it to government and educational institutions.[32] For the NYPA to achieve 200 MW in additional savings beyond its current program, it will need to reduce energy consumption from all of its customers by 7 percent over 2 years.[33] This would save the

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[28]NYSERDA, Proposed Operating Plan for New York Energy Smart Programs (2001–2006), February 15, 2001, pp. 2,3.

[29]The NYPA's efficiency programs have successfully reduced electricity use and electricity bills. For example, the NYPA is working with the New York City Housing Authority (NYCHA) to replace 180,000 refrigerators with more efficient varieties over 8 years. After this project is completed in 2003, NYCHA will reduce energy consumption by 103,000 MWh per year and save over $7 million annually in energy costs. Similarly, its High Efficiency Lighting Program provides energy-efficiency improvements such as new lighting and upgrades to heating, ventilation and air-conditioning systems with no up-front costs to government and educational institutions. These measures can cut up to 25 percent on electric consumption. See, Http://www.nypa.gov/html/es.htm. See also NYPA press release, November 30, 2000.

[30] The NYPA currently spends approximately $60 million per year on demand-side management ("DSM"), but information regarding the amount of generating capacity saved is unavailable. Capacity savings were estimated based on past DSM investments. Between 1990 and 1996, the NYPA spent $255 million on demand-side management programs and reported saving 84 MW (0.33 MW per million dollars spent). Between 1990 and 1997, Investor-Owned utilities spent $1,277 million on DSM and reported saving 1,377 MW (1.08 MW per million dollars spent). Thus, an annual $60 million investment could result in a capacity savings of between 20 and 60 MW per year.

[31] For example, one of the NYPA's largest customers, the Metropolitan Transportation Authority, uses approximately 1,800,000 MWh per year. By updating its lighting and signal systems and other efficiency/conservation projects, it is conservatively estimated that the MTA could reduce its electricity use by 2 percent. (The NYPA reports that they can achieve up to a 25 percent reduction in energy consumption for each efficiency project they undertake. Thus a 2 percent overall reduction is a conservative target.) This project alone could reduce peak demand in New York City—a load pocket—by at least 4 MW, saving 36,000 MWh per year and $2,520,000 in annual energy costs (based on a rate of 7 cents per kWh—the NYPA's rates vary). See NYPA 1998 Annual Report.

[32] New York Power Authority 1998 Annual Report, p.19.

[33]The NYPA would need to achieve 320 MW savings over 2 years to meet the Attorney General's proposal, assuming the NYPA already achieves 60 MW savings per year through its existing $60 million per year program. A 7-percent reduction in electricity use = 5,600,000 MWh. 320 MW x 17,520 hours per 2 years = 5,600,000 MWh.

NYPA's government customers (the taxpayers) and business customers $196,224,000 in energy costs annually.[34] The environmental gains would be commensurately large—an estimated 2 7 million tons of CO_2, 14,280 tons of SO_2, and 5,320 tons of NOx would be avoided.[35] Finally, energy savings of this—magnitude would reduce stress on the existing system, improving reliability.

4. The Legislature Should Direct LIPA to Increase Its Investments in Demand Side Management

Shortly after the LIPA acquired the Long Island Lighting Company, its Board of Trustees issued a Clean Energy Policy Statement that declared the LIPA would establish a Clean Energy Initiative to support energy efficiency, clean distributed generation and renewable technologies. The LIPA funded the Clean Energy Initiative at $32 million per year for 5 years and began implementation in mid–1999.[36] In light of the current demand/supply imbalance on Long Island, the Legislature should direct the LIPA to increase its funding for the Clean Energy Initiative from $32 million to at least $50 million per year for 10 years.

The LIPA's existing Clean Energy Initiative—projected to obtain 144 MW of demand-side energy capacity savings by the time it expires in 2004[37]—will not realize all of the potential for capacity savings on Long Island. A 1999 study that examined opportunities to meet expected-increases in demand on Long Island found that expanded energy efficiency, distributed generation, wind power, fuel cells, and photovoltaics could yield 690 MW by 2010, including 465 MW from energy efficiency alone.[38]

If the Clean Energy Initiative were expanded to $50 million per year until 2010, as. recommended, capacity savings over the next 10 years could be greater than 450 MW.[39] If the funding were increased immediately, and programs were expanded this year, an additional 30 MW could be avoided over the next 2 years and an additional 45 MW savings over the remaining 3 years of the LIPA program. Given the cost savings from efficiency programs in the past, the investment of $50 million per year would save Long Island ratepayers approximately $35 million in each succeeding year, leading to dramatic cumulative savings (perhaps $60 million after 3 years) Again, significant environmental and reliability gains can also be expected.

II. The Review Process for the Siting of New Generation Facilities Must be Streamlined

The need for new supply underscores the importance of the power plant siting process, yet significant problems in that process affect the ability to respond quickly to increased demand with increased supply. Power plants cannot simply be built whenever and wherever someone decides they would like to do so. Rather, because of their size and environmental impacts, plans to build power plants are subject to an extensive and careful State approval process. This State-mandated review has been fraught with delay and uncertainty, impeding the ability of aspiring generators to proceed as expeditiously as would be optimal. Oddly, no process exists by which to rank the relative environmental impact of the proposed power plants. To increase the supply of electrical power to meet our economy's needs while protecting human health and the environment, the process must be dramatically improved.

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[34]Based on a rate of 7 cents per kWh. The NYPA's rates vary.

[35]Based on average statewide emission rates according to PSC Historical Fuel Mix and Emissions Data. Http://www.dps.state.ny.us/fuelmix.htm.

[36] The LIPA's Clean Energy Initiative offers many programs, including rebates for energy efficient products in their "EnergyWise" catalog. More than 37,000 lighting products have been ordered through the program and an additional 170,000 compact fluorescent lights have been sold in home improvement stores. Together, they represent potential electric savings of nearly $9 million and over 2,970 MWh of electricity. The LIPA's Residential Energy Affordability Partnership, a low-income energy efficiency program much like the NYSERDA's, directly installs energy efficiency measures, such as compact fluorescent lighting, refrigerators, wall and attic insulation, and programmable thermostats. The Solar Pioneer Program offers direct consumer incentives toward the installation of qualified photovoltaic systems between 250 and 10,000 watts, as well as a $3.00 per watt rebate for installing approved solar equipment.

[37]Estimated peak load reductions during the first year of the Clean Energy Initiative, totaled approximately 39 MW. Energy reductions resulting from the Clean Energy Initiative during 1999 were estimated to total approximately 16,000 MWh. These savings were achieved within 1 year of the LIPA's approval of the Clean Energy Initiative, demonstrating how quickly efficiency measures can be effective. At the end of the 5-year, $160 million program, the LIPA estimates that it will save 191,000 MWh of energy per year and avoid the need for 144 MW of capacity. See, LIPA, Clean Energy Initiative, May 3, 1999.

[38] Pace Law School Energy Project and Long Island Citizens Advisory Panel, Power Choices: 21st Century Energy Alternatives for Long Island, October 1999, p. 3.

[39] Estimate based on LIPA's current projections of 144 MW per $160 million spent over 5 years (0.9 MW per million dollars spent).

Ideally, the siting process should provide one-stop shopping for generators. Indeed, when the Legislature enacted Article X of the Public Service Law ("PSL") in 1992, the goal was for one entity, the New York State Board On Electric Generation Siting And the Environment ("Siting Board"), to have authority over the entire review process.[40] However, the U. S. Environmental Protection Agency ("EPA") authorizes the State DEC to issue permits under the Clean Water Act and the Clean Air Act. Since such permits are necessary before a generating facility may be built, the process does not readily fit the one-stop shopping model. Additionally, the siting of a power plant is often controversial, so the review process appropriately provides an opportunity for extensive input by interested parties. For these reasons, siting a new plant is neither easy nor quick.[41] Nevertheless, more can and must be done to coordinate and expedite the process if New York is going to meet the expected increase in demand with sufficient increase in supply, while at the same time ensuring that the added capacity results in a cleaner environment. Toward that end, the Attorney General urges the following:

Before filing the application, the applicant, the PSC, DEC, and others may voluntarily engage in negotiations regarding environmental and other studies needed. Once the applicant files its Article X application with the Siting Board, the Chairman of the PSC has 60 days to determine if the application is complete, or needs to be supplemented. Once the application is deemed complete, the Siting Board has 12 (12) months to decide whether to approve it, during which time the DEC and PSC jointly conduct public hearings in which expert witnesses are examined and evidence submitted. The hearing officers make specific statutory findings and recommend a decision to the Siting Board, which has the ultimate decisionmaking authority.

A. Decide Which Siting Applications Merit A Preference for Earlier Review

Currently, the Siting Board reviews each application in the order received, on a first-come first-served basis The Siting Board does not now give a reviewing priority based on relative need for generation at the location of the proposed site or on environmental attributes The Legislature, however, could and should direct the Siting Board and DEC to give a preference in the review process to applications for plants that:

Are located in areas that have an acute need for new generating capacity, and thus would have the greatest incremental impact on New York's structural supply deficit;

- Repower existing plants so overall emissions are reduced and community impacts minimized, or otherwise displace electrical generation that produces greater air emissions in the same air basin;
- Achieve a lower emission rate for particulate matter, NOR, and SO_2 than legally mandated or than other proposed plants, in addition to obtaining the largest offsets (proportional to the plant size);
- Are the most efficient generators, producing the least CO_2 per MWH generated;
- Include active controls for mercury emissions;
- Are sited on former industrial "brownfields," which thus would be redeveloped, cleaned and put to use; or
- Utilize dry-cooling techniques to minimize water impacts.

Since the Siting Board reviews applications as they come in, all other things being equal the first applications will be reviewed, approved and built first. As new supply comes on line, later proposals for plants may be withdrawn. However, the later pro-

[40]Under Article X, any utility, public authority or merchant generator wishing to build a new generator in New York State with a capacity of 80 MW or more must comply with and obtain a Certificate of Environmental Compatibility and Public Need ("Certificate") from the Siting Board approving the plant's construction and operation. See also, 16 NYCRR Chapter X, Subchapter A, § 1000 et seq., which sets forth the Board's rules and procedures. The five permanent members of the Siting Board are the PSC Chairman, who serves as the Siting Board chairman, the Commissioner of Environmental Conservation, Commissioner of Health, Chairman of NYSERDA and the Commissioner of Economic Development. The Governor appoints two members of the public as "ad hoc members" for each generator application: one must reside within the judicial district and the other must be from the county where the proposed plant is to be located.

[41]Article X requires an entity seeking approval for a generating facility to file an application with the Siting Board. At least 60 (60) days before filing its application, an applicant must file a preliminary statement with the Siting Board and various offices within the PSC. An applicant must also obtain environmental air and water permits from the DEC and acceptance of its interconnection study from the NYISO. The PSC and DEC assign staff members to review the application, and each also assigns a project manager to coordinate review within their agencies.

posed plants may, in fact, be preferable from the perspective of the State's energy needs or the environment.

To ensure that the State's needs are best served by proposed plants, and to encourage the private sector to propose such plants, the Legislature should require the Siting Board to give both procedural and substantive preference to plants that meet the above criteria. A preliminary review of any application should establish whether the plant is located in an existing electricity load pocket, repowers an existing plant, and what its emissions rates are.[42] The Siting Board and DEC staff could be preferentially allocated to plants that meet the criteria listed. That alone would speed the review and approval of such plants given existing staff constraints. Similarly, the Siting Board could, in making approval decisions, give a substantive preference to plants that meet these criteria.

B. Designate a Project Manager for Each Application

The time to review a siting application could be sharply reduced if the Siting Board designated a central Project Manager to be responsible for monitoring and ensuring the progress of an application's review at all agencies, rather than relying on separate agency project managers The lack of coordination among the State agencies, especially the DEC and PSC, has often made it difficult for applicants to get clear direction to move forward A central project manager for each application would keep the process from getting bogged down through conflicting or confusing directions.

C. Require Applicants to File Environmental Permit Applications with the DEC Before Filing a Siting Application

Initially, applicants filed siting applications and the DEC permit requests at the same time This led to delays because DEC, subject to EPA requirements in its permit process, cannot generally decide within the Siting Board's 60-day period whether the environmental permit applications are complete As a result, many applications were rejected by the Siting Board at the 60-day deadline as incomplete, and the process had to be restarted.

Applicants should be required to submit their DEC permit requests well ahead of their siting application.[43] The aforementioned Project Manager could coordinate this "front-loading" of the approval process so that an applicant will have negotiated with the PSC and DEC, secured the required environmental permits, and performed the necessary studies prior to filing the siting application.

D. Establish a 30-Day Time Limit to Negotiate Voluntary Stipulations

The Siting Board encourages, but does not require, applicants to negotiate voluntary stipulations with State agencies and interested parties to identify the issues of public concern and the studies or analyses appropriate for the project under review.[44] This "scoping process" is intended to speed review by enabling parties to reach early agreement on which issues need to be addressed in the application, thereby reducing later objections or litigation. With no current timeframe for completion, these negotiations are often protracted—causing unnecessary delay and uncertainty. To address this problem, the scoping process should be made mandatory and should be overseen by the Project Manager, who should establish a 30-day timeframe for the parties, the DEC and PSC to negotiate stipulations. The Project Manager should clarify the details of the environmental and other reviews required by the Siting Board and DEC. Adherence to well-established and understood descriptions of the detailed studies necessary for permitting under the State Environmental

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[42] To ease the initial screening process, the application form could require a cover page that indicates which, if any, of the preference criteria are met by the proposed plant.

[43] Underscoring the necessity for a formal rule, the Siting Board recently adopted an informal policy that it will not consider a siting application to be complete unless the DEC has proposed a draft permit.

[44] See, PSL § 163. These studies include those describing the expected environmental impact and safety of the facility, both during its construction and its operation, that identify "(i) the anticipated gaseous, liquid and solid wastes to be produced at the facility including their source, anticipated volumes, composition and temperature, and such other attributes as the board may. specify and the probable level of noise during construction and operation of the facility; (ii) the treatment processes to reduce wastes to be released to the environment, the manner of disposal for wastes retained and measures for noise abatement; (iii) the anticipated volumes of wastes to be released to the environment under any operating condition of the facility, including such meteorological, hydrological and other information needed to support such estimates; (iv) conceptual 'architectural and engineering plans indicating compatibility of the facility with the environment; and (v) how the construction and operation of the facility, including transportation and disposal of wastes would comply with environmental health and safety standards, requirements, regulations and rules under State and municipal laws, and a statement why any variances or exceptions should be granted. " PSL § 164(c).

Quality Review Act (SEQRA) will also result in greater clarity and expedite the process.

E. Appoint An Ombudsman For Each Project

The Siting Board should appoint an ombudsman to be a focal point of contact for community groups seeking to be involved in the siting process and to work with the Project Manager to—mediate issues concerning the scope of necessary studies Citizens often identify community and environmental concerns about which the DEC and 'Siting Board members are unaware. Earlier identification and mediation of the issues could speed the permitting process by avoiding the need for amended applications, supplemental hearings, and subsequent litigation.

F. Set Deadlines for Transmission and Distribution Owners to Contribute to System Reliability Impact Studies

A siting applicant must submit to the NYISO a System Reliability Impact Study ("SRIS") that identifies both the impact a new or modified plant would have on existing transmission and distribution systems, and the changes needed to accommodate the proposed additional generating capacity. NYISO approval of an SRIS is necessary.

To prepare an SRIS, an applicant needs essential technical information that only the owners of transmission and distribution systems can supply Currently, these entities are not required to provide the information within any particular deadline. The PSC and NYISO should quickly correct this deficiency New York transmission and distribution owners are either subject to PSC jurisdiction or are members of the NYISO. The PSC and NYISO should establish an efficient process for SRJS applicants to obtain information from transmission and distribution system owners, including the deadline by which a system owner must comply with an applicant's request for information. Additionally, formal deadlines for the NYISO to complete its required review should be set.

G. Assign Responsibility for Transmission System Upgrades Necessary for New Generating Capacity

New generators may require costly upgrades or modifications of transmission system facilities to carry the increased power. Transmission facility owners and generators often disagree as to whether a transmission system reinforcement is needed to serve new capacity and which of them should bear an expense. Disputes have the potential to delay or restrict the availability of new capacity. Currently, no clear rule governs as to who should bear this responsibility. However, between them, the PSC and NYISO have jurisdiction over all possible parties. To ensure expeditious resolution of such disputes, the PSC and NYISO should quickly decide disputes over transmission reinforcement obligations.

III. Additional High Voltage Transmission Capacity is Needed

New York must augment the network of high voltage transmission lines used to move bulk power from places with surpluses to areas where the power is needed. Major transmission bottlenecks in central New York ("Central East bottleneck"), around New York City ("In-City bottleneck") and at our borders with other States and Canada limit the amount of power that can be moved.[45] While minimizing the environmental and aesthetic impact of transmission lines, these bottlenecks must be opened.

High-voltage transmission lines enable large amounts of power to move over long distances, provide flexibility in the location of plants, and increase access to diverse sources of electricity, including sources hundreds of miles away.[46] Long distance access is especially important in New York, which has cheap hydroelectric and Canadian power sources at the extreme western and northern borders of the State.

A. Bottlenecks in New York Transmission Cut Off Access to Cheap Power

New York's transmission network contains segments that are not able at all times to carry the optimum amount of power. Each such inadequate segment forms a "bot-

[45]See generally, New York State Energy Planing Board, Report on the Reliability of New York's Electric Transmission and Distribution Systems (November 2000) (hereinafter "Planning Board Report") and New York State Department of Public Service, Analysis Of Load Pockets And Market Power In New York State, Final Report (October 1, 1996) (hereinafter "PSC Analysis").

[46]Dependence on power plants fueled by natural gas has contributed to the recent increase in 'the price of natural gas, which in turn has increased the wholesale price of electric power. Augmenting transmission capabilities would facilitate access to electricity generated by other sources.

tleneck."[47] Near Utica, the transmission lines from western New York and Ontario converge with the transmission lines from the north and Quebec to form the Central East bottleneck. Whatever power is available to the west or north, Central East can pass along only 5,995 megawatts.[48] When the demand for power soars in southeastern New York during the summer, the Central East bottleneck may limit access to surplus power west and north of this bottleneck The In-City bottleneck works similarly to set an even lower limit (4,979 megawatts)[49] on the amount of power New York City and Long Island can import from western and northern New York, Canada and plants in the Hudson Valley.

B. New York's Transmission System has been Neglected

Despite the potential for transmission upgrades to lower our electricity costs and avoid having to build new power plants, fundamental infrastructure is sorely lacking in New York. Measured in constant dollars, between 1988 and 1998 capital improvements to New York's transmission system dropped from $307.7 million per year to $90.0 million per year.[50] The Central East and In-City bottlenecks have existed for at least 20 years. Today only one major project to ease a New York transmission bottleneck is under active regulatory consideration.[51]

Building a transmission upgrade, such as a new high voltage line, is complex and expensive. Once the PSC approves a project, an applicant may then have to negotiate or litigate with possibly hundreds of landowners for rights of way, and obtain dozens of local building permits. Uncertainty about who is responsible for transmission under deregulation and how the cost of transmission construction is to be recovered in a deregulated marketplace has undoubtedly affected decisionmaking on transmission upgrades.

C. Upgrades to New York Transmission Capacity Should not Await Approval of a Regional Transmission Organization

The Federal Energy Regulatory Commission ("FERC") has proposed the creation of disinterested Regional Transmission Organizations ("RTOs") to improve transmission capability[52] and has asked electric utilities to submit proposals for RTOs that would, inter alia, have authority to prepare and enforce plans for optimizing transmission systems. A disinterested RTO could weigh the interest of all, decide what transmission network upgrades are in the public interest and then enforce its decisions by ordering appropriate utilities and others to construct improvements On January 16, 2001, the NYISO and the six private New York electric utilities submitted a joint RTO proposal requesting that the FERC designate the NYISO the RTO for New York[53]

While an RTO is welcome, we should not wait for an RTO to be up and running before addressing New York's transmission needs The PSC and the NYISO must immediately begin working with the transmission facility owners to assess what transmission upgrades are warranted In particular, this joint effort should examine what can be done within the next 2 years to ease the Central East and In-City bottlenecks and increase our ability to import power from other States and Canada. If the FERC approves the application to designate the NYISO an RTO or brings New York under another RTO, the new RTO could take over this work and not have to start from scratch.

IV. New York Should Encourage New Sources of Generation

While our electricity supply brings innumerable benefits and drives our economy, electricity generation also significantly impacts public health and the environment Existing electricity generation in the United States produces: one-third of the nitrous oxide emissions that cause urban smog; two-thirds of the sulfur dioxide emis-

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[47]A transmission bottleneck resembles a section of highway carrying traffic merging from two or more other highways with the same number of lanes. As long as the traffic is light, the merge flows smoothly. But if the merging traffic is heavy, all lanes slow and movement can cease.

[48]PSC Analysis, p. 235. This description of power flows in the New York transmission system is highly simplified and is not intended to take into consideration numerous technical factors that make the movement of bulk power difficult.

[49] Id., p. 123.

[50] Planning Board Report, p. 26.

[51] The LIPA has applied to the PSC for approval of two transmission lines under Long Island Sound to Connecticut. If constructed, these new lines would ease but not eliminate both the InCity bottleneck and the constraints on importing power from New England. The PSC reviews transmission construction proposals under Article VII of the Public Service Law.

[52]Regional Transmission Organizations, Order No. 2000, III FERC Stats. & Regs. § 31,089 (1999); Order No. 2000-A, III FERC Stats. & Regs. § 31,092 (2000).

[53]FERC, Docket No. RTO1–000, Order No. 2000 Compliance Filing (January 16, 2001). The NYPA and the LIPA supported the filing but did not join as applicants. Id., p. 2, fn 3.

sions that cause acid rain; one-third of the mercury emissions that poison fish and wildlife; and one-third of the greenhouse gas emissions, particularly CO_2, that are warming the planet.

The impacts of these problems are very severe in New York State, which is characterized by an asthma rate 2–5 times the national average, and 20 percent of Adirondack lakes too acidic to support life. Though up to 40 percent of New York's air pollution comes from sources out, of State, it is essential that New York lead by example in creating a sustainable electricity policy.

Not all conventional power plants pose the same level of health and environmental hazards. Modern combined-cycle gas-fired generators, which are most of the units proposed for new generation in New York, are far more efficient than power plants built in the past, and are equipped with controls that greatly reduce emissions. To the extent that more efficient units come on line and displace older, less efficient and dirtier units, air emissions problems in New York will decrease.[54] To minimize the adverse impacts of even the cleanest fossil generation plants, alternatives such as enhanced transmission, renewable source generation, clean distributed generation, conservation and increased efficiency must have a major role in a balanced package.

A. Renewable Generation Sources Should Provide at Least an Additional 10 Percent of New York's Electricity

For many decades, New York has benefited from hydro power, a renewable source that does not release air emissions and uses no imported fossil fuels. Hydro power currently produces up to one-fifth of the electricity needs of the State. While ecological and sociological impacts limit the usefulness of further expansion of hydro power, recent developments in solar and wind power generation promise new means of clean electricity generation.[55]

Commercial scale electricity generation from wind and solar (photovoltaic) sources are unlikely to come on line in significant amounts (over 100 MW) by this summer, however they can meet a significant portion of New York's electricity needs in the medium to long term, while reducing air emissions and reliance on imported fossil fuels.[56] Indeed, some argue that renewables could satisfy virtually all of New York's need for increased capacity.

New York is particularly well suited for renewable generation A study by the State University of New York Atmospheric Sciences Research Center concluded that solar power could significantly reduce sharp demand peaks because the State gets most of its sunlight during the same time as electricity demand peaks—hot summer days.[57] Similarly, many areas across the State have strong wind resources It is estimated that up to 5,000 MW of electric capacity could be produced from large scale wind generation sites in New York enough to generate about 13 million MWh, or 10 percent of the State's electricity consumption.[58]

In the past, solar and wind generation were not economically competitive with fossil fuel power generation. However, new technologies for solar and wind generation combined with increased fossil fuel costs narrow the cost gap considerably.[59] During most of the 1990's, wind energy was the world's fastest-growing energy source, expanding by 20–30 percent per year; in the last 24 months, nearly 1,000 MW of wind have been installed in the U.S.[60]

The following steps should enhance use of solar and wind power to produce clean electricity for New York:

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[54]In the short run, even the most modern gas units will likely increase total air pollutants, until the older units become too uneconomical to operate.

[55]Large scale hydropower can adversely affect fish and other aquatic life and can displace indigenous populations. While solar and wind power cause no air or water emissions problems, wind power can raise aesthetic concerns.

[56]Electric generators in New York State rely on fuels that originate elsewhere in the U.S. or abroad. Increasing renewable generation sources in New York State will produce jobs in-state and keep electricity expenditures in-state.

[57]New York Times, New York Ranks Near the Top For Efficient Use of Energy, October 21, 2000, pp. Bi, B6.

[58]Bailey, B. and Marcus, M., AWS Scientific, Wind Power Potential in New York State: Wind Resource and New Technology Assessment, May 1996. ESEERCO Project EP 91–32, p. 36.

[59]According the U.S. Department Of Energy ("DOE"), today's cost of generating electricity from wind is about $0.05 or less per kilowatt-hour, which represents an 85 percent drop over the past 15 years. Http://www. eren. doe.gov/wind/faqs. html.

[60] American Wind Energy Association, The Global Wind Energy Market Report, February, 2001.

1. The Attorney General Will Use Settlement Funds to Develop Wind Power

The Attorney General's Office sued a number of out-of-state coal-fired power plants that upgraded or expanded their old power plants without installing the pollution controls required by the Clean Air Act and whose pollution significantly harmed New York State. The Attorney General has directed that a major portion of the settlement money arising from the Clean Air Act power plant enforcement cases be used as incentives to develop 10–30 MW of renewable wind generation. The Office is also pursuing legal action against similar plants in New York. These cases will likely generate tens of millions of dollars in payments in lieu of penalties that the State can use for clean air and efficiency projects.

2. The Legislature Should Enact a Renewable Portfolio Standard

The Legislature should join New Jersey, Massachusetts, Connecticut, Texas, and many other States by adopting a Renewable Portfolio Standard ("RPS"). The RPS would require retailers of electricity to include in their portfolio of supply an increasing percentage of renewable generation. This would increase demand for renewables such as wind and solar, that would, in turn, create a competitive market for supplies of renewable generation.

A bill to create an RPS has been introduced in the State Assembly.[61] The Legislature should pass, and the Governor should sign, the Assembly proposal to require 0.5 percent of all retail electric sales to come from non-hydro renewables (650,000 MWh; equivalent to about 300 MW of installed capacity, or enough to power 90,000 homes) by 2003. The percentage grows by a half-percent per year until renewables reach 6 percent of sales Thereafter it grows by 1 percent per year until it reaches 10 percent The bill includes a cost cap of 2 5 cents/kWh If renewables at this price cannot be found, retailers have the option of making payments into a "Clean Electricity Fund," calculated as 2.5 cents times their RPS obligation This fund would incentivize the development of renewable generation.

An aggressive RPS could create well over 3,000 MW of renewable generation at little to no additional cost to consumers. For example, a recent study of Massachusetts' RPS (similar to what the Attorney General recommends for New York) found that it would add only 0.4 percent to consumer bills by 2003, rising to 2.2 percent in 2012.[62] An Iowa study—which assumed that the cost of fossil fuels would rise, while wind's costs would decline—showed customers could save $300 million over a 25-year period if the State met 10 percent of its electric demand through wind generation.[63]

Much of the renewable supply needs in New York could be met with wind power, providing significant environmental and economic benefits. It is estimated that for every 100 MW of wind development about $1 million is generated in property tax revenue. New York could see 2,000 MW of wind power by 2010 with an aggressive RPS and financial incentives, generating $20 million annually in tax revenues to rural communities. In addition, since wind farms are generally located on privately owned land, the development of 2,000 MW in New York means annual payments of approximately $4 million to farm and forest landowners.[64]

The reduced emissions of pollution and greenhouse gases resulting from wind power is significant. A single 1.65 MW wind turbine will each year displace emissions of 2,161 tons of CO_2, 11 tons of SO_2, and 4 tons of NOR, based on the New York State average utility fuel mix.[65]

B. Policies are Needed to Increase Clean Distributed Energy Sources

The need for large power plants could be lessened by distributing small-scale generation units that use minimally polluting technologies directly on the site where the electricity is to be used. Electric power can be efficiently generated at small-scale facilities located on or near the consumer's property. Generation options include fuel cells, wind generators, small-scale hydro, solar cells, and cogeneration facilities that combine heating and cooling with electric generation. Because distributed generation facilities may not always provide the exact amount of power needed, the facility is usually connected to the electric power grid. The grid can provide additional power if the facilities run short, or can take the excess power generated.

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[61]See, A.8506-Englebright.

[62] Massachusetts Division of Energy Resources., Massachusetts Renewable Portfolio Standard Cost Analysis Report. December 21, 2000, p. 37.

[63] Wind, Thomas, Wind Utility Consulting, The Electric Price Impact of an RPS in Iowa, May 1, 2000.

[64] Estimated benefits according to American Wind Energy Association RPS Fact Sheet, Http://www.awea.org/pubs/factsheets/nyrps001.pdf

[65]Assumes wind turbine generates electricity 30 percent of the year. Historical fuel mix data and emission rates according to the DPS at Http://www.dps.state.ny.us/fuelmix.htm.

To the extent that local sources of electricity reduce the demand placed on traditional generating plants, they can reduce both (i) the need to build new power plants, and (ii) the wholesale market scarcity—conditions that produce price volatility.

Distributed generation's smaller scale often enables new sources of power to be obtained in less time than with conventional power plants. Another advantage is the greater diversity of generation sources, including renewables such as sunlight and wind, decreasing dependency on fossil fuels. As demonstrated by the current rise in natural gas and oil prices, excessive reliance on fossil fuels subjects New York to risk of fuel shortages and cost volatility Distributed generation also avoids further strain on the transmission and distribution system.

Many forms of distributed generation are. also environmentally cleaner than conventional power plants.[66] Moreover, their smaller scale can minimize the impact on neighborhoods and open space. However, uncontrolled diesel generators—sometimes used for distributed peak supply—emit many times the pollution of modern, large-scale power plants or any form of renewable generation. Thus, public policies encouraging distributed generation must not include incentives for environmentally detrimental onsite generation facilities.[67]

If more commercial, industrial and multi-family residential buildings installed modern onsite generation facilities, the balance between supply and demand in tight regions such as downstate New York could be improved, reducing the need to construct large new power plants or transmission lines. In the past, many onsite generators did not economically compete with traditional sources of electricity. However, recent technological advances have lowered the costs of distributed generation. In addition, the transition to wholesale market pricing and the ability of distributed generation to shave peak demand levels (thereby relieving all power buyers from prices set at the steepest part of the supply/demand curve) further increase the relative economic benefit of distributed generation.[68]

The following policies should reduce barriers to, and promote additional distributed generation:

1. The Legislature Should Offer Financial Incentives to Develop Clean Distributed Generation

The NYSERDA should provide low-cost loans to finance the investment necessary to install onsite facilities, and the Legislature should expand New York State's tax credit for residential solar power systems to clean distributed technologies such as fuel cells, wind, and small hydro power projects.[69] Government incentives are necessary to jump-start development of supplemental electricity generation in New York. If the initial investment barriers are reduced, many distributed generation units could be installed in time to help meet New York's electricity needs for 2002.

2. The Legislature Should Expand the Solar Net Metering Law to Include Wind and Small Hydro Power

The Legislature should expand the Solar Net Metering Law (Public Service Law Section 66-j) to include wind and hydro power. The New York State Legislature enacted the net metering law in 1997, allowing customers who install solar power to use excess electricity produced by the solar panels to spin the electricity meter backward, effectively banking the electricity until it is needed by the customer This provides the customer with full retail value for all electricity produced. In its current form, the net metering law applies only to facilities powered by solar generation Of the 30 States with net metering opportunities, New York is the only State where small wind generation systems are ineligible.[70]

3. The PSC Should Eliminate Unjustifiable Barriers to Clean Distributed Generation

Distributed generation facilities typically require connection to the utility grid. Utilities therefore need to maintain technical safeguards to prevent distributed generation from adversely affecting the transmission system. Formerly, utilities im-

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[66]Wind and solar power are cleaner. Fuel cells that operate on hydrogen fuel emit only water vapor. Other fuel cells use natural gas, and thus emit carbon dioxide.

[67]For example, LIPA's recent action to promote the use of onsite back-up generation does not differentiate between clean onsite generation and diesel generators. This action should be revisited to ensure that financial incentives to use diesel generators are removed. See, LIPA Supplemental Service Tariff. Http://www.lipower.org/suyservtalkpoints.html.

[68]When customers are billed on a real-time basis, such that their bills reflect the power used during peak and off-peak hours, the economic value of solar generation will be maximized, as it is most productive during periods when demand and market prices are highest.

[69] New York State residents can claim a State income tax credit of 25 percent on the cost of their Photovoltaic system, up to a maximum credit of $3,750.

[70] American Wind Energy Association. Http://www.awea.org/smallwind/newyork.html

posed burdensome insurance requirements on independent generators seeking to connect to the power grid. The PSC recently reviewed such tariff conditions, and adopted improved interconnection standards designed to lower this and similar barriers.[71] However, insurance is still required for solar power systems that are net-metered. The PSC should remove this existing barrier and the NYSERDA should provide low-cost insurance or bond coverage to meet utility interconnection requirements. Furthermore, the PSC should review utility policies and practices to ensure that any unjustifiable barriers to distributed generation are eliminated.

4. NYPA Should Work With Local Governments to Install Fuel Cells at Landfills and Wastewater Treatment Facilities

The NYPA should build on its success with fuel cells and work more aggressively with local governments to install them, particularly local governments in load pockets such as New York City and Long Island. Landfills and wastewater treatment plants produce large quantities of methane, which can be used to power fuel cells to generate electricity. If not used to generate power, the gas is either flared or released, significantly contributing to climate change.

In 1998, the NYPA and the EPA installed the world's first commercial fuel cell powered by waste gas, located at the Westchester County Wastewater Treatment Plant in Yonkers. In its first year, the 200 kilowatt fuel cell converted over 20 tons of waste gas into over 1.2 million kWh of electricity.[72] The NYPA has also installed fuel cells at NYPD's Central Park Station and North Central Bronx Hospital, both of which run on natural gas.

Other prospects for fuel cells have not materialized. The New York City Department of Environmental Protection ("DEP") has estimated that it flares or releases enough anaerobic digester gas at its 14 wastewater treatment facilities to fuel between 15 and 25 fuel cells.[73] But a proposal to install two NYPA fuel cells at one of DEP's wastewater facilities did not move' forward largely because of the high cost of fuel cells, which are not yet commercially available.[74] The myriad environmental benefits of fuel cells, and the improved reliability to the grid resulting from distributed generation, must not be overlooked in cost/benefit analyses. To fully realize the potential of fuel cells, the NYPA should seek new opportunities for fuel cell installation across the State, and offer attractive financing to its local government partners to ensure the projects are implemented.[75]

V. Power Prices Must Not Be Permitted To Skyrocket During the Transition to Competitive Markets

A. New York Wholesale Power Markets Must be Significantly Reformed

Since New York's wholesale power markets began operating in November 1999, significant flaws in the design of these markets have been identified. The markets are not fully competitive at all times in all locations, and thus the opportunity to exercise abusive market power often arises When improper market power is exercised, electricity prices can suddenly rise to noncompetitive and, indeed, stratospheric, levels This creates windfalls for generators, as well as unreasonably high bills for energy purchasers. It also impedes the development of truly competitive markets. All possible means must be used to ensure competitive pricing in the NYISO's markets, thwart the abusive exercise of market power, and provide redress for purchasers when market power leads to noncompetitive pricing.

1. NYISO Background

In January 1999, independent power generators, utilities, public authorities and others interested in competitive electricity markets and open access to power transmission requested from the FERC authority to create an "independent system operator" to manage New York's high-voltage transmission grid, operate competitive short-term markets for power, and undertake other tasks essential to establishing

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[71]See, New York State Standardized Interconnection Requirements, Application Process, Contract & Application Forms For New Distributed Generators, 300 Kilo Volt-Amperes Or Less, Connected In Parallel With Radial Distribution Lines, issued November 9, 2000.

[72]March 23, 1999 EPA press release. Http://www.epa.gov/nheerl/ordpr/]999/pr032399.pdf

[73] February 15, 2001 conversation between OAG Policy Analyst Tom Congdon and Energy, Air and Laboratory Services Division Chief Fred Sachs, DEP Bureau of Wastewater Treatment.

[74]Ibid. DEP's electric bill would have increased significantly to repay the NYPA for the cost of the fuel cells. The fuel cells installed at Yonkers Wastewater Treatment Plant and the North Bronx Hospital were subsidized by the DOE.

[75]As with other NYPA efficiency and renewable programs, these fuel cells would be financed from the NYPA's existing rate revenue.

a competitive 'wholesale market for electricity.[76] The NYISO began operations in November 1999.

Today the NYISO manages the transmission grid that moves bulk power around New York, and operates the short-term Day Ahead ("DAM") and Real Time ("RTM") markets that together supply half the power used each day in the State. (The other half is supplied through bilateral contracts between generators and users.) On a typical day, the DAM accounts for about 45 percent of the total power used in New York, while the RTM typically accounts for 5 percent of the power. The DAM and RTM determine the price per megawatt-hour to be paid for wholesale power and the order in which generating plants will be scheduled to run. In highly simplified terms, the NYISO accepts confidential bids stating how much power each utility or other electricity retailer[77] wishes to purchase during each hour of the next day (in the DAM). Simultaneously, each power supplier submits confidential offers stating for each generating plant it owns how much power at a given price it is willing to provide. The NYISO, using complex software, totals the bids and ranks the offers in ascending price order. The most expensive offer that must be scheduled to run to provide the total amount of power requested for a given hour sets the price per megawatt-hour paid to all suppliers for power delivered during that time (referred to as "the market clearing price").[78] The RTM operates similarly.[79]

NYISO membership today consists of private generators, utilities, public authorities, power marketers, representatives of commercial and industrial customers, consumer advocates and others, as well as a paid professional staff. A ten-member Board of Directors sets policy for the professional staff and determines the actions the NYISO will take in its relations with the FERC and other government agencies By NYISO rule, Board members must be disinterested and may not have a financial interest in any aspect of the electric power industry.

A NYISO Management Committee and two other NYISO committees discuss, issues and propose actions to the NYISO Board of Directors. The FERC exercises regulatory authority over the NYISO and other independent system operators. The NYISO has sought the FERC's approval of numerous proposed changes in the way NYISO operates and exercises its authority. While many of the changes involve technical and "housekeeping" matters, several have addressed competition problems identified by the NYISO staffs Market Monitoring Unit ("MMU"). Most notable are the NYISO's June 30, 2000 petition for a $1,000 per megawatt-hour cap on the price of power in the short term markets, and its March 27, 2000 petition for a cap on the price of reserve generation capacity. The FERC approved the power price cap petition on July 26, 2000 and the reserves price cap petition on May 31, 2000. These and other FERC-approved changes in NYISO operations have moderated but not eliminated the potential for exercise of market power.[80]

2. The NYISO Must Ensure That Energy Sellers Cannot Unfairly Exercise Market Power to Raise Electricity Prices

At least two instances have been identified in which the NYISO markets were not competitive in 2000. During certain hours of high demand on June 26, 2000, the price of power in the Day Ahead Market spiked to $1,000 per megawatt-hour due to bidding practices leading to excessively high prices. This behavior cost energy buyers an estimated $100 million in excessive power prices that day. The NYISO has also identified instances of market power in the sale of generating capacity reserves from January to March 2000. The Attorney General has urged the FERC, which has jurisdiction over power transmission and independent system operators, to provide the NYISO the authority it needs to address such exercises of market power.[81]

The NYISO must ensure that design and operational flaws are addressed quickly, before the demand for electricity rises with the start of the summer cooling season

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[76]FERC approval was required because the FERC regulates interstate transmission of power and has mandated open access to transmission services.

[77]In New York, independent electricity supply businesses, termed "energy service companies" or "ESCOs," may compete with traditional utilities for customers.

[78] Alternatives to market clearing prices to set wholesale electricity prices have been proposed. One approach is to pay each seller its asking price, rather than pay all sellers the highest offer taken. Other proposals would peg each offer price to actual costs.

[79]The NYISO also operates competitive markets for generating reserves and other services related to supplying electricity, and monitors the power markets to ensure that they operate competitively.

[80]The NYISO professional staff has taken the position that the NYISO Board does not need to seek the FERC's approval of every operational change intended to strengthen the NYISO's efforts to deter uncompetitive actions. Not all NYISO members agree.

[81]October 31, 2000 Letter from Attorney General Eliot Spitzer to FERC Chairman James J. Hoecker.

in May 2001. In particular, the NYISO must enhance its ability to identify and correct noncompetitive prices and practices. The Attorney General supports a three part approach: (1) "automatic mitigation" of DAM prices as soon as possible; (2) strengthening after-the-fact market monitoring, including retroactive mitigation of noncompetitive prices; and (3), retaining the $1,000 cap on power prices. Finally, the NYISO should follow through on plans to open its markets to increased participation by non-generators and non-load serving entities, so as to enhance competition and liquidity in the power markets.

a. Automatic Mitigation Must be Implemented Quickly On February 20, 2001, the NYISO Board voted to extend its current forward looking market mitigation to the DAM in a way that is intended to prevent the exercise of market power until competition fully takes hold.[82] To effect this mitigation, also referred to as a "circuit breaker," the NYISO will reprogram the software it uses to operate its power markets so that the software automatically analyzes bids before they set the market-clearing price. If the analysis indicates a potential exercise of market power in the DAM, the suspect power prices will be replaced with competitive prices. The NYISO expects to implement the software changes before the 2001 summer cooling season, i.e., by May, 2001.[83]

While agreeing with the general framework, some have objected that the NYISO automatic mitigation would still allow considerable exercise of market power, primarily because the triggering levels in the NYISO proposal are too high. Among other changes, the objectors would lower the initial trigger to $100 per megawatt-hour and the market comparison triggers to $50 per megawatt-hour. Lowering the triggers could more accurately capture the times and places in—which market power may be exercised. For this reason, the Attorney General supports lower thresholds for automatic mitigation.

While lowering the triggers would make automatic mitigation more effective, such a refinement would likely constitute a material change from the current NYISO market monitoring standards and thus might require the FERC's authorization before it could be implemented, with the concomitant risk of delay or denial.[84]

Another objection to the current automatic mitigation is that it does not apply to the RTM. The NYISO staffs explanation is that the logistics of the RTM operate on such a short timeframe that it is not practical to design an automatic mitigation mechanism for the RTM. Experience with Day Ahead mitigation may suggest ways to make automatic mitigation of the RTM practical. Deployment of Day Ahead automatic mitigation should not be delayed, but the NYISO should continue to evaluate capability for automatic mitigation of the RTM as well.

b. Existing Forward-Looking Market Monitoring Must be Strengthened

i. The NYISO's Market Monitoring Triggers Must be Refined

The NYISO staff has a fourteen-member Market Monitoring Unit ("MMTJ") that examines the offers, bids and market clearing prices in the various electricity markets to determine whether noncompetitive prices or practices have occurred. Once it identifies such a price or practice, the MMU takes actions to prevent a repetition. The major difference between automatic mitigation and the current MMU efforts is

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[82]New York Independent System Operator Approves Automated Process For Reviewing Supply Bids—Measure Enhances NYISO 'S Ability To Prevent Market Abuse—, NYISO press release (February 22, 2001).

[83]Automatic mitigation will use as triggering levels the price threshold values in the NYISO's current forward-looking market monitoring procedures. Each day NYISO software will automatically review Day Ahead offers for evidence of market power and recompute excessive offers before they can set the market clearing price. In grossly simplified form, automatic mitigation works as follows: if upon matching offers with bids, the Day Ahead Market in any zone would yield a market clearing price that exceeded $150 per megawatt-hour, a price analysis will be triggered. Depending on where in New York the over-$150 market clearing price appeared, the NYISO software would examine every offer in any zone in the State deemed competitively relevant to the affected zone, and compare it to a predetermined "reference price" associated with the generating facility whose output is represented by each offer. If the difference between any offer and its associated reference price exceeds $100, the NYISO software would substitute the reference price for each offer and recompute a "reference market clearing price" for each affected zone. This recomputed reference market clearing price hen would be compared to the initial "unanalyzed" market clearing price in each affected zone. If the difference between the two market clearing prices is more than $100 in any zone, the NYISO software would then automatically set aside any offer in the affected zone that was initially greater than $100 above its reference price and replace that offer's price with the reference price. These recomputed offers would then be used in the calculation of the official market clearing price for that zone.

[84] Others object to the idea of automatic mitigation as an unnecessary tampering with competitive markets. The markets, however, are not always competitive. Automatic mitigation should prevent excessive prices from occurring in the first instance.

that the MMIIJ addresses prices and practices after the market has cleared; it does not prevent the initial exaction of noncompetitive prices. As part of its effort, the MMU compares the market clearing prices in the DAM and RTM to numerical triggers. If a market clearing price exceeds a trigger, the MMU then employs procedures to identify potential noncompetitive behavior and fashion forward-looking means for preventing its repetition.

Because the current MMU threshold values may not identify accurately enough all situations in which competition is impaired, the NYISO should seek from the FERC, and the FERC should grant, authority for the NYISO to lower these triggers. This refinement would increase the NYISO's ability to discern noncompetitive market behavior leading to noncompetitive prices. It could also lead to the identification of loopholes in NYISO rules that the current market monitoring protocol does not detect.

ii. Authority for Retroactive Mitigation Must be Obtained

The FERC has not authorized the NYISO to recapture excess profits obtained through the exercise of market power. When the MMU identifies a noncompetitive pricing or practice, the NYISO can at most order the offending act or practice to cease prospectively. Thus, currently, one exercising market power in a NYISO market gets at least "one bite at the apple," risking nothing more than being admonished not to do it again. Such limited enforcement capability is inadequate. Noncompetitive market conditions for even a few hours on a single day can exact—large sums in excessive prices.

Adding automatic mitigation to the MMU's tools and tightening the MMU's surveillance triggers will reduce the likelihood of noncompetitive prices, but no preventive system is perfect. The NYISO needs the authority to recover excessive noncompetitive profits if and when market power slips past the NYISO's preventive measures.

As the Attorney General urged in the October 31 letter to FERC Chairman Hoecker, the NYISO should request from the FERC, and the FERC should grant, authority retroactively to mitigate noncompetitive prices identified in the course of its forward-looking market monitoring. The window for identification of possible exercises of market power and for retroactive refunds should be short, both to maximize the value of refunds as a deterrent and to provide the wholesale power market with certainty. Both consumers and wholesale market participants have an interest in the speedy resolution of market monitoring inquiries, as well as in not being forced to pay noncompetitive prices for electric power.

iii. The Current $1,000 Per Megawatt Hour Price Cap Must be Retained

A $1,000 per megawatt-hour cap on the price of wholesale power currently exists in the NYISO's Day Ahead Market and Real Time Market, as well as in relevant markets in the adjacent New England and PJM power pools.[85] The NYISO should ask the FERC, and the FERC should agree, to retain this cap until the wholesale electric market in New York is fully competitive. While NYISO market monitoring can be the first line of defense against market power, and retroactive mitigation may recover excess profits exacted by market power, there may be circumstances in which neither is able to prevent extreme wholesale power price spikes The current NYISO price cap thus provides a crucial final safeguard against extreme price spikes It should be retained until a change in circumstances justifies modifying or retiring it.

To be effective, a price cap must be compatible with conditions in neighboring power pools Otherwise, power suppliers may have a financial incentive to sell preferentially into the power pool with the highest price cap. Today, both power pools neighboring New York have a $1,000 per megawatt-hour price cap. This compatibility of price caps should be maintained.

iv. The NYISO Should Implement Virtual Bidding to Expand Competition

Today the only parties that may buy or sell electricity through the NYISO are utilities and other entities that provide retail service to end users, and those who own or control generating plants. This limits the number of participants in the NYISO markets. Competition would be enhanced if power marketers, brokers and others not directly involved in generating or retailing electricity could buy and sell power through the NYISO markets. In addition to increasing competition, market participation by new types of parties would add liquidity to these markets by increasing the number of ways that power purchases can be contracted for and fi-

[85]The current price cap is set to expire on April 30, 2001 unless extended by the FERC upon request.

nanced. The downside of opening the NYISO markets to new classes of participants is the increased potential for gaming the markets, especially during times of tight electricity supply.

The NYISO currently plans to implement power trading by parties other than generators and retailers, participation termed "virtual bidding," by November 1, 2001.[86] The NYISO's explanation for the delay in instituting virtual bidding is that it needs to correct flaws in its current operating procedures and to develop appropriate software before adding virtual bidding to an already complex system.[87] FERC has accepted the NYISO's explanation.[88] The NYISO should develop the necessary software and make the operational improvements needed to implement virtual bidding as soon as practicable. At the same time, the NYISO should address the increased complexity that virtual bidding will add to its markets and strengthen its market monitoring capability to accommodate the additional market surveillance' that will be needed.

c. Exposure to Volatile Prices Must be Minimized Without Shielding Customers From Market Price Signals

We have seen in New York that highly volatile wholesale electricity prices can accompany the transition from regulated monopoly to competitive commodity markets, especially during times when supply is limited and demand irreducible. During the summer of 2000, Con Edison's customers experienced electricity rates 30 percent higher than during the comparable period in 1999, despite cooler weather in 2000 resulting in lower peak usage levels than usual In addition to the increased cost of oil and natural gas, an almost twelve-month outage at Con Edison's Indian Point 2 nuclear plant tightened supply in the downstate markets significantly, leading to higher wholesale prices in times of high demand.[89] If New York's summer weather in 2001 or 2002 is normal or hotter, wholesale price spikes remain a threat.

Con Edison's and Orange & Rockland's current rate structures permit them to pass through to their customers nearly all of the commodity cost of electricity, no matter how high.[90] Con Edison is a multi-billion dollar company serving over three million customers, and therefore has much more bargaining power than any of its residential or small business customers to control price volatility through negotiation of long-term contracts with generators, and through other hedges that manage

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[86]See, e.g., NYISO, New York Independent System Operator, Inc. 's Report on the Implementation of Virtual Bidding and Zonal Price-Capped Load Bidding in Docket No. ELOO–90–000, FERC (February 2, 2001), p. 6.

[87]Id., p.4.

[88]Some have protested to FERC that the NYISO's implementation of virtual bidding is taking too long. FERC rejected the initial protests as inconsistent with the prudent development of the NYISO's operations. FERC Docket No. ELOO–90–000, Order On Complaint, Morgan Stanley Capital Group, Inc. v. New York Independent System Operator, Inc., 93 FERC 61,107 (October 5, 2000). Certain parties have renewed their protests. See, e.g., Morgan Stanley Capital Group, Inc., Motion For Immediate Commission Action Regarding Virtual Bidding Implementation Schedule, Docket No. E100–90–000 (March 5, 2001).

[89]The Attorney General has taken NYISO analyses and examined the impact of the Indian Point 2 outage on the price of power in the wholesale markets. The unavailability of Indian Point 2's 41 MW capacity output from February 16, 2000 through early January 2001 required the NYISO to rely upon more expensive generators during times of greater demand, and thus increased the market clearing price for peak-hour power purchased by Con Edison. Indeed, it increased the market price throughout the State. The Attorney General, in a motion filed with the PSC has estimated that the outage cost Con Edison's customers $176.5 million and urged that Con Edison be required to reimburse customers for this increase in wholesale power costs. See, PSC Case 00-E–0612—Proceeding on Motion of the Commission to Investigate the Forced Outage at Consolidated Edison Company of New York, Inc. 's Indian Point No. 2 Nuclear Generating Facility, December 4, 2000 Motion by New York State Attorney General Eliot Spitzer For Complete Quantification Of Consolidated Edison 's Liability For Alleged Imprudent Management Of Its Indian Point 2 Nuclear Plant.

[90] Con Edison passes through to its electric customers 90 percent of the difference between the company's forecasted and actual purchased power costs. (Con Edison, P.S. C. No. 9—Electricity, Leaf No. 163, Effective September 11, 2000.) Central Hudson Gas & Electric's rates permit an automatic pass-through, but this is ameliorated by the utility's long term supply contracts with the companies that purchased their former generation units. Rochester Gas & Electric has not yet progressed as far as the other utilities toward restructuring, and currently retains most of its own generating plants. LIPA, as a public authority, is not regulated, but instead sets its own rates. LIPA thus ultimately recovers from its customers any increased cost of power it purchases from generators, although the lack of automatic pass-through likely delays the impact.

risk.[91] To give an electric utility like Con Edison an incentive to hedge its risks in the wholesale market, the company must pay the price for bad market decisions.

Recent experience in California demonstrates that completely insulating consumers from wholesale electricity prices can financially devastate the affected utilities, especially if, as in California, they must buy all their energy requirements in the spot market. While the New York market rules permit and encourage bilateral contracts and other hedging strategies, we cannot ignore the warning of the California experience.

As electric power supplies increase, customers ought gradually to receive more complete price signals to encourage more flexible and efficient demand.[92] Until we reach that point, however, we must ensure price stability for customers during volatile markets. The complete pass-through of energy costs, such as Con Edison and Orange & Rockland currently enjoy, must be modified. The PSC should cap Con Edison's rates once power prices reach a certain per kilowatt hour level. Below that level, customers would,pay the passed-through market price. Above that level, Con Edison would swallow a substantial portion of the difference. Such billing would limit customers' exposure to market volatility extremes while sending them appropriate price signals reflecting the market price of the electricity they use. At the same time, Con Edison would have an incentive to employ long-term supply contracts and other hedges to moderate the cost of power should market prices exceed the rate ceiling established.[93]

VI. Demand for Electricity Must be Reduced to Minimize the Environmental and Public Health Impacts of Generation and to Assure Market Competition and Stable Prices

Aggressive measures to reduce demand, together with construction of clean and renewable power plants, will greatly reduce the environmental and public health impacts of electricity generation and foster competitive markets and lower electricity bills. Reducing electricity use avoids the need for existing power plants to produce that amount of electricity, and the corresponding emissions. Over the long-term, an energy policy is sustainable only if it includes environmental factors among its objectives. When new, more efficient power plants start supplying electricity to the grid, the need for existing, dirtier power plants should be reduced. But only if demand is simultaneously reduced while clean supply is increased will the State ensure a net gain for the environment and for the consumer.[94]

What appears like a small action to reduce demand can have a large impact. For example, replacing just one incandescent light bulb with a compact fluorescent bulb (which uses 70 percent less energy to produce the same amount of light) can save a consumer over $38, save 337 kWh of electricity, and avoid over 300 pounds of the greenhouse gas CO_2 in 3 years. If all 6,766,000 households in New York State replaced just one bulb, over $260 million would be saved, 2.2 billion kWh would be saved (more than the electricity generated at an 100 MW power plant), and over one million tons of CO_2 emissions would be avoided in 3 years. (See Appendix.)

New York already ranks as the second most efficient State in per capita energy use nationwide (in large part due to the natural efficiency of apartment living).[95] Nonetheless, opportunities for improved efficiency and conservation abound. A 1997

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[91]Other New York utilities, such as Niagara Mohawk Power Corporation and New York State Electric & Gas Corp. currently operate under fixed consumer retail rates, and have been able to obtain long-term supply contracts.

[92] Evidence shows that customers react to price signals by reducing demand, and often do so relatively quickly. For example, according to Hal R. Varian, economics professor and Dean at the University of California at Berkeley, when the electric bills of San Diego residents more than doubled last summer, power consumption dropped 5 percent within a few weeks. See, The New York Times, January 11, 2001, p. C2.

[93]The Attorney General opposes alternative bill mitigation proposals that would not accomplish these goals. One proposal would permit customers to postpone payment of that portion of their electric bills representing extremely high levels, and make up the difference during months when prices are below a certain threshold. This proposal would still expose customers to the full cost of power, albeit leveled over a year's bills. Others have proposed to keep rates at or below a certain pre-determined level throughout the year by offsetting higher summer peak market price levels with a variety of customer credits otherwise owed by Con Edison. Since customers are entitled to these rate offsets whether or not power prices rise, this approach to rate mitigation is unsatisfactory, and would conceal from customers what is occurring in the power market.

[94]If the growth in demand is not reduced, there will be a need for both the existing power supply and new capacity. The addition of even the cleanest natural gas plant will result in a net addition of emissions if the State does not ensure that older, dirtier plants are displaced by cleaner new ones.

[95]American Council for an Energy Efficient Economy. National and State Energy Use and Carbon Emissions Trends. September 2000, Http://www.aceee.org/pubs/e001.pdf

study claims that cost-effective investments in energy-efficient technologies could reduce New York's electricity use by 34 percent.[96]

New York State has several programs to compensate for market barriers that discourage energy efficiency. But existing programs are not sufficient to create the environmentally sound, reliable, and balanced energy portfolio that is in the State's best interests. The Attorney General recommends significantly expanding these programs (see Section I.D.). The Attorney General is similarly using his legal authority to direct litigation settlement funds to energy efficiency and renewable power investments. In addition, utility portfolio standards would over the long-term lead to significant savings—perhaps 1,000 MW through efficiency and 3,000 MW through renewable energy—that will shift New York's energy policy to a more sustainable framework.

Together, the funding proposals below would direct approximately an additional $120 million per year (on top of existing programs) to energy efficiency, conservation, and renewable energy programs in New York State. (See table 2.) This expansion could result in a savings of over 600 MW over the next 2 years—an amount sufficient to avoid capacity shortfalls—and a necessity if New York State's electric grid is to maintain reliability and to minimize price spikes. At the same time,-these energy savings will avoid enormous quantities of harmful pollutants—millions of tons of NOx, SO_2, and CO_2—and lead to substantial consumer savings.

If New York's funding levels for efficiency and renewables were increased from the current level of $242 million per year to $360 million per year, as recommended, New York will still spend less per capita than many other States in the Northeast. (See Table 3.)

Table 2

Summary of Attorney General's Proposals to Expand Funding for Current Efficiency and Renewable Programs

Programs	Current Funding (in millions of dollars)	Estimated Annual Capacity Savings from Current Funding	Proposed Funding Level	Estimated Annual Capacity Savings from Proposed Funding
System Benefits Charge (NYSERDA's EnergySmart Program)[97].	$150 million per year until 2005.	200 MW	$150 million per year until 2010.	200 MW
NYPA Energy Services[98]	$60 million per year	20–60 MW	$160 million per year until 2010.	53–160 MW
LIPA Clean Energy Initiative[99]	$32 million per year until 2004	28 MW	$50 million per year until 2010	45 MW
Power Plant Settlements	$0	0 MW	Approximately $20 million	20–40 MW
TOTAL	$242 million per year	248–288 MW	$360 million per year plus settlement funds.	318–445 MW

[97]Estimated savings from the funding proposals are based upon NYSERDA projections, see SBC Proposed Operating Plan For New York EnergySmart Programs (2001–2006) February 15, 2001, p. 2.

[98] Estimated savings are based upon the past experience in New York and other States. Between 1990 and 1997, the State's investor-owned utilities spent $1.2 billion on efficiency or demand-side management (DSM) programs, avoiding the need for over 1,300 MW of capacity. These programs included rebates for efficient appliances and lighting, consumer education, and low income weatherization projects. The NYPA spent $255 million on DSM investments between 1990 and 1996, avoiding the need for 84 MW of capacity. See, NYSEPB, New York State Energy Plan and Final Environmental Impact Statement. November 1998. p. 3–60, 3–62.

[99] Estimated savings based on LIPA's current projections of 144 MW per $160 million spent over 5 years. See, LIPA, Clean Energy Initiative, May 3, 1999, p. 21.

Table 3

Comparison of Demand Side Management and Renewable Energy Spending Per Capita By State[100]

State	Annual DSM Spending Per Capita
Connecticut	$35.95
Massachusetts	$25.91
New Jersey	$28.85
New York	$13.30

[96] American Council for an Energy Efficient Economy. Energy Efficiency and Economic Development in New York, New Jersey and Pennsylvania. February, 1997.

Table 3—Continued

Comparison of Demand Side Management and Renewable Energy Spending Per Capita By State[100]

State	Annual DSM Spending Per Capita
Attorney General's Proposed Funding Level	
New York	$19.78

[100]American Council for an Energy-Efficient Economy. A Review and Early Assessment of Public Benefit Policies Under Electric Restructuring, Volume 2. Summary Table of Public Benefit Programs and Electric Utility Restructuring., Http://www.aceee.org/briefs/mktabl.htm. See also, U.S. Census 1999 population estimates, Http://quickfacts. census.gov/qfd/index. html.

A. Market Barriers to Energy Efficiency

Despite the financial and environmental benefits of efficiency, many opportunities are not taken due to the numerous market barriers to energy efficiency investments. Efficiency often requires a higher capital outlay (e.g., to better insulate a home, get a more efficient refrigerator or motor) and many consumers look only to the up-front cost rather than to the lifetime cost when making purchasing decisions.[100] Within companies, purchasing agents may be responsible only for initial costs while another person is responsible for utility bills. In home or office building and renovations, the person making the capital outlay (e.g., the builder) rarely pays the monthly energy bills, and thus has no incentive to build in efficiency. Stores with limited shelf space often do not offer more efficient products because they are usually more expensive, and thus take longer to sell.

Efficiency investments are also diffuse. Unlike a power plant, which can generate 100 or 500 MW, efficiency savings come in small increments of a few kilowatts or less. Thus, to "generate" efficiency savings of 100 or 1,000 MW, many actors must be involved, and each must reject the incorrect assumption that his/her actions won't make a difference. For these reasons, most programs to stimulate efficiency focus on information disclosure and subsidies (such as tax credits, mail-back rebates to consumers, or payments to sellers) to lower the initial cost, as well as efforts to encourage retailers to sell efficient products.

B. The Legislature Should Enact Tax Incentives to Purchase Efficient Appliances

Since major home appliances account for approximately one-third of residential energy consumption, the Legislature should pass a sales tax exemption[102] for all major home appliances having the EnergyStar label.[103] Past experience with short-term sales tax exemptions suggests that retailers could show significant interest in this initiative.[104] During last year's sales tax exemption on clothing, for example, many stores offered a matching 8 percent-off sale.

If implemented before the coming summer, this incentive could impact air conditioner sales and thus summer peak demand. Other major appliances and products (i.e. refrigerators, clothes washers, dish washers, furnaces, efficient windows, and lighting) also use significant amounts of energy: While not purchased by any individual very often, the cumulative annual sales of these appliances in New York are significant. For example, according to the Association, of Home Appliance Manufacturers, 440,700 room air conditioners, 481,800 refrigerators, 297,700 clothes washers, and 133,400 electric clothes dryers were sold in New York State in 1996.[105]

While it is nearly impossible to predict with precision the cost or impact of the sales tax exemption on efficient products, conservative estimates suggest a positive outcome. If, for example, an exemption steered only 10 percent of air conditioner purchases to more efficient models, it could save 8,814 MWh per year and would cost the State (in lost tax revenue) perhaps $1,762,800 per year, while saving ratepayers $1,181,076 per year.

The sales tax exemption would additionally draw attention to efficient products and show the environmental and economic benefit of purchasing such products. Con-

[101]Most consumers lack information on the energy, cost, and environmental savings that would enable them to comparison shop for more efficient appliances.

[102]The Senate Majority Leader has introduced legislation that includes a sales tax exemption for efficient products and other products that promote conservation. See, S.0002-Bruno.

[103]EnergyStar is a voluntary partnership between the EPA, DOE, manufacturers, utilities and retailers. Partners promote energy efficiency by labeling qualifying products with the EnergyStar logo. EnergyStar-approved products are 10–75 percent more efficient than the Federal efficiency standard. The NYSERDA is an EnergyStar partner and promotes EnergyStar products.

[104]The sales tax exemption could also encourage consumers in neighboring States to buy appliances from New York State businesses.

[105] Association of Home Appliance Manufacturers, Major Appliances—Estimated Distributor Sales by State. See http://www.aham.org/indextrade.htm.

sumer education on the impacts of energy conservation and each individual's ability to contribute is critical to implementation of energy efficiency programs.

C. The Legislature Should Create an Efficiency Portfolio Standard

Electricity retailers, unlike electricity generators, have direct contact with electricity consumers through monthly bills. This contact provides an opportunity to educate consumers. However, absent a legislative mandate, retailers lack incentive to conserve energy because the more they sell, the greater they profit.[106] The Legislature should bring retailers into the State's energy efficiency efforts by enacting an Efficiency Portfolio Standard, requiring retail sellers of electricity to achieve certain levels of efficiency improvements in their service area.

Retailers could achieve these gains through direct installation of efficiency measures and include the cost of the installation in their prices. They could also provide rebates, promotions or education. For example, using bill inserts and instructing employees (such as those answering telephone inquiries or installing equipment) to highlight efficiency and conservation opportunities, retailers could accomplish significant savings. A re-institution of the utility compact fluorescent bulb rebate program could be an important promotion.[107]

While an EPS is a new concept, it has two strong antecedents. Many States have implemented a Renewable Portfolio Standard that requires utilities to buy a minimum percentage of electricity from renewable sources. In addition, before restructuring, utilities were required to achieve certain energy savings through rate conditions that effectively acted like an EPS. Indeed, before restructuring, utilities were able to reduce electrical usage through efficiency measures by over 1,300 MW over 7 years when State regulations granted utilities incentives to accomplish that result.[108] (A further precedent is provided by New York City's program to install—at its expense—water conservation devices in hundreds of thousands of homes and apartments. This program successfully reduced water use significantly.)

D. The Comptroller Should Report Annually on Energy Efficiency and Renewable Energy Programs

Both to enhance public support for and understanding of efficiency and renewable programs, as well as to ensure that the money in these programs is spent most effectively, the Legislature should direct the Comptroller to prepare an annual report on the implementation of efficiency and renewable programs. As noted above, three major State programs currently operate the NYSERDA's EnergySmart program (using SBC funds), the NYPA's Energy Services programs, and LIPA's Clean Energy Initiative. While the PSC requires the NYSERDA to report on the implementation of EnergySmart, the NYPA and LIPA have no reporting requirement. In addition, there should be verification of progress on the Renewable and Efficiency Portfolio Standards.

The Comptroller's annual report, prepared in coordination with the NYSERDA, NYPA, LIPA, PSC and retailers, should include:

- total funds expended on efficiency, conservation and renewable energy;
- total MWh and MW saved as a result of the programs;
- a running list of all completed projects and a list of all planned projects;
- total energy cost savings to consumers;
- comparative effectiveness of programs; and
- remaining barriers to additional efficiency, conservation and renewable energy projects.

Accurate accounting of efficiency and renewable energy projects is essential to understanding how future energy needs should be met. The Attorney General would commit to assisting the Comptroller with this report and in investigating opportunities to remove remaining legal barriers to a sound energy policy.

E. The PSC Should Improve Pricing and Revenue Signals to Encourage Flexible Demand and Conservation

In addition to tax incentives, Portfolio Standards, and direct subsidies through the NYSERDA, NYPA and LIPA, significant opportunities exist to amend pricing mechanisms to foster efficiency and conservation:

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[106] Since distribution costs are essentially fixed, higher sales lead to both higher revenue and proportionately higher profits. See also Section VI.E.3. for proposal to correct these existing market disincentives against efficiency.

[107] Replacement of incandescent bulbs with energy efficient compact fluorescents has the potential to significantly reduce energy consumption and consumer costs. See Appendix A–1.

[108] NYSEPB, New York State Energy Plan and Final Environmental Impact Statement, November 1998, p. 3–62. The demand-side management programs cost the utilities $1.277 billion between 1990 and 1997.

1. Utilities Should Widely Advertise Offers for Different Time-of-Day Rates to Residential Customers to Encourage Load Shifting

The Public Service Law requires large electric utilities to offer residential customers the option of paying different rates for different times of day of instead of paying one rate for all electricity used.[109] For example, instead of paying 13 cents per kilowatt-hour 24 hours a day, a customer could pay 6 cents during the night and 15 cents during the day. Despite this law, it appears that few utilities effectively offer this service to customers.[110] Since this pricing could shift demand away from peak times, the PSC should require utilities to advertise its availability. Time of use pricing reduces electricity bills for customers who have the flexibility to use certain appliances, such as the clothes washer and dryer, dishwasher, or water heater, at times when the price is cheapest. This pricing also sends truer price signals to the customer, as it is far more expensive for the utilities to buy electricity during peak periods than in off-peak periods.

Given the failure of utilities to offer or advertise time of use pricing, significant peak demand reductions may be achievable if the PSC requires more aggressive efforts. The PSC should ensure that each retailer offer reasonable time-of-day (or at least day-night) pricing to all customers, and provide consumers an analysis of the possible savings from such pricing. Appropriate means of financing time-of-day meters will need to be analyzed.

2. Direct Metering or Submetering Should be Expanded

While time-of-day meters would enable direct metered customers to shift some power use to off-peak periods, consumption is not measured individually in many apartments, but rather through the building's "master" meter. Studies have indicated that residents in master-metered buildings tend to consume significantly more electricity than residents with direct meters or submeters. Consideration should be given to the possibility of converting master-metered buildings in New York State to direct metering or submetering.[111] In master-metered buildings, individual residents do not pay for their electricity directly. Rather, electricity charges are included in the rent. These tenants thus have no direct price signal associated with their electricity consumption.

Direct metering and submetering use direct market forces to encourage conservation. For example, a NYSERDA pilot project in 1981 showed an energy savings potential of 18–26 percent from submetering.[112] If comparable energy savings were achieved in the approximately 400,OQO apartments in 1,800 master-metered buildings in the Con Ed service area,[113] demand in the New York City load pocket would be reduced significantly. The considerable costs involved when converting to direct metering or submetering can be offset by the savings in the electricity bills over time.

Efforts to expand direct metering and submetering are ongoing, and should continue. For example, as part of its Residential Innovative Opportunities program, the NYSERDA has pilot projects to enhance submetering of cooperative apartment buildings, and has provided technical advice to building operators interested in converting to submetering.

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[109]See, PSL § 66(27). This law applies only to corporations with annual gross revenues in excess of $200,000,000.

[110]In a December 20, 2000 Order, the PSC required electric utilities to file a report identifying measures that could be taken to reduce peak demand. While several of the utilities indicated that "real time pricing" for their very large users of electricity (i.e. commercial and industrial) might be included in their portfolio of strategies to reduce demand, very few identified programs that could reduce peak demand from residential customers. Only New York State Electric and Gas (NYSEG) offers residential customers both time of use pricing (to customers who use 35,000 kWh or more annually) and day-night pricing (to customers who use 1,000 kWh or more per month). ConEd indicated that residential customers would be eligible to participate in its Direct Load Program which would reward customers who voluntarily allow ConEd remotely to control their central air conditioning units during peak.

[111] Current Energy Code requires all residential new construction to have separate meters for each dwelling (See, 9 NYCRR § 7813.52(b)). Between 1951 and 1979, however, the PSC banned submetering. Thus, much of the housing built during this time—including most public housing and other publicly assisted co-ops—have master meters. The Energy Code states that whenever more than 50 percent of a residential building's electrical system is replaced in a 12 month period, each dwelling unit is to be provided with a separate meter. See, 9 NYCRR § 78 10.6.

[112]NYSERDA, Facilitating Submetering Implementation, Report 96–7, May 1996, p. A–2.

[113]Ibid., p. S–1.

3. Utilities Should be Given Incentives to Encourage Energy Efficiency and Clean Distributed Generation

While generators of electricity are allowed to sell their power at market value in the current restructured environment, the transmission and distribution retailers—the utilities—have remained regulated monopolies. That is, the rates received by the utilities from their customers for the transmission and distribution of electricity is still set through rate agreements with the PSC.

Among the most central issues raised by the restructured marketplace is whether the utilities' profits should be linked directly to sales.

Under the current rate structure there is a rate cap, which means the more electricity a retailer sells, the greater the retailer's profits. But, a retailer's fixed costs for distribution do not increase substantially when marginally more electricity is sold, and thus the rate of profit increases for each additional kilowatt-hour of electricity sold. As a consequence, clean distributed generation, energy conservation or efficiency—all of which reduce a retailer's sales—is usually not in a retailer's best interests despite its significant benefits to consumers and the public.

If the rate structure rewarded retailers for reductions in demand, energy conservation would more likely become a priority for retailers and consumers. The PSC should develop a formula for the distribution charge that rewards (or at least does not discourage) efficiency, distributed generation, and similar efforts.

F. The Federal Government Should Implement New Appliance Efficiency Standards

The DOE should implement the new appliance energy efficiency standards [114] to reduce energy use in an important sector. Not only would this help New York's energy efficiency efforts, but since New York receives significant pollution from upwind States, efficiency efforts elsewhere can improve New York's air.

In 1977, the DOE promulgated efficiency standards for residential refrigerators, residential room air conditioners, and fluorescent lamp ballasts. These standards have been very successful in leading manufacturers to produce far more efficient products, often 25 percent or more efficient than previous models. The DOE estimates that the standards already promulgated will save enough energy to eliminate the need for over 13,000 MW of generation capacity nationwide.

In early 2001, the DOE announced the adoption of new energy efficiency standards for four additional types of appliances—residential central air conditioners and heat pumps, residential clothes washers, residential water heaters, and commercial heating and cooling equipment. These new standards are projected to save consumers and businesses more than $19 billion through the year 2030 and to alleviate the need to build 91 new 400-megawatt power plants. The residential central air conditioner standard alone is estimated to avoid the need for 53 of these plants. [115] It is critical that these standards be adopted by the new administration and fully implemented.

VII. Challenge and Encourage New Yorkers to Assist in Reducing Demand

Every New Yorker can help to save energy, clean the air, and prevent climate change. By implementing these measures, consumers will also save on their electricity bills. State officials should use available opportunities to educate the public on efficiency, renewable power and conservation options.

An average U.S. family spends close to $1,500 a year on its home utility bills (both heating fuel and electricity bills). Businesses spend much more. Unfortunately, not even including inefficient appliances, a large portion of that energy is wasted through actions such as running an almost empty dish or clothes washer, or uninsulated attics, walls, floors, and basements. Lights left on when no one is around, at home or in stores or offices after hours, consume electricity needlessly. The DOE estimates that the amount of energy wasted nationwide is about the same amount of energy that we get from the Alaskan pipeline each year. [116]

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[114]See, 66 Fed. Reg. 33 13–33, January 12, 2001 (clothes washers); 66 Fed. Reg. 3335–56, January 12, 2001 (commercial heating and cooling equipment); 66 Fed. Reg. 4473–97, January 17, 2001 (water heaters); and 66 Fed. Reg. 7169–7200, January 22, 2001 (residential air conditioners).

[115]See, New Efficiency Rules Cut Need for 91 New Power Plants, Environment News Service, Washington, DC, January 19, 2001. A 'more complete description of the standards can be found at Http ://www.eren.doe.gov/buildings/codes—standards/stkappl.htm.

[116]DOE, www.eren.doe.gov/comsumerinfo/energy savers/introbody.html. Electricity generated by fossil fuels for one home plus the energy that is generated in the home (for example, a boiler) emits twice as much carbon dioxide as does one typical car in 1 year. Every kilowatt hour of electricity avoided in New York State saves almost one pound of CO_2 from entering the atmosphere.

Individual consumers can do many things at home to save electricity, reduce air pollutants, and reduce their energy bills. Table A–2 in the Appendix illustrates ways, many of which are free and available immediately, to save electricity. For example, if a household increases the air conditioner thermostat in summer by merely three degrees, it would save 937 kWh/yr, and $126 annually. If all New York households did the same, then 6.3 million MWh of energy would be avoided, along with over 3 million tons of carbon dioxide. Avoiding this amount of carbon dioxide is tantamount to removing 600,000 cars in 1 year.

APPENDIX

Table A–1

Electricity Savings: Incandescent vs. Compact Fluorescent Lights

Savings show result of replacing one incandescent bulb with a compact fluorescent bulb in one household and in each of the 6,766,000 households in NYS.

Bulb Type	100 watt incandescent	23 watt compact fluorescent	SAVINGS OVER 3 YEARS BY REPLACING BULB
Purchase Price	$0.75	$11.00.	
Life of the Bulb	750 hours	10,000 hours.	
Number of Hours Burned per Day	4 hours	4 hours.	
Number of Bulbs Needed	about 6 over 3 years	1 over 6.8 years.	
Lumens	1,690	1,500.	
Total Cost of Bulbs	$4.50	$11.00.	
Total energy used over 3 years	438 kWh per household 2.964 billion kWh if all households 100 w (4 hrs/day)(365 days/year) (3 years) = 438000 watt-hours or 438 kWh 438 kWh (6,766,000) = 2.964 billion kWh	100.74 kWh per household 682 million kWh if all households 23 w (4 hrs/day)(365 days/year) (3 years) = 100740 watts-hours or 100.74 kWh. 100.74 kWh (6,766,000) = 682 million kWh	337.26 kWh per household 2.282 billion kWh if all households (equivalent to the power generated from an 86.8 MW power plant, 24 hours every day.)
Total Cost of Electricity for 3 years (avg price in 1999: 13.4 cents/kWh)	$58.69	$13.50.	
Total Cost over 3 years (cost of energy + cost of bulbs)	$63.19 per household $427,543,540 if all households	$24.50 per household $165,767,0Q0 if all households	$38.69 per household $261,776,540 if all households
Total CO_2 emissions over 3 yrs (avg emission rate: 996.7 lbs/MWh or 0.9967 lbs/kWh)	436.56 lbs per household 1,476,882 tons if all households 438 kWh (.9967 lbs/kWh) = 436.56 lbs 436.56 lbs (6,766,000)/2000 = 1,476,882 tons.	100.41 lbs per household 339,687 tons if all households 100.74 kWh (.9967 lbs/kWh) = 100.41 lbs 100.41 lbs (6,766,000)/2000 = 339,687 tons.	336.15 lbs. per household 1,137,195 tons if all households
Total SO_2 emissions over 3 yrs (avg emission rate: 5.1 lbs/MWh or 0.00511 lbs/kWh)	22.38 lbs per household 75,711 tons if all households 438 kWh (.00511 lbs/kWh) = 22.38 lbs	0.52 lbs per household 1,759 tons if all households 100.74 kWh (.00511 lbs/kWh) = 0.52 lbs	21.86 lbs. per household 73,952 tons if all households
Total NOx emissions over 3 years (avg emission rate: 1.9 lbs/MWh or 0.0019 lbs/kWh)	0.83 lbs per household 2,807 tons if all households 438 kWh(.0019 ;bs/kWh) = 0.83 lbs	0.19 lbs per household 643 tons if all households 100.74 kWh(.0019 lbs/kWh) = 0.19 lbs	0.64 lbs. per household 2,164 tons if all households

Table A–2

Electricity Savings, Electricity Cost Savings, and Carbon Dioxide Emissions Avoided By Implementing Efficiency and Conservation Measures in One Household and in All New York Households

Household Measure	Electricity saved for one household (kWh/yr)	Electricity saved for all NY households (MWh/year)	Money saved for one household	CO_2 avoided for one household (lbs/yr)	CO_2 avoided for all NY households (tons/yr)
Replace a 1970's refrigerator w/a new EnergyStar refrigerator	2,197	14.9 million.	$294	2,190	7,408,770
Increase AC thermostat by 3F degrees for cooling	937	6.3 million.	$126	934	3,159,410
Replace 5 incandescent light bulbs with compact fluorescent	562	3.8 million.	$75	560	1,894,480

Source: U.S. Energy Information Administration, Household Energy Consumption and Expenditures 1993, and Rocky Mountain Institute's calculations at www.rmi.org (1999)

Statement of Thomas E. Stewart, on Behalf of the Ohio Oil and Gas Association And The Independent Petroleum Association of America

Committee members, good morning. I am Thomas E. Stewart and I serve as the executive vice president of the Ohio Oil & Gas Association, a trade association whose one thousand three hundred members are involved in the exploration, production and development of crude oil and natural gas resources within the State of Ohio. This Association has represented the Ohio industry since 1947. I am also testifying on behalf of the Independent Petroleum Association of America (IPAA). IPAA represents the thousands of independent petroleum and natural gas producers throughout the nation.

Today's hearing continues the Environment and Public Works Committee's examination of environmental laws and their interaction with the nation's energy supply and demand. My testimony today will focus primarily on several environmental issues and how they impact the petroleum and natural gas exploration and production (E&P) industry.

Let me begin by describing the unique nature of the industry and the specific challenges we face in the context of Federal environmental law. The petroleum and natural gas E&P industry is distinguished by its breadth and diversity. Oil and gas are natural resources that are found in 33 States, 12 of which are represented on this committee. There are over 850,000 producing oil and natural gas wells in the country in areas ranging from arid plains to forests to wetlands.

The operation of these wells has been regulated since the 1920's with an increasing emphasis on environmental controls since the 1960's. This regulation has been and continues to be done effectively by the States—a reality that has been recognized by the Congress and by the EPA. Because of the diverse conditions associated with oil and natural gas production, the regulatory process must be flexible and reflect the unique conditions in a State or areas within a State. It requires the technical expertise that has been developed in each State and which does not exist within the EPA. For this reason Federal law has generally deferred regulation of this industry to the States. Additionally, because so much of Federal law is written based on regulating small numbers of point sources, some laws have created particular problems for the oil and gas E&P industry. In some instances this has resulted in specifically crafted provisions to address the oil and gas E&P industry.

Complying with environmental regulations remains a significant cost for the E&P industry, with estimates of annual costs ranging from about $1.6 billion to more than $2.6 billion. These costs are particularly significant during times of low commodity prices, such as occurred during the 1998–99 oil price crisis. Equally important is understanding that independent producers, who range from large publicly traded companies to small business operations, drill 85 percent of the wells within the United States. The common factor for these independents is that their revenues and hence their ability to meet these environmental costs comes solely from the exploration, production and sale of crude oil and natural gas from the wellhead. Unlike the large major producers—the integrated oil and gas industry—the independents have no means of passing on production and regulatory costs through other operations, such as refining and marketing. Ohio's producers are "price-takers" rather than "price-makers."

Consequently, the industry places great emphasis on cost effective regulation, limiting paperwork burdens, and avoiding duplicative regulatory requirements. In general, the unique problems associated with the diverse nature of the E&P industry have been addressed, making the burden of regulation manageable. However, there have been exceptions and there are issues that need attention.

Safe Drinking Water Act, LEAF v. EPA and Hydraulic Fracturing

For example, the most compelling environmental issue currently confronting the oil and natural gas E&P industry is a movement to have U.S. EPA regulate hydraulic fracturing under the Safe Drinking Water Act (SDWA).

Hydraulic fracturing is a common and necessary procedure used by producers to complete crude oil and natural gas wells by stimulating the well's ability to flow increased volumes of oil and gas from the well's reservoir rock into the wellbore. It is necessary in order to obtain production from wells that, for lack of proper stimulation, would not naturally yield economic volumes of crude oil and natural gas. Massive numbers of hydraulic fracturing have been performed in Ohio and throughout the United States, dramatically increasing the nation's oil and gas resource base.1

At the time the SDWA was enacted, the States had already developed extensive Underground Injection Control (UIC) programs to manage liquid wastes resulting from oil and gas operations and the reinjection of produced waters. By 1980 Congress—recognizing the need for further State flexibility—modified the SDWA to give States "primacy" based on comparable State oil and gas UIC programs. These changes were made because Congress recognized that the approach it had envisioned was inconsistent with the realities of UIC regulation. It recognized that the State UIC programs were well structured and that EPA could not fashion a Federal program with the flexibility needed to deal with the different circumstances existing in the various States.

At no time during these debates—in 1974 or in 1980—was there any suggestion of including hydraulic fracturing in the UIC waste management requirements. Nor was it an issue in the 1986 or 1996 reauthorizations of the SDWA. The reason is clear. Hydraulic fracturing—while it temporarily injects fluids into underground formations—is not the underground injection that the SDWA was designed to regulate. There have been over a million hydraulic injection operations during the past 50 years. States have regulated its use in their well permitting processes. It does not create environmental problems.

Nonetheless, in the mid–1990's the Legal Environmental Assistance Foundation (LEAF), after years of failing to make an environmental case against coalbed methane development, petitioned the U.S. EPA to regulate hydraulic fracturing under the UIC program. EPA rejected LEAF, arguing that Congress never intended UIC to cover hydraulic fracturing. LEAF appealed to the 11th Circuit Court of Appeals.

In 1997, the 11th Circuit Court decided the LEAF v EPA case. The Court never addressed the environmental risks of hydraulic fracturing; it merely decided that the plain language of the statute could include hydraulic fracturing as underground injection. This decision compels a revision to the SDWA because its basis is so fundamental that adverse regulatory action is inevitable.

Initially, EPA responded to the LEAF decision by requesting the Groundwater Protection Council (GWPC) to study coalbed methane wells. After evaluating 10,000 wells, it found one complaint—the LEAF case Alabama well that EPA had already concluded was not a fracturing problem. However, LEAF went back to the Court to force EPA action. EPA then compelled Alabama to develop a UIC regulation that requires the use of federally certified drinking water for fracturing jobs, water that must be purchased from willing cities and trucked to the well development operations.

LEAF filed a second case—likely to be decided this year—arguing that EPA erred in the Alabama regulation. LEAF argues in part that EPA should have first written a nationally applicable rule. If EPA loses this case, all hydraulic fracturing jobs could be federally regulated. The National Petroleum Council estimates that 60 to 80 percent of all the wells drilled in the next decade to meet natural gas demand will require fracturing.

Even if EPA wins the LEAF II case, the likely result would be a rash of cases raising the hydraulic fracturing issue in Federal Circuit Courts across the country. Given the "plain language" nature of the original case, most attorneys believe that such cases would produce similar results—a forced Federal regulation in each State.

Not considered an issue at the time the SDWA was passed, Congress did not specifically exclude hydraulic fracturing. Two decades later, a court ignored the facts of the issue and changed the scope of the law on a technicality. Now, a legislative resolution is essential to clarify the original intent of Congress and the definition of underground injection. Industry believes that Congress should address this issue

quickly through a bipartisan effort. A clear opportunity exists to bring the States and EPA together on this matter and produce an environmentally sound resolution that would prevent the loss of key energy supplies.

Clean Water Act, Endangered Species and Clean Air Act

While hydraulic fracturing represents the most compelling issue that needs legislation, there are others that require attention as well. For example, because many oil and natural gas producers are small businesses, paperwork burdens are always an issue. Here, some issues that affect producers are:

- Under the Clean Water Act, producers are required to submit Spill Prevention, Control, and Countermeasure (SPCC) Plan updates every 3 years (EPA has proposed to extend this period to 5 years). These SPCC plans provide details about the facility's operations and spill control measures. Producers must also submit Emergency and Hazardous Chemical Inventory Forms under the Emergency Planning and Community Right-To-Know Act (EPCRA), but must do so annually. Most of these EPCRA forms do not change and the same objective could be achieved by filing every 3 years with annual reports that would identify any significant changes. It would reduce the paperwork burden with no environmental detriment.
- Additionally, the requirements that trigger the need for a stormwater construction permit under the Clean Water Act are changing. The construction area subjected to these permits is being reduced from five acres to one acre. As a result, oil and gas production facilities—which have typically not been required to get these permits—will now be subjected to this regulatory requirement. While EPA has indicated that it will craft the permit requirements to minimize burdens to the producer; this process needs to be carefully monitored as it is implemented to avoid undue delay in developing production sites.

Not all issues are related to procedures or paperwork. Others relate to interpretations of laws that can adversely affect natural gas and oil exploration and development. Historically, these problems have related more to obtaining permits for operations than to meeting emissions limitations. For example:

- Under the Clean Water Act, some projects require Section 404 dredge and fill permits. While this process is managed by the Corps of Engineers, it involves interactions with agencies that have jurisdiction with regard to wetlands. Moreover, the definition of a wetland has been confusing and in dispute for decades. The result of these factors has been permitting uncertainty. Part of the concern results from different objectives of the agencies involved in the permitting process. While their responsibilities will not change, it is essential that they all recognize the need to develop domestic energy supplies and work toward achieving this national objective in a cost effective, environmentally sound process.
- The Endangered Species Act raises similar issues. When Federal Land Managers—principally the Bureau of Land Management—develop resource management plans (RMPs) one of their important considerations is habitat management for endangered species. Oil and natural gas exploration and production is a temporal process. It involves drilling activities for a limited period of time followed by production activities that can include well maintenance efforts while the well produces. When the well is depleted, it is closed and plugged and the area returns to its prior condition. Over the years these activities have become less intrusive to the environment. The Department of Energy's 1999 report, Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology, demonstrates the types of actions that are taken. The key point here is that oil and gas E&P coexists with nature. This reality needs to be recognized as RMPs and other permit actions are developed, including habitat management plans that protect endangered species and encourage energy supply. Addressing this important balance does not require sacrificing the principles of the Endangered Species Act, it merely requires greater efforts to define alternatives that can accommodate both national objectives whenever possible.
- Recently, there has been discussions of aggregating individual oil and gas wells in a particular geographic area for purposes of defining a "major source" under Title V of the Clean Air Act. If that is done, it would impose a whole host of additional regulatory burdens on the producing industry with little benefit to the environment. The question of how to determine when Federal clean air regulation should apply to E&P facilities has already been raised in the context of the operation of Section 112 as amended in 1990. Congress concluded that individual oil and gas wells should not be aggregated for the purpose of determining whether they represented a major stationary source. This decision reflected the reality of oil and gas E&P operations. While there may be several wells in an area, there is no certainty that they are operated by the same entity; in general, they are not. Unfortunately, the issue has arisen with regard to whether the definition of major source under Title

V with regard to whether facilities permitted by the Federal Government should be interpreted consistent with Section 112. While the definitional limitations are not replicated in Title V, we believe that EPA should use the same approach. In particular, since aggregation would not result in appreciably different control requirements, it makes no environmental sense to capture oil and gas E&P operations under the permitting burdens of Title V.

While issues such as endangered species have greater impact on oil and gas development in the Western United States, similar issues have also impacted development in the Appalachian Basin. For example, in the Wayne National Forest of Ohio, Carlton Oil Corporation, a small oil and gas producer, for an extended period has been seeking to obtain a permit from the Bureau of Land Management (BLM) to drill a development well on a Federal lease tract. Since applying for the permit in February 2000, the producer has been waiting while the Forest Service has performed an environmental assessment taking into account new information, if any, regarding endangered species and the relationship of that information to the Forest Plan. It is ironic that the producer already operates two other wells on the same property. Even more ironic is that continuous oil and gas operations have existed in this area since 1860. While this producer has been waiting for the Federal process to resolve itself, his requisite permits issued by the State of Ohio have been issued and expired. Needless to say, he is frustrated with a process that stymies the drilling of a simple and common development natural gas well in what is the most mature oil and gas producing province within the United States. Meanwhile, Ohioans have joined the national chorus demanding answers to why natural gas supplies are tight.

These types of issues reflect an ongoing dilemma that needs to be addressed. Without altering the underlying requirements of environmental law, the energy supply implications of new regulations, guidance, resource management plans, interagency memorandums of understanding, and other planning and review processes need to be identified early and become a part of the decisionmaking process. This step would assure that where possible these actions could be tailored to address both environmental and energy needs. Such an approach has been included in Section 101 of S. 388 and S. 389, the National Energy Security Act of 2001.

Pipeline Issues

There are pipeline issues as well. Congress, in its 1996 amendment to the Pipeline Safety Act of 1992, directed the U.S. Department of Transportation ("USDOT") to define the term "gathering line" for purposes of jurisdiction in its gas pipeline safety regulations. This is important because gathering lines are generally exempt from regulation unless they are located within urbanized settings. USDOT failure in the past to address this issue has created a regulatory vacuum that has resulted in uncertain and vague application of regulatory standards within the States.

In 1999, U.S. DOT issued a Request for Comments on the issue of whether and how to modify the definition and regulatory status of gas gathering lines for the purposes of pipeline safety regulation. In response to USDOT's request, an industry coalition comprised of representatives from across the country and from small independent producers to the large integrated companies, proposed a unified definition for the pipeline safety program for gas gathering. That definition was filed with the agency on April 24, 2000. The American Petroleum Institute published a recommended practice document based on this definition.

Establishing regulatory stability in the arena of pipeline construction and operation is an important goal for the regulated community, particularly for the Appalachian oil and gas industry. The Appalachian Basin is the country's oldest natural gas producing field. It has been producing and gathering natural gas without safety mishaps for over a hundred years. It is located in very close proximity to major population areas of the country, especially the northeast. At a time when consumption of natural gas is expected to increase, it is imperative that a nationally driven gathering pipeline regulatory program be established that acknowledges the safety record of the Appalachian region and that enhances the region's ability to collect its naturally high quality gas and deliver it to transmission and distribution systems.

On March 8, 2001 representatives of the Gas Gathering Industry Coalition, to include the Appalachian industry, met with USDOT representatives to discuss the agency's plans with regard to its open rulemaking on the definition of gas gathering for the Pipeline Safety program. DOT conceded that it has yet to act on the need to establish a promulgated rule. The agency has offered to reconsider its reluctance to review the Industry Coalition proposal and committed to providing a response to industry's request that a public meeting be held to further discuss the development of a rulemaking. It is essential that the DOT be given the appropriate support and guidance for bringing to resolution this long outstanding issue. It is also essential

that any such resolution enhances the movement of gas rather than create unnecessary regulatory burdens.

Pipeline issues also extend to the downstream industry that seeks to deliver finished petroleum products to the consumer. In Ohio, Marathon Ashland Petroleum LLC is proposing to build a 14" diameter petroleum products line to connect supply from its Catlettsburg, KY refinery to one of the fastest growing areas—Central Ohio. The Midwest faces unique challenges in the petroleum industry as it lacks the refining capacity to manufacture enough gasoline, diesel fuel, jet fuel, etc. to satisfy consumer demand. As a result, States like Ohio rely on Gulf Coast refineries for 25 percent of their petroleum products—most of which travels through capacity-constrained pipelines. There is an obvious need for more petroleum products into the Midwest. Marathon Ashland Petroleum's proposed project (Ohio River Pipe Line) will bring up to 80,000 barrels/day of refined product into Central Ohio. Nonetheless, the project has suffered many permit and legal delays and 3 years later not a single mile of pipeline has been laid.

Marathon Ashland has endured 3 years of environmental reviews and evaluations of streams, wetlands, rivers, cultural resources, and State and federally listed threatened or endangered species. Even though the company has met, and many times significantly surpassed, the requirements of the requested permit, the approval process is not yet complete nor is it streamlined to the point where approvals can occur in an acceptable timeframe. Additionally, there is broad subjectivity in interpreting the regulations and oftentimes there are conflicting requirements between the multitude of State and Federal agencies involved. Primary agencies involved in the process include the U.S. Army Corps of Engineers, the USEPA, the U.S. Fish and Wildlife Service, the Ohio EPA, the Ohio Department of Natural Resources, the USDOT's Office of Pipeline Safety (OPS) and the State Historical preservation offices. The lengthy process and uncertainty associated with this project is symbolic of the significant challenges for companies wanting to invest in infrastructure.

Inadvertent Targets, TMDL

The industry also faces issues where it becomes the inadvertent target of a Federal regulatory initiative. For example:

- EPA has initiated a new program to address Total Maximum Daily Loadings (TMDLs) on streambodies throughout the United States. The effort is one of a long line of efforts to try to grapple with non-point source pollution of water bodies. While the Clean Water Act has enjoyed great success with its point source control program, non-point source control has been elusive because of its diverse nature. Moreover, because it largely must address drainage from agricultural and forest lands, it has always had to yield to the realities—both technical and political—that control of these sources requires something other than a Federal mandate. The E&P industry finds itself, therefore, in a vulnerable position. In looking at a typical streambody under the TMDL effort, the point sources will be controlled and therefore not likely to be further controlled and the agricultural and forest non-point sources will be deferred until a control strategy can be developed. This leaves small non-point sources as the only remaining targets for EPA to address. While they will not resolve the TMDL problems, they can provide a public relations victory. E&P operations meet this characterization. They are small but do construction work that can produce runoff even when managed properly.
- The Clean Air Act has elements that can create similar vulnerability. Its history is clear. State and local regulators do not want to impose tough regulations on their citizens if they can shift the control elsewhere. It is much easier to push for auto emissions controls or fuel standards that are the responsibility of distant industries than to require local inspection and maintenance control programs. Visibility regulations are an example where the premise is based on emissions from facilities hundreds of miles away. It creates opportunities for regulators in one State to demand action by other States. In these circumstances there are many western States where there are few sources and those are regulated for local reasons or under new source requirements. The E&P sources become potential targets not because they are significant but because they are there.

These types of events do not improve the nation's environmental management, but they can threaten its energy supply without any judgment that such regulations would be appropriate or necessary. Balanced decisions are necessary—decisions based on cost effective regulation and sound environmental management needs.

ATTACHMENT

Mr. Stewart serves as the Executive Vice President of the Ohio Oil and Gas Association, having been elected to that position in September, 199l. At OOGA, Mr. Stewart is director of staff, editor of the Association's publications and an advocate for the industry as a registered legislative agent.

Mr. Stewart serves as an Ohio representative to the Interstate Oil and Natural Gas Compact Commission (IOGCC). Ohio Governor George Voinovich appointed Mr. Stewart to the position in 1997. At IOGCC, Stewart chairs the Public Outreach Committee. Stewart also serves on numerous other committees of national organizations that address issues impacting independent oil and gas producers. He is the Northeast Regional Vice President of the National Stripper Well Association and a charter member of the Cooperating Association Council of the Independent Petroleum Association of America (IPAA).

Prior to joining OOGA, Mr. Stewart has 15 years' experience in the oil and gas industry as an oil and gas producer and provider of contract drilling services. He is the third generation of his family making their livelihood in the domestic oil and gas industry.

OOGA is a statewide trade association with over 1,300 members who are actively involved in the exploration, development and production of crude oil and natural gas within the State of Ohio. The Association's mission is to protect, promote, foster and advance the common interests of those engaged in all aspects of the Ohio crude oil and natural gas producing industry.

1 An oil and gas producer performs a fracturing procedure to increase the flow of oil and gas from rock, known to contain oil and gas, but where the rock's natural permeability does not allow oil and gas to reach the wellbore in sufficient volumes. These reservoirs are called "tight" and wells drilled to them must either be plugged and abandoned or stimulated to enhance well flow. During a fracture procedure fluid is pumped into the reservoir rock using necessary force to split the rock. In other words, to frac a well is to create drainage ditches that penetrate deep into the reservoir rock.

Hydraulic fracturing is currently the most widely used process for stimulating oil and gas wells. Most often it is a one-time process performed on a well. According to the 1989 SPE Monograph on Recent Advances in Hydraulic Fracturing, the procedure is a standard operating practice that by 1988 had been performed over 1 million times. At that time, 35–40 percent of all wells were fractured, and about 25–30 percent of the total U.S. oil reserves have been made economically feasible by the process. By 1988, SPE experts Stated that fracturing was responsible for increasing North America's oil reserves by 8 billion barrels.

Since 1951, over 73,000 wells have been drilled to the Clinton, Berea and Ohio Shale zones of Ohio. Between 1970 and 1992, a combination of commodity market conditions and government tax policy caused a boom in tight-formation drilling. During that period, 58,874 wells were drilled in Ohio of which 54,198 wells were productive—a 91.4 percent success rate. Of these wells, 55,046 were drilled to the Clinton, Berea and Ohio Shale. The Clinton comprised 78.4 percent percent of that population. With very limited exceptions, hydraulic fracturing was used to complete all of these wells. Exploitation of the tight Clinton sands would not have been possible without fracturing. The hydraulic fracture process made the modern Ohio oil and gas industry.

According to a recent statement issued by the Ohio Department of Natural Resources, Mineral Resources Management Agency, the regulatory agency has not identified a single incident of groundwater contamination associated with a hydraulic fracturing operation.

STATEMENT OF JASON S. GRUMET, EXECUTIVE DIRECTOR, NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT (NESCAUM)

Thank you Mr. Chairman. My name is Jason Grumet and I am the Executive Director of the Northeast States for Coordinated Air Use Management (NESCAUM). NESCAUM is an association of State air pollution control agencies representing Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont. The Association provides technical assistance and policy guidance to our member States on regional air pollution issues of concern to the Northeast. On behalf of our eight member States, I would like to express our appreciation for this opportunity to address the subcommittee regarding the interaction between environmental regulation and our nation's energy policy.

The issues before the subcommittee this morning are numerous and complex. I commend the subcommittee for its efforts to develop policy approaches that are

mindful of the necessary connection between sustainable energy and environmental policies. Through thoughtful dialog and determined policy, the dual goals of clean air and plentiful low cost energy are mutually reinforcing. However, it is equally true that efforts which focus myopically only on energy or the environment, to the exclusion of the other, are doomed to fail.

The present focus on our nation's energy supply presents challenges and opportunities. It is understandable yet regrettable that our body politic tends to focus its attention on energy policy primarily during moments of predicted or realized scarcity. It is at these times when the fundamental vulnerability of our nation's dependence on a monoculture of imported petroleum is most pronounced. Unfortunately, it is at these same moments when long-term strategies to achieve real energy security are often eschewed in favor of quick fixes that promise immediate price relief at the pump or at the switch. A meaningful national energy policy must address both the supply and demand sides of our energy equation. On the supply side, we must develop a diverse portfolio of sustainable energy sources that can be developed without exacting an unacceptable toll on the natural environment and public health. On the demand side, we must begin to confront the careless waste and inefficiency that far too often describe our nation's consumption of scarce energy resources.

It is worth noting that Congress has boldly grappled with these questions before. The Energy Policy Act of 1992, explicitly acknowledged the unsustainable course of our hydrocarbon economy and set a reasoned goal to diversify our motor fuels supply using domestically produced non-petroleum alternatives. Under EPACT, 75 percent of the vehicles procured by the Federal Government were slated to operate on non-petroleum alternative fuels by 1999. By last year, EPACT established the goal that a full 10 percent of our nation's motor fuel be displaced by non-petroleum alternatives. By 2010, EPACT envisions that a minimum of 30 percent of our nation's motor fuel will be derived from non-petroleum sources.

Our progress toward these goals has been woeful. At present, less than 1 percent of the motor fuel used on this nation's highways is derived from non-petroleum alternatives and there are no meaningful Federal efforts underway to achieve the EPACT goals for 2010. In fact, the Energy Information Association recently reported that U.S. oil demand is forecast to jump from the current 20 million barrels per day to 26 million barrels per day by 2020. Last year alone, our nation spent over $100 billion for imported oil. On March 15, of this year, the Associated Press reported that our nation's trade deficit surged to an all time high of $435.4 billion (up 31.3 percent) on a huge rise in imports of oil. As a founding member of the Governors' Ethanol Coalition, I recognize Chairman Voinovich, that you appreciate better than I the need to promote domestically produced renewable fuels. I respectfully submit that had our nation directed the necessary public and private resources and technological commitment toward achieving the promise of EPACT, the substance and mood of today's discussion and the scope of our policy options would be very different.

I would now like to briefly discuss three specific environmental regulatory policies that present opportunities to better harmonize our nation's air quality and energy policy goals. First I will review two recent EPA efforts to address the toxic emissions from motor vehicles. Then I will review the basis for the Northeast States' view that Congress must act to lift the oxygen mandate in the Federal Reformulated Gasoline Program.

Mobile Source Toxics

As we chart a long-term course to harmonize our environmental and energy needs, we must begin to grapple more effectively with the problem of toxic air pollution resulting from the combustion of motor fuels. Over a decade ago, Congress reacted to the growing body of evidence identifying motor vehicles as the dominant source of toxic air pollution in the nation by adopting Section 202(l) of the of the Clean Air Act Amendments of 1990 (Act). The Clean Air Act requires the Agency to produce a study on the "need for, and feasibility of, controlling emissions of air toxic pollutants which are . . . associated with motor vehicles and motor vehicle fuels (sec. 202(l)(1))." The Act instructs the Agency to focus on "those categories of emissions that pose the greatest risk to human health." Section 2020(l)(2) then directs the Agency to "promulgate regulations . . . to control hazardous air pollutants from motor vehicles and motor vehicle fuels." These standards—at a minimum for benzene and formaldehyde—should "reflect the greatest degree of emission reduction achievable through the application of technology which will be available."

In its legislative history, Congress instructed EPA to "broadly characterize the urban air toxic problem by conducting ambient monitoring" in order to determine the "true scope of the problem." Congress characterized EPA's previous efforts in the area of regulating air toxics as "this record of false starts and failed opportunities."

It stated explicitly: "The Environmental Protection Agency has not made sufficient use of the existing authorities available under section 112 of the Clean Air Act to protect public health."

Unfortunately, EPA's efforts to carry out the requirements of this section and the intent of Congress over the last decade have been uninspired. In 1993, EPA identified mobile source emission from on-road vehicles as the No. 1 source of hazardous air pollutant emissions in the country. However, EPA failed to promulgate a regulatory determination as required by statute to address these toxic contaminants. In 1998, EPA published the results of the Cumulative Exposure Project (CEP), which estimated that ambient concentrations of seven cancer-causing compounds exceed Federal-health protective thresholds in every census tract in the country.

In the Northeast, and across the country ambient levels of four pollutants: benzene, 1,3 butadiene, formaldehyde and acetaldehyde exceed health-based cancer and non-cancer thresholds by one and sometimes two orders of magnitude. The CEP, and subsequent analysis by the NESCAUM States conclude that mobile sources are responsible for the vast majority of emissions of these four compounds. In the face of this information, EPA still failed to act. Finally, earlier this month under Court order, EPA promulgated regulations under 202(l) that set a backstop to prevent the average toxicity of gasoline from increasing, but offers no new strategies to mitigate the unacceptable risks posed by mobile source air toxic emissions. The Northeast States are disappointed that it has taken the Agency 10 years to promulgate regulations under Section 202(l) that will provide no air quality benefits to our member States. These views are expressed rather strongly in comments NESCAUM delivered on the rule proposal that I would like to submit to the record (attachment 1).

The most valuable aspect of the recently promulgated rule is EPA's forthright acknowledgement of the gaps in the Agency's understanding about key aspects of the mobile source air toxics problem and its commitment to work with the States and other interested parties to cure these inadequacies and propose new regulations no later than July 2003. Specifically EPA commits to: 1) evaluate and re-assess the need for, and level of controls for both on-highway and nonroad sources of air toxics; 2) develop better air toxics emission factors for nonroad sources; 3) improve estimates of air toxics exposures in microenvironments; 4) improve consideration of the range of total public exposure to air toxics; and 5) increase our understanding of the effectiveness and costs of vehicle, fuel, and nonroad controls for air toxics.

While we trust the sincerity of EPA's commitment to address these issues through a robust research agenda and welcome the opportunity to contribute to this process, we recognize that the questions that EPA now seeks to address are the very same questions that the Agency failed to confront over the past decade. We ask that this subcommittee join the States in working to support this effort and conduct the oversight necessary to ensure that this critical section of the Act is fully and faithfully executed.

Diesel Emission Control Efforts—Consent Decrees

Diesel engines remain the life-blood of commercial transportation in this country. However, the failure to date to adequately control the pollutant emission from diesel engines has exacted an unacceptable and unnecessary toll on the health of our citizens, especially those who reside in urban areas where diesel vehicles are most concentrated. Two ongoing initiatives hold potential to dramatically improve the environmental performance of diesel engines and diesel fuels. The stakes are very high. If successful, these efforts will enable our nation to continue to responsibly rely on diesel engines for years to come. However, if these efforts fail, our nation will continue to be forced to choose between the economic benefits provided by the diesel engine and the health of our citizens.

First, 1998, five diesel engine manufacturers (Caterpillar, Cummins, Detroit Diesel, Mack Trucks, and Volvo) entered into binding consent decrees to remedy the most substantial violation of our clean air laws since the passage of the Clean Air Act. In essence, these engine makers had designed and marketed over one million engines that appeared to meet the emission requirements when tested in a controlled laboratory environment but then dramatically exceeded these standards, by as much as 300 percent, when operated on our nation's highways. This flouting of our environmental laws will result in excess emissions of roughly 100 million tons of NOx over the course of the next 20 years. To mitigate the consequences of this illegal behavior, engine manufacturers committed to a host of activities including the early introduction of cleaner engines in 2002, a commitment to retrofit non-complying engines when they are brought in for engine rebuilds, and a commitment to design engines to meet a "not to exceed" (NTE) standard to ensure that engines when operated on the road reflect the emission profile promised in the laboratory. These commitments were the product of months of intensive negotiations that en-

abled the defendant companies to avoid potential criminal penalties and also allowed these companies to continue to market non-complying engines until the transition to cleaner engines could be economically completed in 2004.

It has come to our attention that many of these same companies are now seeking relief from their own consent decree commitments. I would like to submit to the record a letter dated February 5, 2001 from the Detroit Diesel Company to Administrator Whitman seeking relief from the commitment to market clean engines beginning in 2002 (attachment 2). This request comes on the heels of a series of requests to create exceptions to the NTE requirements and a growing body of evidence that the rebuild programs established in the consent decrees will not realize their promised environmental benefits. Even if all these programs are implemented as promised, the consent decrees still would allow 12 million tons of excess NOx to pollute our States and frustrate our attainment efforts. We simply cannot afford to weaken the commitments that form the basis of these consent agreements. If some engine manufacturers cannot fulfill the commitments established under the consent agreements, alternative reduction obligations must be established that more than offset these failures. Anything less unfairly rewards those companies that have failed to live up to their commitments at the competitive expense of those companies that have strived to succeed.

The consent decrees were negotiated in private through a legal process largely void of the public engagement we have come to rely on under the Administrative Procedures Act. Because of this, States and other interested parties have been largely shut out of these negotiated settlements. We urge this subcommittee to look into the recent developments in the implementation of the consent decrees in order to ensure that the public receives the full benefit of the legal bargain.

Diesel Emission Control Efforts—2007 Rule

The Northeast States wish to express our appreciation to the Administration and EPA for their decision to move forward with the implementation of the new diesel standards for model year 2007 and later engines. This rule is critical to State efforts to attain the air quality standards for ozone and to protect the public from toxic air pollutants such as particulate, formaldehyde, and acetaldehyde. The rulemaking process that produced this regulation was both extensive and inclusive. During the rulemaking process, EPA garnered written input from over 370 stakeholders and worked closely interested parties in the development of the final rule. The broad support for this rule is evident in a March 19, 2001 letter to Administrator Whitman. A broad coalition including automobile manufacturers, trucking associations, environmental groups, States, and truck and engine manufacturers joined together to express our appreciation for the enormous public health and environmental benefits that will be achieved by under this regulation. I wish to submit a copy of this letter for the hearing record (attachment 3).

While some continue to assert that this rule poses a long-term threat to the refiners of diesel fuel and the makers of diesel engines, nothing could be farther from the truth. In fact, this rule must be fairly understood to have saved the diesel engine from inevitable demise due to the unacceptable threat it has to date posed to public health. Once this rule is fully implemented the words "clean" and "diesel" will for the first time rightfully belong in the same sentence. By promulgating a comprehensive approach that simultaneously addresses both diesel engines and the quality of diesel fuel, the Agency has created a role for the continued reliance on diesel-powered engines for years to come.

The 2007 clean diesel rule rests on a successful history of technology advancing environmental regulation. Time and again, our nation has proven that when given adequate lead-time and clear performance standards, American industries possess the technological knowledge and innovative ability to produce products that meet our public health and environmental needs. The Northeast States are concerned by reports that the Administration is considering upsetting this time honored dynamic by imposing a third-party technical review, such as by the National Academy of Sciences, on the clean diesel rule. While certainly well intended, this idea is likely to do far more harm than good by creating a climate of uncertainty that could lead refiners and engine manufacturers to postpone investment in technology research, development and physical plant upgrades that form the basis of their compliance strategy.

EPA has provided more than 5 years of lead time for fuel providers and the manufactures of emission control equipment to put in place the necessary infrastructure and technical changes needed to meet the requirements of the rule. Through the Federal Clean Air Act Advisory Committee (CAAAC), Congress has already established a forum that EPA effectively employs to secure meaningful and timely public input on ongoing regulatory initiatives. Already, the Agency maintains a Mobile

Source Technical Review Subcommittee of the full FACA Committee comprised of technical experts from industry, academia, States and public health advocacy organizations. This subcommittee is well suited to oversee progress on implementation of the 2007 rule. In contrast, formation of a third party review to question the basis of the standards has potential to become a self-fulfilling prophecy for failure by undermining the certainty corporations need to invest for success. Moreover, third party reviews defeat the democratic process envisioned and required under the Administrative Procedures Act. We believe the Agency conducted an extensive, inclusive and effective rulemaking process. Those who disagree have already sought to legitimately express their concern through the judicial process. Anointing a group technically trained individuals to second-guess the Agency's rulemaking process, disconnected from the transparency and public participation required under the Administrative Procedures Act, is undermining to this regulation in particular and to the rulemaking process in general.

Reformulated Gasoline, MTBE, Ethanol and the Oxygen Mandate

Our region has much at stake in the debate over RFG, MTBE and ethanol. Seven of our eight States have or are participating in the Federal RFG program. The use of RFG in the Northeast has provided substantial reductions in smog forming emissions and has dramatically reduced emissions of benzene and other known human carcinogens found in vehicle exhaust. However, the unique characteristics of MTBE pose unacceptable risks to our region's potable groundwater. Groundwater testing conducted throughout the northeast has detected low levels of MTBE in roughly 15 percent of the drinking water tested. Nearly 1 percent of samples tested contained MTBE at or near State drinking water standards. MTBE's unpleasant taste and odor at higher concentrations and the frequency of MTBE detections poses a disproportionate and unacceptable threat to our region's drinking water.

The challenge facing us all is to mitigate the environmental and economic harms caused by MTBE contamination without sacrificing the environmental and public health benefits provided by RFG and without undermining a reliable supply of low-cost gasoline. Unfortunately, the law as currently written prevents both EPA and the States from effectively facing this challenge. The oxygen standard leaves States to choose between the "rock" of MTBE contamination and the "hard place" of a summertime ethanol mandate that will result in either environmental backsliding, gasoline price increases or a combination of both.

It is simply not possible to protect air quality, water quality and ensure gasoline price stability unless the oxygen mandate is lifted or, at a minimum, modified to require EPA to waive this requirement upon State request. Unless the oxygen requirement is lifted or waived, a substantial reduction in MTBE use creates a de facto summertime ethanol mandate. While ethanol usage is far preferable to MTBE from a groundwater perspective and promotion of ethanol can further a host of energy, agricultural, and environmental goals, an ethanol mandate in the summertime reformulated gasoline program is not sound environmental or economic policy for the Northeast. Due to its high volatility and resulting increase in evaporative emissions, the use of ethanol during the summertime ozone season may actually exacerbate our urban and regional smog problems, absent further protections.

The tension between environmental quality and fuel costs posed by a de facto ethanol mandate in RFG is demonstrated by recent EPA and State actions. On March 15, 2001 Administrator Whitman announced that EPA was proposing to relax the environmental performance requirements for RFG containing ethanol out of concern for summertime price increases like those experienced in Chicago and Milwaukee last summer. The lead to the EPA press release reads:

> "Administrator Christie Whitman today told the Speaker of the House and members of the Illinois and Wisconsin congressional delegations that EPA is very close to reaching a decision that should help reduce the costs for blending ethanol into gasoline."

The release quotes Administrator Whitman stating,". . . I recently directed EPA staff to finalize an upward adjustment to the VOC standard . . . which will provide greater flexibility than the .2 pounds that was originally proposed." I would like to submit a copy of the EPA statement to the hearing record (attachment 4).

In plain terms, EPA is weakening the environmental performance of RFG blended with ethanol out of concern over price increases. If ethanol cannot be relied upon as a cost-effective means to satisfy the RFG requirements in the States where it is produced, we in the Northeast shudder at the potential cost implications and/or the weakening of environmental performance requirements that will result from imposition of a de facto ethanol mandate in our region.

EPA's decision to incrementally weaken the RFG program to accommodate ethanol is even more unfortunate when one realizes that the Agency could provide far

more robust consumer protection without weakening the environmental performance of RFG laws by granting State requests to waive the oxygen mandate altogether. On March 27, 2001 a diverse group of State environmental agencies, water quality agencies, oil companies, fuel suppliers, retailers, and refiners, wrote to Administrator Whitman to urge EPA to act quickly to approve California's petition for relief from the oxygen standard. I would like to submit a copy of this letter to the record (attachment 5). This broad support for lifting the oxygen mandate by rule or through statute remains the key to fixing the RFG program. I would like to thank Senator Inhofe for his efforts last year to advance legislation that enabled States to waive application of the oxygen standard. The Northeast States look forward to continuing to work with you and Chairman Smith in the full committee to pass such legislation this year.

In the absence of Federal efforts, States are left to choose between continued MTBE contamination and an ill designed and unwise summertime ethanol mandate. The State of Connecticut is on the leading edge of this unfortunate choice having adopted a legislative ban on MTBE which takes effect in 2003. In a March 14, 2001 report from Arthur J. Rocque, Commissioner of the Connecticut Department of Environmental Protection (DEP), to the State Legislature, the Commissioner writes:

> "The ban on MTBE effective in the year 2003 is not prudent for the State of Connecticut and we recommend that the Environment Committee consider changing the date of the ban. If this action is not taken, Connecticut's position in the region as the first and only State to ban MTBE while required under the Clean Air Act to comply with the Federal reformulated gasoline program (RFG) will likely result in one of several undesirable options. These options could include: the delivery of special or non-compliant gasoline or an increase in the price of gasoline conservatively estimated in the range of 3–11 cents per gallon."

I would like to submit a full copy of the Connecticut Report for the record (attachment 6). There is no question that it is possible to dramatically increase domestic ethanol production. Similarly there is no question that it is possible to ship massive quantities of ethanol to the Northeast by barge, rail and truck. The question remains at what cost. While our region embraces the goal of increasing renewable fuels nationally and sees great promise in the development of a biomass ethanol industry in the Northeast, we are convinced that there are policy approaches to achieve these legitimate ends that are far preferable to mandating the use of ethanol in summertime RFG.

Conclusion

In sum, the Northeast States are committed to working with Congress and the Administration to develop mutually supporting and sustainable air quality and energy policies. I'd like again to thank the subcommittee for the opportunity to testify here today.

STATEMENT OF BOB SLAUGHTER, GENERAL COUNSEL, NATIONAL PETROCHEMICAL AND REFINERS ASSOCIATION (NPRA)

Good morning, I am Bob Slaughter, General Counsel of the National Petrochemical and Refiners Association (NPRA) and I thank you for this opportunity to offer our views on national energy policy. NPRA represents almost 500 companies, including virtually all of the domestic refining capacity and most petrochemical manufacturers with processes similar to refiners.

Our members supply consumers with a wide variety of products that are used daily in homes and businesses. These products include gasoline, diesel fuel, home heating oil, jet fuel, lubricants and the chemicals that serve as the "building blocks" in making products as diverse as plastics, clothing, medicine and computers. For many of our members, energy is both an input and output. Thus, discussion of the direction for our nation's energy policy is of vital and direct interest to them. NPRA's members are eager to be part of the dialog to identify ways to develop additional energy supplies, enhance national security and use energy more efficiently.

In this testimony, we would like to:

- provide our perspective on the current energy situation and how it developed;
- highlight several key regulatory programs that have made, or will soon make, it more difficult to meet consumers' energy needs; and
- identify fundamental policy principles that we think should be used to shape new energy policy directions.

In the past year or so, consumers have experienced supply and cost impacts from disruptions in heating oil, gasoline, natural gas and electricity markets. While

weather, unforeseen equipment problems in the energy supply and distribution infrastructure, and changes in consumer demand patterns all can play a role in increasing costs, government policy also is a major determinant of whether adequate supplies of energy will be available at reasonable cost.

It has been many years since we've had a serious national debate on energy policy. For much of the last decade or two, low prices and plentiful supplies have enabled consumers to take energy for granted. As a result, policies have often been pursued in a piecemeal fashion and without the necessary attention to their impact on our overall supply of energy and on the mix of individual energy supply sources. As a nation, we have not seen the "big picture" because we often have not examined the cumulative impact of regulatory programs nor have we fully balanced other important national goals such as environmental improvement with the need to maintain reliable domestic energy supplies. Too often, we have not acknowledged the difficult tradeoffs inherent in major policy decisions. We have, at times, even assumed that these tradeoffs do not exist. Although as electricity customers in California can attest, reality does eventually intrude.

Thus, our recent energy situation has been characterized by: 1) significant concerns about heating oil prices in the Northeast last winter after a prolonged cold snap; 2) shortages of gasoline in the Midwest early last summer with prices that exceeded $2 per gallon; 3) natural gas prices that hit a record high this winter resulting in consumer heating bills estimated at triple last year's levels; and 4) rolling blackouts in California and very high electricity prices throughout the West with concerns being voiced about the ability to meet electricity demand this summer in cities such as New York and Chicago.

Overall, our national energy policy, such as it has been, has resulted in the following:

- Domestic oil production is declining.
- Domestic natural gas production, while growing, still has not returned to where it was in the early 1970's.
- Imports of crude oil and refined petroleum products are increasing.
- Refining capacity is stretched to its limit and the prospects for expansion are limited by regulatory policies.
- The nation's energy delivery infrastructure is aging and increasingly overwhelmed by demand, with new construction and/or expansion made more difficult by regulatory impediments.

According to the Energy Information Administration's (EIA) Annual Energy Outlook 2001, total U.S. energy consumption in 2000, by fuel source, was:

- 39 percent oil
- 23 percent natural gas
- 22 percent coal
- 16 percent nuclear, hydropower and non-hydro renewables

While on the surface this may seem like a reasonably diverse mix of energy use, critical sectors of the economy are much more heavily reliant on a particular energy source.

For example, barring unforeseen technological advances, petroleum products will be needed to provide the vast majority of transportation fuels for at least the next decade or longer. EIA estimates that petroleum use for transportation will increase by 5.6 million barrels per day (MMB/D) between 1999 and 2020.

However, domestic refiners are increasingly challenged in just meeting existing demand. Since 1983, the number of U.S. refineries has decreased from 231 to the 152 that are operating now. While total refining capacity has remained relatively stable throughout this period, demand has increased dramatically. Thus, for a substantial period of the last year, refineries were running at or near their operational maximum. The overall U.S. refinery utilization rate peaked at 97 percent last summer but was as high as 94 percent in December (based on EIA data). As the attached graph from the recent National Petroleum Council (NPC) study ("U.S. Petroleum Refining: Assuring the Adequacy and Affordability of Cleaner Fuels") shows, U.S. demand for petroleum products exceeds domestic refining capacity, hence the growth in refined petroleum product imports (see attachment 1).

Due to both financial and regulatory constraints, it is rather unlikely that new refineries will be constructed in the United States. Indeed, there has been no new refinery built in about 20 years. Rates of return for refineries have averaged about 5 percent in the last decade, roughly equivalent to the return from a passbook savings account—but with much greater risk. In the same period, refiners were required to make substantial capital investments to meet environmental requirements—investments that the NPC estimated were greater than the book value of the refineries themselves.

Since there are few currently viable substitutes for petroleum-based transportation fuels, the emphasis in the environmental arena has been on reducing emissions and making petroleum products cleaner burning. Since the Clean Air Act Amendments of 1990, refiners have had to:

- reduce the volatility of gasoline (as measured by its RVP);
- introduce oxygenated fuels in carbon monoxide nonattainment areas;
- reduce on-highway diesel fuel sulfur levels;
- introduce Federal reformulated gasoline in 1995 with a second phase requiring even more stringent emission reductions in 2000.

And, refiners face even more challenges ahead. As this chart demonstrates (see attachment 2), an avalanche of new environmental requirements faces refiners—most of which fall within the same narrow time period for implementation. While I will address a couple of these programs later, the investment requirements that refiners face will be substantial and may raise questions about their continued viability. NPRA estimates that some $20 billion must be spent over the next decade to comply with newly issued or anticipated gasoline and diesel fuel requirements. The recent closure of one Midwest refinery is a reminder that we cannot assume that all existing refineries will continue to operate.

Thus, for domestic refiners to maintain or grow capacity, expansions must be made at existing sites. The alternative is to meet increased demand with increased imports of petroleum products. Unfortunately, EPA's permitting programs and the retroactive reinterpretation of its rules has made expansion of existing capacity an even more formidable challenge. I will discuss this in more detail later. Further, the product distribution structure is already severely challenged, even without new fuel requirements. This chart (attachment 3) was prepared by ExxonMobil and identifies current fuel requirements within different regions of the United States. A complicating factor in recent years has been the addition of area-specific and State requirements (so-called "boutique" fuels) to the Federal programs already in place. As you can see from this map, more than 16 categories of gasoline are represented (14 shown in color on the map plus conventional gasoline meeting Northern and Southern volatility requirements) . Assuming three grades (regular, midgrade and premium) of each type of gasoline, there are almost 50 distinct gasolines represented on this chart. That is before any new requirements are considered. Pipelines and fuel terminal operators struggle to keep all these grades separate. In the future, they could be faced with the need for additional segregations and new storage tanks to maintain compliance and fuel integrity. Yet, they, too are faced with additional constraints on their operations and, like refiners, find it difficult to expand their facilities. Recent experience with the Longhorn pipeline is an example of new constraints that pipelines face since Longhorn had to commit to not carrying fuels containing MTBE in order to gain permits and the necessary approvals.

The proliferation of these many different requirements has led to increased volatility in gasoline markets and to reduced flexibility in shifting available supplies to areas that need fuel the most. As we saw in the Midwest last summer and California previously, differing fuel specifications can severely limit the ability to move supplies to areas that are short.

When demand exceeds supply, market economics operate so that price becomes the allocation mechanism for any available supplies, hence the type of price spikes seen last summer in Chicago. The former chairman of the Federal Trade Commission (FTC), Robert Pitofsky, in reference to the Commission's report on Midwest gasoline prices, noted that "while there were many short-term causes of the increases, the underlying lack of U.S. refinery capacity threatens similar price spikes in the future in the Midwest and elsewhere."

Looking ahead, fundamental changes in energy markets have increased the potential for supply constraints and price volatility. Due to these changes, it is even more important that future government policies be fully evaluated to determine and understand the impact on energy supplies. However, first we must deal with several ongoing initiatives that we believe pose threats to future energy supplies.

The first is EPA's New Source Review enforcement program, which, for refiners, began in 1999. Let me be clear, the refining industry is not arguing against enforcement, rather we are asking for fairness in ensuring compliance by all. EPA has been engaging in retroactive reinterpretation of its permitting rules—what we see as regulation through enforcement rather than through a public rulemaking process. In doing this, EPA has focused on two energy providers that already face increasing difficulties in meeting consumers' energy needs—utilities and domestic refineries. In short, EPA is seeking to fine those who acted in good faith but who failed to comprehend the incomprehensible—EPA's reinterpretation of the rules after the fact.

EPA has reinterpreted its rules covering modifications to existing facilities long after those modifications have been completed. Companies have been faced with potential fines in the millions and pressed to make binding commitments for installing specific, additional emissions reduction technologies at their facilities. Three have settled with EPA simply in order to get on with their business, others are talking with EPA and others have already begun or are considering legal challenges to EPA's actions. EPA's enforcement reinterpretations center on two key elements of the NSR permitting requirements, 1) the provisions allowing exemptions for routine maintenance, repair and replacement activities, and 2) calculation of whether an action resulted in significant emissions increases using a discredited method for determining emissions based on "potential" rather than actual emissions.

Senators Inhofe and Breaux have recently sent a letter to Vice President Cheney questioning EPA's approach. We agree with their concern that unless addressed,". . . EPA's implementation of NSR permitting requirements will continue to thwart the nation's ability to maintain and expand refinery capacity to meet fuel requirements." We also agree that "EPA's NSR interpretations have created great uncertainty as to whether projects long recognized to be excluded from NSR permitting can be undertaken in the coming months to assure adequate and reliable energy supplies."

Also as noted earlier, refiners face an avalanche of new regulatory requirements that will require many facility modifications. The effect of the uncertainties surrounding EPA's NSR interpretations will be to slow down future modifications necessary to produce complying fuels and to discourage expansions of refinery capacity. Remember, that the industry's ability to meet consumers' demands for fuels today in part depends on these modifications now questioned retroactively by EPA. If refiners had not acted—and they acted in compliance with interpretations of the law and regulations at the time—we would be worse off today and quite likely be facing reduced fuel supplies and higher costs. Unless capacity can be further expanded to meet increasing demand, domestic fuel supplies will grow tighter and markets more volatile.

NPRA hopes that this committee will give thorough review of EPA's NSR program implementation a high priority. Further, it may well be time to reassess this program. Of course, for the sake of equity, consideration of future action will need to consider those who have settled with EPA so as not to place them at a disadvantage.

Companies need greater certainty if they are to move forward. The current uncertainty threatens the implementation of key environmental programs such as the Tier II low sulfur gasoline program. This program begins in just a few years and will require numerous refinery modifications. Yet, because it is both difficult to determine when an NSR permit is needed and quite time-consuming to secure permits, the current state of the program may prevent the timely introduction of cleaner burning fuels.

This is a key time not only to address the problems of the past, but also to consider improvements for the future. For example, flexibility in meeting requirements could be enhanced by greater use of market-based incentives in permitting programs. The effectiveness of market-based incentives has been demonstrated in the successful sulfur dioxide trading program implemented under the acid rain provisions of the Clean Air Act. Administrator Whitman, in her recent letter issuing EPA's fiscal year 2000 Annual Report, highlighted the importance of these types of incentives.

Ideas such as cap and trade, averaging and "bubbling" (setting an emissions target for a facility, not for individual processes or pieces of equipment) should be explored as ways to provide assurances of environmental improvements without further constraining refiners' ability to operate and their ability to produce needed fuel supplies. The bottom line is that fuel supplies will be further strained unless a more flexible, efficient and streamlined permitting process can be developed. NPRA urges the Administration to review EPA's existing enforcement initiative and to include improvements in the permitting process as essential elements of national energy policy.

One need only look to California to see some of the impediments that overly complex and confusing permitting processes can play in impeding the development of energy supplies. We understand that, in response to the electricity shortages, Governor Davis has ordered an expedited process to be applied to new electric generation capacity. Another EPA initiative that could severely jeopardize fuel supplies and economic growth is the ultra-low sulfur diesel program that was quickly adopted in the waning days of the previous Administration. The refining industry is committed to lowering sulfur in diesel fuel, having offered its own proposal to reduce sulfur by 90 percent from today's levels. However, EPA adopted a less cost-effective

program by choosing a reduction of 97 percent and an effective date of 2006. As a result, future diesel fuel supplies are in jeopardy and vital parts of the economy are at risk. Most goods in the United States are shipped by truck, including agricultural products.

Regarding the threat to fuel supplies, Charles River Associates (in a study commissioned by API) determined that the EPA proposal would result in an average supply shortfall of 12 percent versus current supplies. However, that is a national average and regional shortfalls could be greater—Charles River Associates estimates that the Rocky Mountain region could face a shortfall of 37 percent.

And, to make matters more difficult, the program's effective date forces refiners to make major investments in the same timeframe that they must modify refineries to produce low sulfur gasoline. These overlapping timeframes raise serious questions about the availability of the engineering and construction resources needed to tackle both programs simultaneously. As a result, the previously mentioned National Petroleum Council study cautioned that". . . a significant risk of inadequate supplies will result."

During the course of the rulemaking, the agricultural community, food marketers, trucking industry and even the Department of Defense raised concerns about diesel fuel availability and cost. The nation's largest producer of truck engines also questioned EPA's analysis of the rule, indicating that its estimate of the potential engine costs (using a combination of as yet unproven technologies) to meet the heavy duty truck standards is some six times higher than EPA's.

NPRA tried many times to convince EPA to study this rule further before deciding on a standard that could mortgage future fuel supplies. We urged that they take the time to fully appreciate the energy supply impacts as well as the environmental benefits through an independent analysis by a third party such as the National Academy of Sciences. We would continue to welcome such an assessment. Meanwhile, we are pursuing every avenue, including litigation, to focus attention on and fix a rule that we think will have severe supply consequences. Simply put, we are very concerned about the current timeframe for this rule and think it should be adjusted. Such a step would correct the supply problems associated in this rule without undercutting its environmental benefits.

A third area of concern for future energy supplies relates to efforts to reduce the use of MTBE. The Clean Air Act Amendments of 1990 require the use of oxygenates, such as MTBE in Federal reformulated gasoline (RFG) to ensure that an average of 2 percent oxygen by weight is maintained in this fuel. Oxygenates, like MTBE and ethanol, can assist in the production of cleaner burning fuels. They help expand the overall amount of gasoline supplies, add octane for better fuel performance and help reduce the use of other blending components that may make it more difficult to achieve lower emissions. However, oxygenates also present tradeoffs. MTBE can move farther and faster through the soil and into groundwater supplies should there be a spill or leak. Ethanol requires the use of lower volatility blendstocks to compensate for the increase in evaporative emissions otherwise associated with ethanol fuels. Since ethanol rapidly separates out from the gasoline blend when even small amounts of water are present, ethanol blends generally cannot be shipped through pipelines, requiring special blending equipment and additional storage tanks at fuel terminals.

Several States, including California, New York and Connecticut, have set deadlines for ending the use of MTBE in gasoline due to groundwater concerns. However, MTBE does currently play a significant role in supplementing gasoline supplies. MTBE represents about 4 percent of the nation's gasoline supply on average, and even more in RFG areas on the coasts—11 percent. Thus, we must fully understand the implications of actions to reduce its use on gasoline supplies.

NPRA supports strong underground tank enforcement and prompt clean-up of water already affected by MTBE. Further, if MTBE use is reduced, the 2 percent RFG oxygen mandate should be eliminated, while the air toxics reductions achieved in RFG with the help of oxygenate blending are maintained. Renewables, such as ethanol, can help expand our fuel supplies, but, given the logistics constraints on their shipment, they must be allowed to be used where they make the most sense. Ethanol will continue to grow in importance as a source of fuel octane, but forcing its use through mandates will increase consumers' fuel costs.

In closing, let me address the question of what should guide future energy policy. We suggest the following as key guidelines to follow:

1. Don't pick a favorite. The nation is best served by a diverse portfolio of energy supplies. Natural gas is a good example of a fuel whose consumption pattern has been changed by government policy. A few of us still remember the 1970's when concerns about natural gas supplies led, for a time, to prohibition of its use for electricity generation. More plentiful supplies in much of the intervening period have

generally erased that memory. Yet, environmental policy objectives have led to increased natural gas use for electricity generation. This trend seems likely to continue absent a serious commitment to improving clean coal technology or a change in attitude regarding nuclear power. Indeed, natural gas use for electricity generation (excluding cogeneration) is projected by EIA to triple over the next two decades. EIA expects that 89 percent of new electricity generation built between now and 2020 will be gas-fired. Absent additional natural gas supplies in the United States (and Canada) and additional pipeline capacity to transport these supplies, questions arise regarding the continued availability of natural gas and natural gas liquids as reliable and affordable petrochemical feedstocks that allow domestic petrochemical producers to be competitive in global markets.

2. Provide access. Many areas in the United States have been placed "off limits" for oil and gas exploration and development. We understand concerns for protecting the environment of these areas. However, technology is available to minimize the development "footprint" and to help prevent adverse impacts. If we are to enhance domestic supplies, access is needed to promising areas for domestic oil and gas development.

3. Encourage new technologies to revitalize traditional energy sources. For example, domestic coal reserves are considerable and coal could continue to play a key role in our energy equation if "clean coal" research and development was given greater emphasis and encouragement. Contributions made in one energy sector can have important benefits in others. For instance, coal could make an important contribution in powering future electricity generation in an environmentally acceptable manner and thus allow natural gas (and natural gas liquids) to provide reliable feedstocks for petrochemicals where there are few, if any, substitutes.

4. Don't forget the full energy supply chain. While a focus on "upstream" issues such as improved access to promising acreage is important in order to expand the "input" side, oil and gas are raw materials that must be converted into consumer products and delivered to end users. As noted earlier, there is a critical need to remove existing impediments to expanding refinery capacity as well as to continue to seek policy enhancements that can maintain, or increase, domestic supplies. Similarly, emphasis should be placed on improving our domestic product distribution infrastructure.

5. Strike a sensible balance. As we know from our own lives, decisions involve tradeoffs. We all could probably agree that we should work to preserve the dramatic environmental improvements that have been made in the last few decades. However, we all also can agree that Americans would like to continue to improve their lifestyles and encourage further economic growth. In order to honor all these goals, we must first fully understand the implications of policy choices and then carefully weigh the tradeoffs inherent in those choices. Recently, we have not focused on our nation's energy needs as much as we should. We need to strike a better balance between environmental goals and our need for reliable energy supplies. These need not be incompatible goals, but we do need to work on the right balance. There are policy tools that can help us make more informed decisions and more fully understand the tradeoffs we face. Thus, you might consider the development of energy impact analyses for major rulemakings. Similarly, periodic review of the cumulative effects of regulations could help us understand whether the balance is shifting too far in one direction or the other.

6. Pursue improvements in how regulations are made. Lessons have been learned about how to develop more effective, and more efficient, regulations. It is time to put those lessons to work for us in developing national energy policy. We should set performance goals rather than mandating the use of specific technologies or setting product specifications. The command and control approach stifles innovation. We should avoid overlapping leadtimes for regulatory programs whenever possible. Costs will be greater for programs that must compete in the same time period for necessary goods and services to ensure compliance. We should enhance flexibility through market-based mechanisms and incentives. Emissions credit trading has been demonstrated to lower compliance costs. Incentives could help encourage earlier introduction of cleaner fuels without jeopardizing refiners' viability through unrealistically stringent mandates. We must rely on the best information available to inform our policy choices. Use of sound science and cost-benefit analyses would help us better understand the tradeoffs in policy decisions.

Finally, while I have concentrated on how to enhance energy supplies today, we cannot forget about the demand side of the equation. Improving the efficiency of energy use should also play a vital role in helping us meet our energy needs. For example, lighter weight materials can assist in improving vehicle fuel economy. Incentives for the purchase of higher fuel economy vehicles might also be considered. Im-

provements in our roads to improve traffic flow and reduce congestion can also help conserve our energy resources.

Thank you again for the opportunity to share our views. I look forward to responding to your questions.

STATEMENT OF CARLOS J. PORRAS, COMMUNITIES FOR A BETTER ENVIRONMENT

Honorable members of the Senate Committee on Environment and Public Works: Thank you for this opportunity to address the committee. My name is Carlos J. Porras. I am the Executive Director of Communities for a Better Environment (CBE), a 23-year-old environmental health and justice organization with over 20,000 members throughout California. CBE works directly with people who live in some of the most polluted urban areas of California, many of whom live in the shadows of oil refineries, to identify feasible, cost-effective means to reduce pollution and improve safety while still retaining jobs. Since the time it was signed into law by President Richard Nixon, to the time it was amended by President George Bush, Sr., the Federal Clean Air Act has enjoyed bi-partisan support. Implementation and enforcement of the Act has brought the nation slowly and gradually closer to the day when all Americans will breathe healthful air, while also allowing the longest sustained economic expansion in the nation's history. The Clean Air Act displays a delicate balance of environmental and economic interests that has served the nation well.

1. Southeast Los Angeles: A Toxic Hotspot

Some of CBE's work has focused in Southern California on the communities of Southeast Los Angeles County (SELA). SELA is a predominantly Latino community that is also home to the highest concentration of toxic chemical generating facilities in the nation. CBE's research has uncovered a strong correlation between the location of facilities listed on the toxic release inventory (TRI) and the percentage of people of color living in the area.[1] This correlation has been called "environmental racism," or "environmental injustice." Additionally the closer one looks at our communities the more one recognizes the congestion caused by multiple toxic facilities, this is a phenomenon called "toxic hot spots."

2. Powerine/CENCO: A Case Study in the Importance of the Clean Air Act New Source Review Requirements

I came to work in the environmental arena not in as a back-packer or hiker, but out of necessity from being a labor union president whose members were subjected to frequent accidents, explosions, and releases from one of the worst refineries in California—Powerine. After a struggle of many years, Powerine ceased operating in 1995. Now a new company called CENCO seeks to reopen the refinery without first installing the Best Available Control Technology (BACT), in plain violation of the Federal Clean Air Act.

Santa Fe Springs, the home of the Powerine Refinery, is located in the southern portion of Los Angeles County, 12 miles from downtown Los Angeles. The area of Santa Fe Springs is slightly more than 9 square miles with a resident population of 16,400 and a daytime employment population of approximately 80,000.[2] The ethnic composition of city residents is 67 percent Latino.

Powerine was identified by the South Coast Air Quality Management District ("SCAQMD" or "Air District") as having the worst record for air quality violations and public complaints of any refinery in the South Coast Air Basin.[3] The SCAQMD levied hundreds of thousands of dollars of fines on Powerine for various violations of the Health and Safety code, including criminal violations, and numerous toxic chemical releases that have endangered the health and safety of area workers and residents.[4] The Santa Fe springs Fire Department Chief has stated that "The Powerine Refinery generates and abnormally high number of releases [[of toxic gases]."[5]

Powerine is among a small handful of refineries in the State still using the deadly chemical hydrofluoric acid (HF), which was used as a chemical warfare weapon during World War One. A May 1989 Los Angeles Times article revealed that Powerine was not adequately equipped to handle a major HF leak. An accidental release of

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[1]CBE Report, "Holding Our Breath."
[2]City of Santa Fe Springs, Discovering Santa Fe Springs, California, Undated Pamphlet.
[3]SCAQMD statement (October 1989).
[4]Los Angeles Time (Mar. 23, 1989); SCAQMD data bases for Jan.1, 1990—April 7, 1994.
[5]Los Angeles Times (Oct. 5, 1989).

HF from Powerine could kill hundreds, or even thousands, of area workers and residents.

In addition to accidental releases, Powerine was responsible for significant ongoing emissions, including releases of such highly toxic and/or carcinogenic chemicals as lead, mercury, benzene, cadmium, xylene, toluene, and a long list of other toxic chemicals.[6] Indeed, despite Powerine's classification as a "small" refinery, it poses almost twice as great a cancer risk to the surrounding community than does the Chevron Richmond refinery, one of the largest refineries in the nation,[7] with a throughput approximately five times larger than Powerine's.

Powerine was also responsible for dumping massive quantities (over 400,000 tons) of "criteria" pollutants into the air each year, such as nitrogen oxides (NOx), sulfur oxides (SOx), particulate matter (PM_{10}), and volatile organic compounds (VOCs).[8] NOx and VOCs form ozone, which is known to cause permanent lung scarring, asthma and emphysema, among other problems. PM_{10} has been labeled one of the most serious public health threats, causing respiratory illnesses such as asthma and emphysema,[9] and can carry cancer-causing chemicals deep into the lungs. VOCs are not only ozone-precursors, but many are also highly toxic chemicals in their own right. Despite its small" size, Powerine was ranked the ninth worst emitter of PM_{10} in the entire four-county South Coast Air District, and among the top 20 worst for ROCs and SOx.[10] For 1991 and 1992, Powerine was the twelfth worst overall polluter in the basin.[11] Air samples taken downwind from Powerine reveal elevated levels of air contaminants.[12]

For decades, the predominantly Latino community of Santa Fe Springs and the neighboring areas which live downwind of the refinery, have borne the brunt of Powerine's toxic pollution. The clustering of environmental hazards in communities of color has been deemed "environmental racism."

My involvement with Powerine stems from the fact that the refinery is located directly upwind from the city maintenance yard where approximately 75 members of the City Employees' Association report to work. I was the President of that union for several years, during which time employees voiced concern over unidentified noxious odors, accidental fires, ominous clouds, and paint eroding from cars parked near the refinery. These concerns, coupled with the cancer-related deaths of several yard employees prompted the Employees Association to take action to protect the health and safety of yard employees threatened by the Powerine facility.

Between February 15, 1989 and October 31, 1990 there were 46 separate complaint dates listed by the Fire Department. These included complaints about black smoke, gas oil, and rotten egg odors, SO_2 releases, and a release of deadly hydrogen fluoride gas. On March 15, 1989, Powerine and three company officials were fined $177,750 for knowingly releasing pollutants into the air between December 18, 1987 and January 2, 1989. Thirty-eight different charges were originally filed against Powerine for these releases. The fine was among the largest ever levied. Deputy District Attorney Fred Macksoud said that some of Powerine's emission violations remained uncorrected for as long as a year. "This case was an aggravated case," Macksoud said, "We put a heavy hand on these people so they'll learn not to violate clean air rules." In addition to fines of the company, three company officials were personally fined for their failures in their responsibilities to oversee faulty equipment responsible for releases.[13]

On January 7, 1992, Santa Fe Springs fire fighters were awakened by an explosion at the Powerine refinery. The three alarm fire took nearly 4 hours to knock down. The explosion and fire were caused by a propane leak that was ignited by a nearby heater. One worker was hit in the face with a piece of flying equipment and was hospitalized with an eye injury. Fire hydrant water supply was too low because water pressure had not been increased by Powerine as required. (Santa Fe Springs Fire Department Incident Report No. 200601, January 7, 1992; Daily News, January 8, 1992).

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[6]Draft Environmental Impact Report (DEIR) Powerine Oil Company Reformulated Fuels Project (Feb. 16, 1994), p. 4–14.

[7]Powerine existing cancer risk level is 14.7 per million. DEIR p. 3–12. Chevron Richmond existing cancer risk level is 8.4 per million. DEIR for Chevron Richmond Reformulated Fuels Project p. IV.D.16.

[8]SCAQMD, "The Top 20 Polluters for 1991 and 1992" (June 30, 1993).

[9]Draft Final Socio-Economic Report for 1991 Air Quality Management Plan, SCAQMD, p. 4–1 (May 1991).

[10]Los Angeles Times (Jan. 9, 1992).

[11]SCAQMD, "The Top 20 Polluters for 1991 and 1992" (Jun.30, 1993).

[12]DEIR p. 3–11.

[13]L.A. Times, (March 23, 1989), attached.

In 1993 Powerine settled a personal injury lawsuit with Patty Guthrie. She was working across the street from Powerine when a vaporized acid cloud from Powerine was accidentally released onto Ms. Gutherie's worksite (Johnson Trucking Co.). Powerine's incident report confirmed that the release was a result of a breakdown of a sulfur unit. While Powerine did not comment on the case, the woman was awarded $850,000. She alleged that she suffered from traumatic emphysema, which allows a person to inhale, but not to exhale. Her attorney commented "Her life has been cut short and she's going to have to be provided for." (Daily News, Jan. 9, 1993) Finally, after decades of such problems, the Powerine refinery ceased operations in 1995.

3. CENCO Attempts to Resurrect the Powerine Refinery

This history of accidents is highly relevant to the matter before the committee today. A new company, owned by televangelist Pat Robertson's Charitable Trust, has proposed to reopen the Powerine Refinery. CBE and the United States Environmental Protection Agency have sued CENCO in Federal District Court to require the company to comply with requirements of the Clean Air Act.

The story of the Powerine Refinery points out the importance of the Clean Air Act. It was years of inadequate enforcement of the Act and repeated violations of the Act that resulted in Powerine's long line of accidents and releases, and ultimately to the closure of the facility. If the South Coast Air District and EPA had aggressively enforced the requirements of the Act, Powerine could have been made to run cleaner, more safely, and possibly more profitably.

The proposed re-opening of the refinery by CENCO points out the importance of enforcing the Clean Air Act's New Source Review Requirements ("NSR")—the very provisions that have been put into question. The Act requires new facilities, major expansions, and facilities proposed for re-opening after long closures, to install Best Available Control Technology (BACT), through a process call New Source Review. The importance of the New Source Review requirement could not be clearer than in the case of Powerine. It is obvious that prior to opening, CENCO must upgrade the refinery to incorporate the Best Available Control Technology. This is the only way to ensure that when and if the refinery reopens, it will not again become the worst refinery in the State. It is also important for CENCO to comply with other New Source Review requirements such as the analysis of safer alternative technologies, such as the use of sulfuric acid rather than hydrofluoric acid, and the consideration of alternative locations farther from population centers. If this body weakens those New Source requirements, we can only expect a return to Powerine's days of accidents, explosions, and toxic chemical releases.

The New Source Review requirement was one of the most important compromises in the Clean Air Act. Rather than requiring all existing facilities to install modern technology immediately, NSR requires installation of Best Available Control Technology only for new construction, major expansions, or reopening of facilities after permanent closure. Congress believed that the NSR process would result in the gradual modernization of all of the nation's major polluting facilities as those facilities were expanded and rebuilt, when such retooling is most cost-effective. If this body weakens this requirement, then we can expect a future of continued operation of obsolete, polluting, and dangerous refineries and other heavy industries.

4. Refineries are the No. 1 stationary source of air pollution

The story of Powerine and CENCO is by no means unique. A Report released by CBE and the Contra Costa Building and Construction Trades Council just this week concludes that the incidence of serious refinery accidents is on the rise in recent years in at least one California County.[14] The Report recommends stricter enforcement of existing laws and adoption of new community and worker safeguards.

The United States' 164 Petroleum Refineries are the single largest stationary sources of air pollution in the country. In 1998 there were 27 refineries in Texas, 24 in California, 20 in Louisiana, 6 in Pennsylvania, 6 in New Jersey, and 6 in Illinois. Most of these refineries are decades old, and some are over a century old. Modernizing these facilities is a key to achieving clean air throughout the nation.

Refineries are the single largest stationary source of volatile organic compounds (VOCs), the primary precursor of urban smog—releasing over 246,069 tons of VOCs each year. Refineries are the fourth largest industrial source of toxic emissions, releasing over 58 million pounds per year. Refineries are the single largest source of benzene emissions—a chemical known to cause cancer in humans—releasing over 2.9 million pounds per year. Refineries also release a wide variety of other toxic

[14]CBE and Contra Costa Building and Construction Trades Council Report, "No Accident!" (April 2001).

chemicals, including MTBE, toluene (7 million pounds), xylenes (4.2 million pounds), methyl ethyl ketone (4.1 million pounds), among numerous others.[15] Refineries are the second largest industrial source of sulfur dioxide emissions, which create acid rain, the third largest industrial source of nitrogen oxides, which contribute to smog, and the fourth largest industrial source of particulate matter emissions.[16]

In addition to these reported emissions, government reports estimate that 80 million pounds of refinery VOC emissions go unreported each year, including 15 million pounds of toxic pollutants and 1 million pounds of benzene.[17] These inaccurately reported emissions point out the need for continuous emissions monitors (CEMs) at refineries and other major sources of pollution. CEMs are clearly provided for in the Clean Air Act, but the requirement has not yet been enforced adequately.

A recent study demonstrates that non-smokers living downwind of refineries experience markedly decreased lung capacity.[18] In 1995 U.S. EPA estimated that 4.5 million persons living within 30 miles of oil refineries were exposed to benzene at concentrations that posed cancer risks higher than the Clean Air Act's acceptable risk threshold, and some experience benzene cancer risks as high as 180 times the acceptable threshold.[19] Numerous studies show that communities burdened by hazardous wastes produced by these facilities and others are disproportionately often communities of color.[20]

5. There are Cost-Effective Means to Drastically Reduce Refinery Pollution While Saving or Even Creating New Jobs

More than half of refinery VOCs come from "fugitive emissions"—leaks from refinery valves, storage tanks, flanges, seals, connectors.[21] As the Waxman report concludes, many of these leaks can be sealed by "simply tightening a valve with a wrench."[22] The Report further concludes that eliminating such leaks would be equivalent to removing the VOC exhaust emissions from five million new cars.[22] Indeed, the Clean Air Act itself requires such leak detection and reporting.[23]

Through Clean Air Act enforcement actions, CBE has reached agreements with numerous refineries throughout California to install technologies to reduce VOC and other emissions. For example, CBE's collaboration with the International Longshore and Warehouse Workers Union indicated that several oil companies in Los Angeles had failed to install marine vapor recovery equipment required by the Clean Air Act to capture toxic gases released during oil tanker loading. The equipment is similar to vapor recovery nozzles common at gas stations. Through a series of enforcement actions the companies, (Ultramar, GATX, and Chevron), agreed to use the required equipment, reducing VOC emissions by over 95 percent. Some of the companies agreed to reduce VOC emissions further by installing "leakless" bellows valves on their refineries. Not only did the companies remain in operation, but they have enjoyed some of their most profitable periods in the time since the agreements were reached. In fact, some of the companies report that the newer leakless technology has reduced their operating cost since it reduces the amount of ongoing inspection and maintenance required.

CBE has a history of identifying technologies that not only reduce pollution and increase safety, but also save money in the long run. For example, CBE worked with Chevron's Richmond, California refinery to conduct a pollution prevention audit that resulted in installation of technologies that reduced lead emissions by 97 percent, reduced nickel emissions by 86 percent, and reduced chromium emissions by 67 percent.[24] CBE reached an agreement with Unocal's Rodeo refinery, now owned by Tosco, to reduce its toxic air pollution by 143 tons per year (a 28 percent reduction) through installation of leakless valves and valve tightening. CBE has worked with numerous other companies to capture pollution that would otherwise have been released into the atmosphere and turn it into usable product. CBE worked with companies in the South San Francisco Bay Area, to identify technologies that reduced

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[15]"Oil Refineries Fail to Report Millions of Ponds of Harmful Emissions," U.S. House of Representatives, Minority Staff, Special Investigations Division, Committee on Government Reform, Prepared for Rep. Henry Waxman. (Nov. 10, 1999) (Hereinafter, "Waxman Report") pp. i, 3.

[16]Waxman Report, p. 4.

[17]Waxman Report, p. ii.

[18]Detels, et al., American Journal of Public Health (Mar. 1991).

[19]EPA, "Regulatory Impact Assessment for the Petroleum Refinery NESHAP: Revised Draft for Promulgation," 211–212 (July 1995).

[20]See, e.g., "Toxic Wastes and Race," Civil Rights Commission of the United Church of Christ. (1987)

[21]Waxman Report at p. 3.

[22]Waxman Report, p. iii.

[23]40 CFR 60.482.

[24]31:8 Environment 45 (Oct. 1989)

heavy metal discharge by over 90 percent, while saving enough money to pay for itself within 5 years.[25] CBE's work recognizes that pollution is often wasted product. Pollution prevention can result in the recapture of marketable product that otherwise would have been lost to the environment.

Contrary to popular belief, enforcement of strict environmental laws can have a positive impact on the economy. A Boston University study showed that strict air pollution regulations on Los Angeles area refineries actually had a positive impact on employment, probably due to the hiring of people to install and maintain abatement equipment. The study further found that productivity at refineries forced to install pollution control equipment was higher than at other similar refineries not subject to such regulation because the need to invest in pollution abatement equipment accelerated management decisions to invest in other more productive technology.[26] Similarly, an MIT study showed "a consistent and systematic positive correlation between stronger State environmentalism and stronger economic performance across four of the five indicators. States with stronger environmental standards tended to have higher growth in their gross State products, total employment, construction employment, and labor productivity than States that ranked lower environmentally."[27] These conclusions have lead some labor organizations, such as the Building and Construction Trades Union, to collaborate with CBE and other environmental groups with the understanding that environmental enforcement can mean more jobs building and operating pollution control equipment.

6. Conclusion

On behalf of Communities for a Better Environment and its 20,000 members, I urge this committee to leave the Act in tact, and ensure that future generations will enjoy a better environment. Recent research indicates a startling connection between environmental health and learning, concluding that children who live in high pollution areas have statistically lower test scores. Approximately 12 million children in this country suffer from learning, developmental or behavioral problems, and the number of learning disabled children enrolled in special education programs increased nearly 200 percent over the last 20 years. Soaring rates of childhood asthma, especially among inner city youth, have been a particular concern. The resulting respiratory problems often diminish learning capacity and achievement. Increasingly, scientists and regulators alike are linking these adverse health effects among children to environmental pollution. With the health of our children at stake, it is clear that we must redouble our efforts to reduce harmful air pollution, not roll-back important protections that are critical to achieving healthful air quality.

In particular, CBE recommends the following public policy actions:

1. Toxic Use Reduction: Polluters should be encouraged to reduce the use of toxic chemicals and to replace such chemicals with non-toxic alternatives. The best way to reduce the release and disposal of such chemicals is to prevent their use in the first place.

2. Pollution Prevention: Polluters should be required to prevent chemicals from entering the environment, rather than focusing resources on much more expensive efforts to remediate pollution after it has contaminated soil, air, or water.

3. Precautionary Principle: The precautionary principle common in the medical field should be applied equally to the environmental field. Chemicals should be demonstrated to be safe prior to their introduction into the environment.

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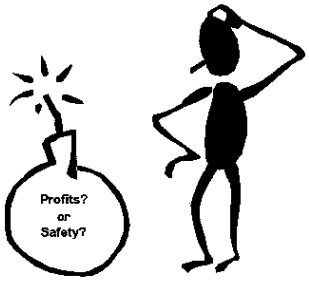
[25]CBE Report, "Clean, Safe Jobs: A Sustainable Manufacturing Model." (1994)

[26]Berman and Bui, National Bureau of Economic Research (1998).

[27]Meyer, "Environmentalism and Economic Prosperity: An Update" (Feb. 16, 1993).

No Accident!

How Industry and Government Agencies Are Failing to Prevent Chemical Spills



Major Accidents and Serious Incidents: 1999-2000
Contra Costa County-California

Communities for a Better Environment-California and Contra Costa Building and Construction Trades Council

"The first steps toward accident prevention are identifying the hazards and assessing the risks. Once information about chemical hazards in the community is openly shared, industry, government, and the community can work together toward reducing the risk to public health and safety."

"The County recognizes that regulatory requirements alone will not guarantee public health and safety, and that the public is a key stake holder in chemical accident prevention, preparedness, and response at the local level. Preventing accidental releases of regulated substances is the shared responsibility of industry, government, and the public. The first steps toward accident prevention are identifying the hazards and assessing the risks. Once information about chemical hazards in the community is openly shared, industry, government, and the community can work together toward reducing the risk to public health and safety."

"The success of a Safety Program is dependent upon the cooperation of industrial chemical and oil refining facilities within Contra Costa County. The public must be assured that measures necessary to prevent incidents are being implemented, including changes or actions required by the Department or the Stationary Source that are necessary to comply with this chapter."[1]

EXECUTIVE SUMMARY

No Accident! presents the results of an analysis of County records of industrial hazardous materials incidents and accidents. In 1999 and 2000, fires, explosions and toxic releases continued to kill and injure workers and sicken hundreds of nearby residents. Major accidents continued at the rate of almost one per month despite various new agency efforts to prevent chemical spills.

Analysis of the most recent data on file reveals an alarming failure of industry and government to come to terms with the problems of industrial accidents. Data maintained by the Contra Costa County Hazardous Materials Division reveals that:

- The County experienced 13 major accidents[2] in 1999 and 12 major accidents in 2000. Four workers lost their lives during the period, making it the deadliest 2-year period in County refinery history.
- Refineries are responsible for the vast majority of major accidents and serious incidents.

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[1]Industrial Safety Ordinance, Ordinance No. 98–48, adopted by the Contra Costa Board of Supervisors, 1998.

[2]This study reviewed official incident report records on file at the Contra Costa County Hazardous Materials Division. See the discussion of methodology below.

- A large percentage of accidents were actually worse than the facility first reported, which may have prevented appropriate response and investigation. Some facilities, especially Chevron's Richmond refinery, failed to notify the County of some accidents until confronted by offsite complaints.
- County staff failed to verify self-reported facility claims by conducting on-scene investigations 95 percent of the time in connection with serious incidents and 80 percent of the time in connection with major accidents.
- Many accidents recur at the same "repeat offender" processes that are never made fully reliable.

No Accident! concludes with a number of recommendations for action to address the need for industrial safety, including proposals designed to:

- Fulfill the promise of easy access to information regarding industrial hazards.
- Improve the accuracy of this information.
- Focus inquiry on industrial processes most likely to cause accidents.
- Ensure the effective participation in problem solving by the communities most at risk.

It is no accident that Communities for a Better Environment and the Contra Costa Building and Construction Trades Council present this report at the time that the County Board of Supervisors are considering the effectiveness of the Industrial Safety Ordinance and the need to increase participation by affected communities. Although the County has made some progress in taking regulatory initiatives to control industrial hazards, much remains to be done. The first step is to understand the scope of the continuing problem.

METHODOLOGY

Communities for a Better Environment (CBE) and the Contra Costa Building and Construction Trades Council (CCBCTC) have tracked fires, explosions and toxic releases at Contra Costa County refineries since 1989. Increasing media coverage has also generated information about major chemical spills in the area. More recently the Hazardous Materials division of Contra Costa Health Services has begun to compile its own data. This report is based on that data.

Definitions

CBE and CCBCTC have used a consistent methodology to analyze data on accidents in producing reports over the years.[3] Although Contra Costa County ordinances have repeatedly changed the definitions of "major accident" and "serious incident," CBE and CCBCTC have consistently analyzed data using the following definitions:

Serious Incident—an unplanned event at a facility that uses, stores or manufactures hazardous materials or waste that causes or has the potential to cause a significant impact on or offsite. If a serious incident causes an injury, death or offsite impact, it becomes a "major accident."

Major Accident—an incident in which the release of toxic gases, fire or explosion causes a serious impact to workers, the community, or the environment. These impacts include death, injury, illness, shelter-in-place orders (confinement), evacuations, and activation of the Community Warning System.

By contrast, the current Industrial Safety Ordinance defines "major accident" more restrictively to include only those incidents that result in the release of a Regulated Substance and meet one or more of the following criteria: (1) result in one or more fatalities; (2) result in greater than 24 hours of hospital treatment of three or more persons; (3) cause property damage (on and/or offsite) initially estimated by the Stationary Source at $500,000 or more; (4) meet the definition of a Level 3 or Level 2 Incident in the Community Warning System incident level classification system defined in the September 27, 1997 County guideline for the Community Warning System; or (5) result in flammable vapor clouds of more than 5,000 pounds. The current ISO has also eliminated entirely the definition of "serious incident."

Data Compilation

CBE reviewed summary lists issued monthly by the County to identify possible serious incidents and major accidents. For events that appeared to meet the definition of serious incident, CBE reviewed the initial intake form on file at the County as well as subsequent documentation for that event. Incidents meeting the serious incident criteria were entered into a data base containing the facility identification,

[3]See Neighborhoods at Risk, A Report on Industrial Accidents in Contra Costa County: 1989–1996 (July 29, 1996) and Rising Risks to Refinery Communities, the Troubling Trend of Toxic Spills in Contra Costa County California 1989–1997 (July 8, 1997).

the date, and a summary description of the incident. For each incident, other data elements were extracted from available documentation, including whether action was taken by the County, whether an on-scene investigation was conducted, whether the incident was more severe than initially estimated, whether workers were injured, whether a fire or explosion occurred, whether flaring or a pressure relief valve was triggered, whether a vapor cloud or smoke was released, whether a written report was prepared, and whether a root cause investigation pursuant to the ISO was undertaken.

In some cases, lengthy notes were condensed to a brief description. In other cases, only brief descriptions of the incident were available, lacking some essential information.[4]

Finally, CBE reviewed all serious incidents to determine whether they met the criteria for a major accident.

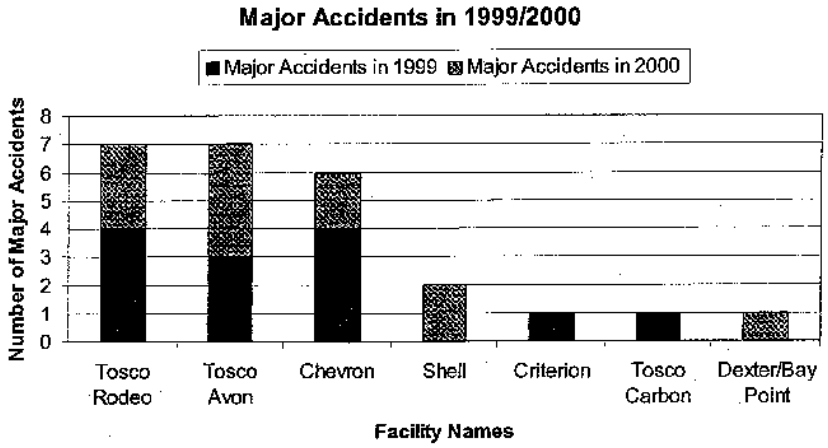
Potential For Error

Given the lack of independent monitoring data, the reliance on the County's current incident reporting program creates the potential for error in analyses such as this. In cases where data supplied to the County was flawed or incomplete, the classification of incidents as major accidents may also introduce a potential for error. Other potential sources of error include hand written incident forms by County staff which are illegible in some cases, the large number of incidents, missing forms in County files at the time of review, missing or incomplete information, lack of standard terms, and self-reporting by involved parties.

CONCLUSIONS

The Rate of Major Accidents Remains Unacceptably High

There were 25 major accidents in Contra Costa County industrial facilities in 1999 through 2000. This is more than one major accident every month. In comparison, the previous analysis reported one major accident every 5 weeks during the period January 1996 to June 1997.[5] Clearly, major accidents continue at the same unacceptably high rate.



Note that the data for the 1999/2000 period confirms the conclusion in the previous analysis that the rate of reported major accidents has risen since 1989. In the period from 1989 to June 1997, the reported major accident rate was one every 2 months. However, in the last 18 months of this period, from January 1996 to June 1997, the reported major accident rate was one every 5 weeks, leading CBE/CCBCTC to suspect an increase in the statistic. The data for the last 2 years showing more than one major accident reported every month confirms this conclusion.

[4]See the discussion below of the problems of self-reporting and the County's failure to investigate incidents.

[5]See Rising Risks to Refinery Communities, the Troubling Trend of Toxic Spills in Contra Costa County California 1989–1997 (July 8, 1997) p. 1.

Concern should be heightened by the fact that the County has adopted and implemented new programs to reduce these incidents. While some progress has been made in implementing new safety procedures and equipment, the fact that significant numbers of incidents continue to occur indicates that not enough has been done.

Some observers attribute the increase in major accidents to better reporting by industry. There is no doubt that since 1989 industry has improved its reporting in response to requirements developed by the County. The question remains whether the rate is tolerable to communities and workers.

Refineries Are Responsible for the Vast Majority of Major Accidents and Serious Incidents

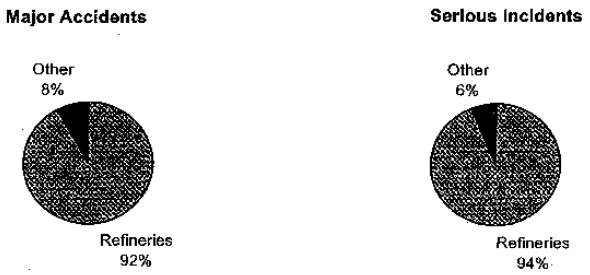
With 23 out of 25 major accidents, refineries were the leading source of major accidents in 1999 and 2000. This most recent data is consistent with past studies, which also indicate that refineries are the leading source of major accidents.

With 7 major accidents at both the Rodeo and Avon Facilities, Tosco had the poorest record in the County. Chevron had 6 major accidents in the 2-year period. The Shell refinery in Martinez had 2 major accidents.

Chevron is not covered by one of the new County programs designed to reduce industrial accidents, the Industrial Safety Ordinance, because it is located in the city of Richmond rather than in County jurisdiction. Richmond has failed to adopt a parallel Industrial Safety Ordinance, despite the passage of a City Council action and the participation of Richmond City staff in a parallel environmental review process with the. County. Because of this lack of action, Chevron enjoys less safety oversight than any facility in the County. It appears that workers and local residents may have paid a price for this lack of oversight.

In addition to major accidents, serious incidents at Contra Costa industrial facilities continue to plague the region. Review of County Hazardous Materials Division files shows that most of these incidents occur at oil refineries. Chevron, Tosco Rodeo, the Avon refinery (Tosco/Ultramar), and Shell were responsible for 202 of the total 216 serious incidents in 1999 and 2000. The fact that refineries in the County are responsible for 94 percent of serious incidents is consistent with past analyses.

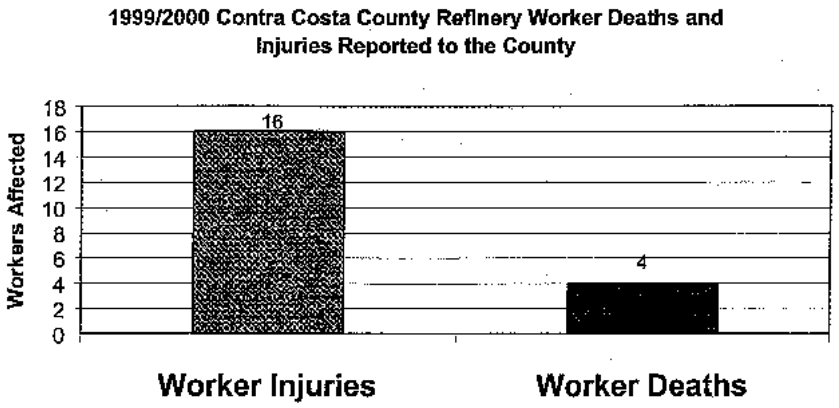
Refinery Share of Major Accidents and Serious Incidents



It may well be that refining industry pressures to exceed past performance and to increase competitive advantages have overwhelmed remedial efforts. Many facilities may have engaged in cost cutting measures, increased production and delayed maintenance, which in turn may have out-paced any new safety improvements. During this period, refineries have been bought, sold, and affected by mergers. These industry efforts together with other market forces have led most oil companies to post extremely high profits in 1999 and 2000.

Major Accidents Continue to Kill and Injure Workers

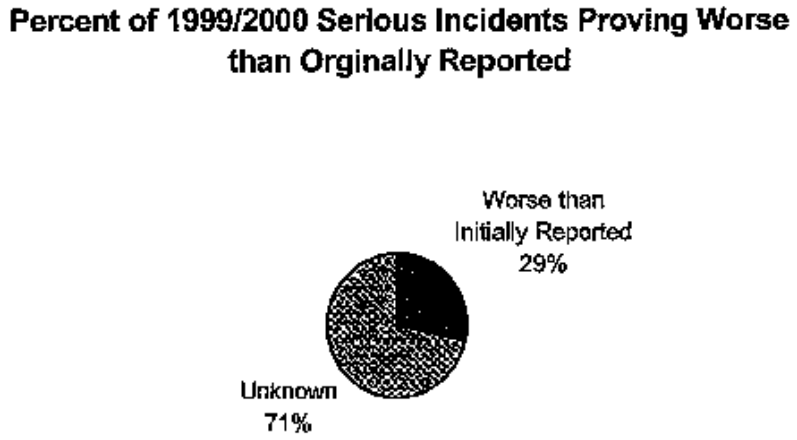
Worker deaths and injuries on the job continue to occur at alarming rates at Contra Costa County refineries. In 1999 and 2000, at least 16 injuries and 4 deaths were reported to the Contra Costa County Hazardous Materials Division. In fact more injuries may have occurred because workplace injuries are not always reported to the County. Worker injuries are usually reported to CAL OS HA, which is responsible for worker health and safety issues.



When four workers were killed and one seriously injured while working on an operating unit at Tosco Avon, the accident became the County's worst. In response, the public pressured County Supervisors to request closure of the facility so an independent safety review could be conducted. Tosco reluctantly accepted the recommendation of a committee of various stakeholders that it submit to a broad review of the facility's safety culture. The review by A.D. Little revealed serious flaws in Tosco management's approach to safety at the facility. Other plants have not been subject to this kind of review.

Facilities Underestimate Incident Severity

The survey of reports made to the County of serious incidents at industrial facilities indicates that in at least 29 percent of serious incidents the facility acknowledged that it had initially underestimated the problem. Because many of the County incident forms did not contain this information, it was unknown in over two-thirds of the cases whether industry had accurately reported incident information. Thus the underreporting problem may be even more serious.



In several cases in 1999 and 2000, Chevron did not report serious incidents until neighbors or the Sheriff alerted the County of a problem. On one incident report, a frustrated county staff member wrote that Chevron was not following the notification process in a proper and legal manner.

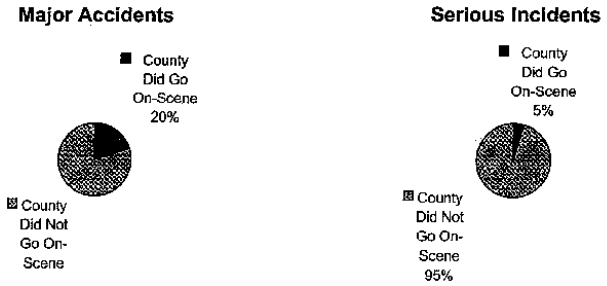
In many cases, a refinery reported a process upset that was expected to have no offsite impact. However, the facility was forced to report later that it had underestimated the problem. In some cases, these incidents became major accidents.

The County Usually Fails To Conduct On-Site Investigations To Verify Reports

In only 5 percent of serious incidents reported by industrial facilities did the County Hazardous Materials staff verify industry claims by going to the scene. In 95 percent of serious incidents, County staff relied on the facility's self-reported information to make decisions. This failure to verify incident reports may encourage the tendency noted above for facilities to underestimate the severity of incidents. Available data indicates that initial reports underestimated the severity of problems at least 29 percent of the time. The actual statistic may be far greater due to lack of on-scene investigation.

Even in connection with major accidents, the County conducted an on-scene investigation only 20 percent of the time.

Frequency of 1999/2000 On-Scene County Investigations to Verify Facility Claims



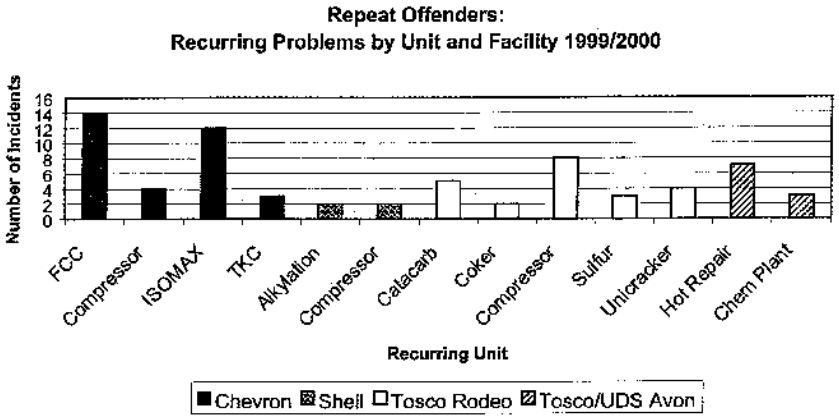
The combination of industry's underestimation of the seriousness of incidents and government's failure to investigate impedes a full understanding of the nature, severity, and causes of accidents and inhibits the development of effective long-term solutions. Without adequate information about the problems, responses will likely be inadequate and workers and communities will remain threatened. . The fact that workers continue to be injured and killed as a result of chemical accidents suggests that more rigorous investigation techniques are justified.

Investigation of the scene of an incident and verification of claims by industry officials are standard techniques that are key to compliance and enforcement. Rather than utilizing these techniques, the County has continued to rely on self-reporting by facilities that may be of questionable accuracy.

In order to encourage accurate reporting and response to the serious problem of chemical accidents in Contra Costa County, CBE and CCBCTC continue to urge that onsite investigations of potentially serious incidents be conducted by County staff.

Recurring Incidents Demonstrate a Failure To Remediate Problems

Many of the serious incidents and major accidents at Contra Costa County refineries are due to recurring problems at certain process units that remain unresolved and result in continuing accidents. An examination of County records for 1999 and 2000 shows that, over and over again, incidents occurred in the same problem areas, even after the facility claimed to have solved the problem and resumed operations.



Chevron's refinery was the worst facility for recurring problems in the County with a total of 33 incidents involving the same 4 units. Fourteen serious incidents occurred at Chevron's FCC unit alone. Twelve serious incidents occurred at a related unit, the Isomax. Both the Isomax and the FCC units had experienced major accidents in past years. These units were involved in Chevron's controversial reformulated fuels project, which was challenged by community and environmental groups as increasing pollution and accident risks from increased intensive refining methods. Since Richmond has failed to adopt the County's Industrial Safety Ordinance approach, there is no adequate County oversight or public opportunity to examine and find root cause solutions. Instead Chevron controls self-investigations and solutions, which are apparently ineffective.

Tosco's Rodeo refinery closely followed as the County's second worst facility for recurring problem units with a total of 22 incidents involving five units. Recurring problems caused serious incidents in the refinery's Unicracker unit, gas compressors, Catacarb, sulfur plant, and Coker unit, again and again. Several of these units have had major accidents in past years.

The Tosco Rodeo Catacarb problems are particularly troubling due to the 1994 major accident that sickened hundreds of workers and thousands of neighbors. It appears that problems in the process have not been fully resolved by Tosco or the County. In 1994, a 16 day leak was blamed on delayed maintenance as officials sought to exceed past production records. Whether delays in maintenance continue to be a problem should be carefully investigated. Another factor in the accident was the County's failure to conduct an on-scene investigation to verify management's claims that emissions were not traveling offsite.

Tosco Rodeo is also experiencing continuing problems at its gas compressors which apparently cannot accommodate various unit upsets. As a result, toxic gases have had to be released through flares and relief devices into the community and the environment. Again, gas compressor failures had been previously identified as a problem in a 1995 audit. Apparently company and County efforts were ineffective in preventing continuing problems. Likewise, problems at the facility's sulfur plant and at an area known as the sulfur pit are recurring. This area has experienced a number of fires over the years, which is of particular concern.

One apparent success is the replacement of the old ground flare adjacent to Hillcrest school, which caused major accidents in 1999 and in previous years. However, this problem was identified in 1995 and thus took at least 4 years to solve. Is this the speed at which we can expect other serious problems to be solved?

The Avon refinery, operated for most of the period by Tosco and recently taken over by Ultramar, was the fourth worst for repeat problems. Most of the problems resulted from the practice of attempting to repair units and problems while operations continued rather than shutting down the facility first. This troubling trend continued despite the tragic incident that killed four workers and seriously injured another while the workers attempted repair on an operating unit.

RECOMMENDATIONS

Based on review and analysis of Contra Costa County records of information reported by industry about incidents and accidents in the region, CBE and CCBCTC make the following recommendations to the County and other agencies:

1. Make data on incidents at Contra Costa County easily available in a timely fashion to fenceline neighbors and the public via the Internet and other effective methods.

2. Require County staff to compile and analyze incident data on a monthly basis and make it readily available to the public. Analysis should include the categories included in this study at a minimum. The County's Hazardous Materials Ombudsperson is the logical independent party to conduct this review and analysis.

3. Require County Hazardous Materials staff to conduct on-scene investigations during all potentially serious incidents in order to verify facility claims and to gauge appropriate response. In addition, County staff should be required to conduct on-scene investigations of incidents on a regular basis by random selection to ensure accurate reporting by facilities.

4. Target recurring problems with repeat offender units and processes at Contra Costa County facilities by County officials for immediate action under the ISO and other appropriate regulations. Surprise inspections of such repeat offenders should be conducted immediately.

5. Mandate investigations by the California Air Resources Board (CARB) that explore linkages between its reformulated fuels requirements and increased and repeat accidents and harmful emissions at Bay Area refineries. Existing problems with the production of reformulated fuels must be addressed immediately in a comprehensive fashion by all agencies.

6. Require facilities that violate the notification policy, either by delay or underestimation of the impact, to install state-of-the-art fence line monitoring systems, such as the one in use at Tosco Rodeo. Continued failure to report incidents in a timely and accurate fashion must be met with requirements aimed at providing the County with independent monitoring and with stiff penalties for the violators.

7. Implement basic video monitoring of facility flares and sites to enable officials to verify immediately the extent of possible offsite impact during incidents. Kentucky, for example, has operated such a system for years. Facilities should bear the cost of such a system.

8. Amend the County's Industrial Safety Ordinance to (a) expand the definition of a "major accident" to ensure more frequent investigations and root cause analyses in order to prevent more accidents, (b) give the Board of Supervisors the power to require safer systems rejected by the facility for cost or other inappropriate reasons, and (c) require adequate training of contract workers in accordance with the California State-certified apprenticeship training programs.

9. Enact a parallel Industrial Safety Ordinance in the city of Richmond in 2001 to ensure that facilities operate under the same safety programs as their competitors in the County.

10. Implement outreach programs to increase the meaningful participation of Environmental Justice communities in safety programs. Such programs should rely on the proven success of past efforts led by community-based organizations.

11. Investigate the implementation of the ISO and other programs designed to ensure the safety of industrial neighborhoods to determine whether it has violated the County's promise of equal protection under the new Environmental Justice Policy. The Board of Supervisors should lead this investigation.

STATEMENT OF TAYLOR BOWLDEN, AMERICAN HIGHWAY USERS ALLIANCE

Mr. Chairman and members of the subcommittee, thank you for the invitation to appear before you today. I am Taylor Bowlden, vice president of the American Highway Users Alliance. The Highway Users represents both motorists and a broad cross-section of businesses that depend on safe and efficient highways to transport their families, customers, employees, and products. Our members pay the bulk of the taxes that finance the Federal highway program, and they want those taxes used to make highway travel safer and less congested.

We are pleased to have this opportunity to discuss with the subcommittee the important issue of motor fuel consumption and demand in the development of our nation's energy policy. Today, I will address three specific issues in the purview of the Environment and Public Works Committee that should be considered in Congress' energy policy debates:

- The importance of easing traffic congestion in order to reduce fuel consumption;
- The need to streamline the environmental review process to expedite congestion relief projects; and
- The adverse impact on fuel prices and highway improvements associated with legislative proposals to mandate ethanol use in motor fuels.

Traffic Congestion and Fuel Consumption

Most Americans observe it in their daily commutes, and more objective data verify that traffic congestion has grown worse in cities across the country during the past decade. Moreover, economic and demographic forecasts suggest that this trend will continue for the foreseeable future, although most experts agree that the annual increase in highway travel demand should begin to slow relative to the dramatic jumps reported in recent years.

A few statistics will illustrate the problem succinctly. Since 1970, America's population has grown by 32 percent, but the number of licensed drivers has doubled that pace, growing by 64 percent. The number of vehicles has increased by 90 percent, and the miles we drive those vehicles has skyrocketed by 132 percent! Yet, during the same period of time, road mileage has increased by a mere 6 percent.

The statistics only make clear why congestion has grown. The adverse economic and social consequences are evident in the daily experience of ordinary commuters and commercial shippers and carriers across the country. Alan Pisarski, an internationally known transportation consultant and author of the definitive study on commuting (called "Commuting in America"), made the following observations at a recent congressional hearing:

- When workers hit the road at 5 am and then sleep in their cars in parking lots at the office or at transit stations, the system is failing;
- When commuter routes are congested in the reverse direction—outbound in the morning; inbound in the evening—the system is failing;—When peak period spreads over so many hours that truckers cannot afford to get off the road and wait out the rush hour, the system is failing;—When small incidents cause monumental tie-ups or a fender-bender becomes a 100 car pile-up, the system is failing.

And the system is failing in many parts of the country. The Texas Transportation Institute (TTI) estimates that in 1999 travel delay cost more than $75 billion in the 68 cities included in TTI's annual report and wasted approximately 6.6 billion gallons of fuel.

Unless Congress and the states do something dramatic to alleviate congestion, the problems associated with it, including significant additional fuel consumption, will only get worse. A recent industry study shows that by the end of this decade, with only moderate economic growth, the number of Class 8 trucks is expected to increase by over 35 percent, and the number of Class 3, 4, and 5 trucks will double. Why?

Lance Grenzeback, senior vice president at Cambridge Systematics, a highly respected transportation research firm, told a congressional panel recently, AWe are seeing a customer-driven shift toward customized, mass-market products and services. This has expanded the demand for highly tailored and reliable freight services. This trend is accelerating with the adoption of e-commerce and e-business.

In other words, we're moving larger numbers of smaller shipments, requiring more trucks.

Eliminating Congestion Chokepoints

What can be done to ease congestion? There are many potential solutions, depending on circumstances in a particular area. There is no doubt, however, that a program targeted at eliminating the nation's worst traffic chokepoints would produce significant fuel and time savings in addition to other social and environmental benefits.

Cambridge Systematics found that improving traffic flow at our nation's 167 worst bottlenecks (which comprise only a few hundred of the nearly four million miles of U.S. roads) would reduce gasoline and diesel consumption by 19,883,611,000 gallons over the next 20 years. These findings were contained in a study prepared in 1999 for The Highway Users, entitled Unclogging America's Arteries: Prescriptions for Healthier Highways.

A followup study we commissioned—Saving Time, Saving Money—estimates the value of these fuel savings at $28 billion over the next 20 years, but again that number only considers improvements to the worst bottlenecks . . . system-wide road investments would increase those fuel-saving benefits manifold!

The fuel saving benefits associated with bottleneck relief are just the tip of the iceberg. In addition, Unclogging found that fixing the 167 traffic bottlenecks nationwide will, over the 20-year life of the improvements:

- Prevent almost 290,000 crashes, including nearly 1,150 fatalities and 141,000 injuries;
- Nearly halve pollution at the bottlenecks, reducing carbon monoxide by 45 percent and smog-causing volatile organic compounds by 44 percent;

• Slash emissions of carbon dioxide, a greenhouse gas, by 71 percent at those sites; and

• Reduce truck delivery and motorist delays by an average of 19 minutes per trip—nearly 40 minutes a day for commuters who must negotiate a bottleneck in both morning and evening rush hours.

The overall economic value of these beneficial by-products of congestion relief is astonishing. According to Saving Time, Saving Money, businesses, commuters, and other motorists nationwide would enjoy more than $336 billion in economic improvements as a direct result of fixing these bottlenecks. The average commuter traveling through one of the bottlenecks twice each workday could expect to save $345 each year in time and fuel alone if the improvements were made. Copies of both of these important studies can be accessed at our web-site at www.highways.org.

It is important to note that alleviating congestion at a traffic chokepoint does not necessarily require additional road capacity at the particular site. Preliminary analysis of a proposed new highway connecting Rockville, Maryland with Fairfax, Virginia, for instance, indicates that the new route would carry 120,000 vehicles per day. That project would significantly reduce traffic volumes at the interchange of I–270 and the Capital Beltway, the fifth worst bottleneck in the country, because many commuters would no longer have to use the Beltway to travel from their home in one Washington suburb to their work in another.

Other means of reducing congestion at a bottleneck may include new information technologies to help commuters choose other routes during heavy congestion, corridor access for bus or rail transit, flexible work hours at major employment centers nearby, and of course, additional lanes at the bottleneck. I11While a balanced approach incorporating all of these options may work best in many cases, it is also important to note that investments in transportation alternatives to the exclusion of additional highway capacity are unlikely to be successful. While noting that transit improvements, better highway operations, adjusted work hours, telecommuting and other efficiency options are vital components of an overall solution,

TTI's Dr. Timothy Lomax testified recently that these same options "do not seem to offer the promise of large increases in person carrying capacity for the current system."

Dr. Anthony Downs, senior fellow at the Brookings Institute, observed in the same congressional hearing that transit carried 3.5 percent of work trips in 1995, compared to 90.7 percent in private vehicles. "Even if the total percentage of persons commuting by public transit tripled," Downs said, "that would reduce the percentage using private vehicles by only 11.6 percent. Any reduction in congestion achieved through increased transit usage would be more than overcome by sheer population growth."

While we would strongly encourage Congress to develop a program targeted at eliminating bottlenecks in order to reduce congestion and conserve fuel, we recognize that some will deride such a program as folly because additional highway capacity will only lead to more travel and renewed congestion. Independent studies have differed widely on the question of whether and to what extent travel is "induced" by the addition of road capacity.

Without entering that debate here, I would only repeat an observation made by Mr. Pisarski, the transportation consultant whose congressional testimony I cited previously:

> "Most trips we make have economic transactions at their ends, and if not, they have social interactions of great value to those making the trips. Given that, "induced travel," which seems to be so reviled today, seems like a very attractive concept to me. We should celebrate it, not condemn it."

Finally, I would note that eliminating traffic bottlenecks to reduce fuel consumption is a win-win approach to energy policy. It is a policy aimed at accommodating the public's need and desire for greater mobility while, simultaneously, reducing the amount of fuel needed to meet the demand for transportation. Many other energy conservation proposals, including the proposed increase in Corporate Average Fuel Economy standards, are aimed at changing rather than accommodating consumer choices, an approach in which the odds are heavily weighted against success.

Streamlining the Environmental Review Process

Should Congress embrace the idea of funding a program targeted at eliminating traffic bottlenecks, its success will depend in large measure on streamlining the process for reviewing the environmental impact of major road projects. Today, it takes approximately 12 years for major highway construction projects to wend their way through the stages of planning, design, environmental review, and right-of-way acquisition. That's before a single spade of dirt can be turned! Typically, one to 5

years of that time is spent completing the necessary environmental reviews, often to the detriment of the environment, public safety, and mobility.

Examples abound of proposed projects delayed by a cumbersome and costly review process that 60 percent of Americans in a recent nationwide poll said takes too long. Here in Washington, for instance, officials have long known that the 38-year-old Woodrow Wilson Bridge, bearing almost 200,000 vehicles a day on Interstate–95 crossing the Potomac River between Maryland and Virginia, must be replaced because of structural problems and inadequate capacity. Yet, it took 11 years from the time the first bridge improvement study was initiated until construction finally began in October 2000. Even as construction has finally begun, litigation against the project continues. Under the current timetable, the first span of a new bridge will open to traffic in autumn of 2004, approximately the same time when engineers have projected the old bridge will have to be closed to truck traffic because of structural weaknesses.

Similarly, a bridge over the Ohio River to connect the Indiana and Kentucky portions of I–265 around Louisville has been in the planning and review process for 15 years. The ongoing environmental review, public hearings, and litigation make it likely that construction on the bridge won't begin until 2003 at the earliest. Meantime, Louisville motorists waste time sitting in traffic or "taking the long way" to get around town, business development is slowed because of this critical missing link in the area's transportation network, and local taxpayers foot the bill for even more environmental studies and litigation.

The fact is any transportation project faces a Federal bureaucratic and legal obstacle course. There are at least 65 Federal laws, regulations, or executive orders that directly address the environmental effect of building roads. At least six cabinet departments and three independent or executive agencies have responsibility for administering those various provisions. Due to the proliferation of reporting requirements and the layers of bureaucratic review, the environment itself often takes a back seat to the cumbersome process designed to protect it.

In TEA–21, Congress made a serious attempt to deal with this problem by directing the U.S. Department of Transportation (DOT) to work with the Environmental Protection Agency and Federal resource agencies to streamline the review process. Based on House and Senate oversight hearings held last year, it seems fair to say that the product of DOT's work to date has not met the expectations of those Members of Congress who drafted the statutory provision. We still do not have a review process that ensures environmental concerns will be raised early and that an appropriate timeframe for action can be set and enforced.

Given the significant time and expense involved in the current environmental review process, we urge Congress to renew its effort at reform. Specifically, we encourage you to consider giving States the opportunity to play a greater role in interacting with Federal resource agencies and developing the necessary environmental assessments or impact statements. In addition, we believe Congress should designate transportation officials as the final arbiter of the "transportation purpose and need" of a proposed project and give those officials authority to set appropriate deadlines for comment by Federal resource agencies. We believe these reforms would expedite the review process while fully protecting the environmental resources that may be affected by a proposed project.

It is worth noting that the economic benefits attributable to improvements at all 167 of the nation's worst bottlenecks would be increased by $30.2 billion if the time for completing the projects could be reduced by as little as 3 years, according to Saving Time, Saving Money. Since most of those improvements would require the preparation of an environmental impact statement, a successful program to expedite the environmental review could, in fact, reduce the typical review time from the current 5 years down to 2 years or possibly less. In so doing, Congress would not only have improved mobility and reduced fuel consumption but also reduced tailpipe emissions from idling cars and made highway travel significantly safer.

Ethanol's Impact on Highway Improvements

Mr. Chairman, if Congress focuses on eliminating bottlenecks to reduce congestion and save fuel, and even if the environmental review process is streamlined in order to expedite transportation improvements, those projects will still cost money. No one knows better than the members of this committee that the Federal funding for such improvements comes solely from taxes paid by motorists and deposited in the Highway Trust Fund.

Today, gasoline is taxed at 18.4 cents per gallon and diesel at 24.4 cents. Gasoline blended with ethanol, however, is taxed at a lower rate, resulting in a revenue loss to the trust fund and a corresponding decrease in Federal funds distributed to the States for highway improvements.

Last year, this committee considered and approved legislation, S. 2962, that would have phased out the use of methyl tertiary butyl ether (MTBE) in gasoline, simultaneously establishing a nationwide renewable/alternative fuels program, essentially mandating a large, new market for ethanol-blended gasoline. Given the dramatic adverse effect that such legislation would have on funds available for road safety and congestion relief projects, The Highway Users wrote to all Senators expressing our strong opposition to the bill.

We understand that similar legislation may be introduced in this Congress, so I am taking this opportunity to reiterate a couple of points from our analysis of last year's bill. In addition to the revenue loss resulting from the lower tax rate on ethanol, a portion of the tax that is imposed on ethanol-blended fuel is deposited in the General Fund rather than the Highway Trust Fund. Last year, the General Fund diversion combined with the tax subsidy cost the trust fund $1.224 billion in lost revenues. If S. 2962 had been enacted, the mandated ethanol market would have substantially increased the sale of ethanol-blended fuel. By 2007, when the current ethanol tax subsidy expires, we estimate the trust fund's total subsidy to ethanol would have been $2.465 billion annually.

With the highway funding guarantees of TEA–21, lost tax revenues attributable to ethanol-blended fuel will inevitably reduce the amount of highway funds distributed annually to the States. The loss of highway funding means less money will be available for projects to reduce congestion and conserve fuel.

I want to commend you, Mr. Chairman, for taking the lead last year in addressing part of this problem. In a colloquy with other members of the committee, you suggested that the portion of the ethanol tax that is currently deposited in the General Fund should be transferred to the Highway Trust Fund, and other members agreed to support such an effort. We strongly encourage you to pursue this course at the appropriate time, and we look forward to working with you to accomplish that goal. I would note, however, that even if all the tax currently imposed on ethanol-blended fuel is deposited in the Highway Trust Fund, the trust fund will still be losing as much as $2 billion per year if Congress mandates a national market for ethanol while maintaining the trust fund subsidy.

Mr. Chairman, these issues are of great importance to taxpaying motorists across the country. I appreciate this opportunity to testify, and I will be happy to answer any questions that you or other members of the subcommittee may have.

STATEMENT OF THOMAS L. ROBINSON, CHIEF EXECUTIVE OFFICER, ROBINSON OIL CORPORATION, ON BEHALF OF THE NATIONAL ASSOCIATION OF CONVENIENCE STORES AND THE SOCIETY OF INDEPENDENT GASOLINE MARKETERS OF AMERICA

My name is Tom Robinson. I am Chief Executive Officer of Robinson Oil Corporation of San Jose, California. Our company owns and operates 28 "Rotten Robbie" retail gasoline outlets located in the San Francisco Bay Area of California.

I submit this statement to this subcommittee today as a representative of the National Association of Convenience Stores ("NACS") and the Society of Independent Gasoline Marketers of America ("SIGMA"). NACS represents an industry of more than 120,000 retail outlets, 75 percent of which sell motor fuels. In 1999, convenience stores sold more than 117 billion gallons of motor fuels which accounts for more than 60 percent of American consumption.

- SIGMA is an association of approximately 260 motor fuels marketers operating in all 50 States. Together, SIGMA members supply over 28,000 motor fuel outlets and sell over 48 billion gallons of gasoline and diesel fuel annually—or approximately 30 percent of all motor fuels sold in the nation last year.

Collectively, NACS and SIGMA members sell more than 75 percent of the gasoline and diesel fuel purchased by American consumers each year.

I appreciate the opportunity to submit this statement on the interaction between environmental regulations and the nation's energy policy. The companies I represent are different from all of the witnesses who will give testimony at today's hearing. For all practical purposes, we are a surrogate for the nation's gasoline and diesel fuel consumers. Our primary mission is to secure adequate supplies of gasoline to sell to consumers at a competitive price. My company is not involved in the exploration or production of oil, nor does it refine oil. If companies like mine, independent marketers of motor fuels, are unable to secure this adequate supply, then we cease to be a competitive force in the marketplace. If independent marketers cease to be an effective competitive force in the marketplace, then consumers lose as retail gasoline and diesel fuel prices rise in response to the supply shortage.

NACS and SIGMA have two primary messages for this subcommittee today. First, if we, collectively, do not address aggressively the motor fuels supply crisis that is

facing this nation in the near future, then the price spikes we have witnessed, for the past decade in California and for the past 2 years in other portions of the nation, in gasoline, diesel fuel, and other petroleum products will become the norm rather than the exception. Ultimately, if we fail to act, it will be consumers who will pay for this inaction—through higher retail motor fuels prices at the pump.

Second, the debate over the future of our nation's energy policy need not be confrontational. Our nation can have both a clean environment and affordable, plentiful supplies of gasoline and diesel fuel. However, in order to achieve these twin goals, all sides to the current debate—industry, government, consumers, and environmentalists—must approach this debate in a spirit of cooperation, not confrontation.

These are not new points for either the associations I represent or for me. As a California marketer I have personally witnessed these events happening over and over again. I personally have had the opportunity to present these points to Congress in the past. Unfortunately, our warnings have been ignored. However, it is my personal hope that the renewed attention to the need for a national energy policy will produce the results NACS and SIGMA have been calling for over the years.

The challenge facing this subcommittee and your colleagues in Congress today is straightforward. We must preserve current and future improvements in air quality while at the same time maintaining and expanding supplies of motor fuels. Otherwise, our nation's consumers will pay the price when supply shortages occur and retail prices at the pump spike, as they have done repeatedly over the past 3 years in several areas of the nation and over the past decade in California. These price spikes will not be limited to the additional expense of producing the new cleaner fuels. Rather, they will be multiples of this amount as the market drives prices far above the additional cost of manufacture in times of short supply.

I firmly believe that our nation is facing a serious energy crisis in the motor fuels refining and marketing industry. Dozens of petroleum refineries have closed over the past two decades and new environmental protection mandates, such as low sulfur gasoline and diesel fuel, are likely to exacerbate this trend. Operating inventories of diesel fuel and gasoline are at historically low levels and the nation's refineries are operating at or near maximum capacity. Gasoline and diesel fuel demand is increasing by between 1 and 2 percent each year, and yet the number of refineries operating to meet this ever increasing demand is decreasing. In 1990, there were essentially six different types of gasoline being sold nationwide. Now, there are over 25 different gasoline formulations, all being transported and distributed through the nation's motor fuel infrastructure. The pressure of overlapping Federal, State and local regulations has crippled what was previously one of the most efficient commodity distribution systems in the world—the United States' fungible grade motor fuels distribution system.

As the saying goes, there is no free lunch. It should not surprise policymakers that after tens of billions of dollars in environmental compliance costs borne by refiners and marketers, the complete fragmentation of the motor fuels distribution system, and the politically motivated diverse gasoline formulations adopted by various States, there is a price to pay—a price that ultimately must be paid by consumers of gasoline and diesel fuel. As long as the motor fuels refining and distribution system works perfectly, supply and demand stay roughly in balance and retail prices remain relatively stable. However, if a pipeline or refinery goes down, overseas crude oil production is reduced, the weather disrupts smooth product deliveries, or a new regulatory curve ball is thrown at the motor fuels refining and marketing industries, we do not have the flexibility to react and counterbalance these forces.

If there is one point that I really want to emphasize it is the point of "no free lunch." Our country can have clean and environmentally friendly fuels and it can have plentiful supplies—there will be a cost and it will be borne by the consumer (that is a given)—our job is to make the lunch, if not free, at least a fair bargain.

Californians have become somewhat accustomed to motor fuels price volatility over the past 5 years because California is in fact the laboratory for the fuels programs that EPA currently is forcing on the rest of the country. When a refinery in California goes down, or a pipeline breaks, the impact on prices is almost immediate. In California, gasoline prices can increase by 40 cents per gallon within 2 or 3 days. When prices get high enough to attract supply from other markets, then eventually the supply shortage is alleviated and prices start to fall.

This is the reason I am submitting this statement today. The motor fuels supply problems we have witnessed in California over the past decade are now being visited on the rest of the nation. If we do not act, independent motor fuels marketers (who I am very concerned about), and gasoline consumers (who we all should be very concerned about), will suffer in the near future.

The public policy solution to the current motor fuels supply crisis will not be simple, but it must be addressed. NACS and SIGMA posit that the solution is not the rollback of environmental protections. This solution is a non-starter and should be discarded. Alternatively, NACS and SIGMA encourage Congress to consider an effective plan to assist our nation's domestic refining industry to meet the challenges posed by ever more stringent environmental mandates and restore fungibility to the nation's distribution system. This will increase gasoline and diesel fuel supplies and keep retail prices down.

We must collectively arrive at a public policy that assures that our nation's refineries, both large and small, stay in business, expand to meet increases in demand, and produce clean, affordable motor fuels. But this policy cannot be achieved without enlightened government policies and programs. The capital expenditures that refineries must make over the next 6 years in order to meet new environmental mandates are huge. Many refineries, particularly small, regional refineries, will be unable to justify those expenditures and will cease operation—further straining motor fuels supplies. Already, this year, Premcor announced that it would close its Blue Island refinery rather than undertake the upgrades necessary to make low sulfur gasoline and diesel fuel. Other refineries, owned by both large and small companies, will follow suit in the next few years.

NACS and SIGMA urge Congress to assist these refineries in making these upgrades. This assistance will be particularly important to small-and medium-size " regional" refineries because the environmental upgrade costs fall more heavily on these smaller refineries because they do not enjoy the economies of scale that some larger refineries possess to make these upgrades. In many cases, these smaller refineries represent the " marginal" gallon of gasoline and diesel fuel in many marketplaces—the gallon that is the difference between adequate supplies and supply shortages.

• Motor fuels marketers and refiners are not always on good terms. We compete daily in the marketplace for customers and market share. So it may seem odd to have motor fuels marketers recommend to Congress that assistance must be given to our nation's domestic refining industry. However, without adequate and diverse sources of gasoline and diesel fuel supply, independent marketers cannot exist. Thus, the solution we are proposing to Congress is the only way our segment of the marketing industry can survive and can continue to provide consumers—your constituents—with the most affordable, clean gasoline and diesel fuel in the world.

NACS and SIGMA do not have a specific legislative proposal to put forward at this time to put our joint recommendation into operation. Instead, we offer the following principles which we are convinced must be a part of any legislative initiative: (1) greater fungibility in motor fuels and a stop to the balkanization of our nation's gasoline and diesel fuel markets; (2) fuel requirements that recognize the limitations and strengths of the motor fuel distribution system in the United States; (3) reasonable implementation plans for new environmental initiatives; (4) fuels programs that set performance goals, rather than specific formulas; and (5) while we are not suggesting the government bail out refineries which are not economically viable, we believe the economic viability of a refinery should not be determined by the timing of the implementation of a new environmental regulation. If such regulations render a refinery non-viable, then adjustments to that regulation should be considered.

We look forward to working with this subcommittee and others in Congress to explore legislative options in the months ahead. We offer our assistance to this subcommittee in this exploration.

The debate over our nation's energy policy is just starting. But the crisis has been on the horizon for some time. We can either discuss potential solutions collectively now, or we can wait until the next price spike, and the outraged response of consumers. We encourage all parties to this debate to adopt fresh approaches to the problems our nation is facing. Both the environment and our nation's motor fuel consumers can be the winners in this debate, but only if all sides agree with the premise that environmental protection and affordable energy are not inherently contradictory goals. NACS and SIGMA assert that these goals need not be irreconcilable.

Thank you for permitting me to submit this statement.

STATEMENT OF THE NATIONAL ASSOCIATION OF MANUFACTURERS

An adequate and secure energy supply at globally competitive prices is necessary for the nation's economic growth. The NAM—and its more than 14.000 member companies and associations, including 10,000 small and medium manufacturers—supports the development of markets and policies that provide adequate, reliable

and competitively priced energy resources with a minimum of government intervention. The NAM promotes an economically balanced and varied mix of energy sources' consistent with prudent environmental policies. The NAM is very concerned that many current Federal policies are working at odds with the fundamental need to maintain adequate future energy supplies for the economy and the welfare of the American people.

The top priority of the NAM for the past decade has been to advocate a pro-growth, pro-manufacturing and pro-worker policy agenda. Durable economic growth is the only guarantor of rising living standards for Americans. The NAM has long recognized that a skilled work force, high technology and innovation are important underpinnings of prosperity—but so, too, are adequate energy supplies.

Overall, U.S. manufacturers continue to strive for improved efficiency in the competitive world marketplace, including increasingly efficient uses of energy. For example, although manufacturing output has increased by 41 percent since 1990, industrial electricity consumption has increased by only 11 percent. (Overall U.S. electricity use has increased 22 percent during the same period). A recent NAM poll of its members revealed that, over the past 5 years alone, 85 percent of U.S. manufacturers have upgraded and improved the energy efficiency of their U.S.-based plants and offices.

Despite continuing efforts to increase energy efficiency, increasing the supply of traditional energy sources and developing alternative energy sources remain critical for sustained economic growth. [See Appendix 1: U.S. Energy Profile). Unfortunately, harbingers of energy supply problems are increasingly evident in the United States. Last summer, electricity supply shortages occurred in the Midwest and Northeast. This summer, California has suffered power interruptions and the first-ever rotating blackout in the San Francisco area. One step that must be taken to address the uncertainties accompanying a patchwork of State restructuring laws regarding electric utility regulation is passage of Federal legislation. The NAM supports Federal legislation that would facilitate wholesale and retail competition and strengthen reliability and efficiency of supply as soon as possible.

However, the energy-policy warning signs are not just flashing because of regional electricity disruptions. Also this year, the U.S. has already experienced tight supplies on natural gas and transportation fuels. The Department of Energy has just issued a warning of higher natural gas and potentially higher heating oil prices this coming winter due to insufficient supplies. The warning signs are here that the need for adequate energy supplies has been neglected for too long.

The current Administration has created an unbalanced national energy policy by focusing on energy efficiency, natural gas and non-traditional energy sources. while undermining the use of other energy sources. A policy that is narrowly focused on certain fuels to the exclusion of others, such as by promoting switching from coal to natural gas for electricity generation, is a recipe for disaster. Historically, the Federal Government has caused enormous economic waste when it tries to pick "winners and losers" in the energy marketplace. It has also caused waste when its energy policies are not coordinated with other policy objectives or considered in the context of economic growth.

Of particular concern for the NAM is the apparent policy disconnect between favoring natural gas use and discouraging natural gas production. The National Petroleum Council (NPC), the Energy Information Administration and others are projecting dramatic increases in natural gas use in the next 10–20 years—especially in electricity generation. However, the NPC warns that not enough natural gas supplies are being developed to meet the NPC's estimated 7 Tcf (34 percent) increase in natural gas use over the next decade, which is more than twice the percentage growth in gas use from the 1980's to 1998. The NPC identifies as a critical barrier to meeting future demand projections for natural gas the fact that access to over 200 Tcf of natural gas reserves is being restricted on multiple-use Federal lands and the OCS. Currently, natural gas and oil exploration and production are off limits or significantly restricted in 40 percent of the Rocky Mountain region and in the OCS off of the entire East Coast, the entire West Coast and more than 50 percent of the Eastern Gulf of Mexico. Access to new coal deposits is also being systematically denied. (See Appendix 2. Administration Restrictions On Resource Access.)

Denial of access to resources on multiple-use Federal lands is not the only policy of this Administration that discourages the use of traditional fuels. Since first entering office in 1993, this Administration has assaulted virtually every domestic energy source (except "non-hydro renewables," which account for only about 2 percent of total electricity generated)—particularly coal use. After failing in its attempt to secure a Btu tax on fossil fuels, mandated centralized inspections for automobiles and forced van pooling, the Administration focused its efforts on more indirect means by denying access to fossil resources to cutoff supplies and by using environmental

restrictions to reduce production and use. (See Appendix 3. EPA Restrictions on Energy Production and Use.) The Administration has even tried to use international pressure to force domestic energy-use reductions by signing the ill-advised Kyoto Protocol in 1997. If ratified, this Protocol would arbitrarily impose quotas on carbon dioxide emissions equivalent to a reduction in fossil-fuel use by more than 30 percent from projected levels in 2010.

An energy policy that emphasizes only some energy sources and priorities—without regard for their negative impacts on energy markets—threatens the sustainability of the national economy and the welfare of the American people. When such a policy also undermines the development of domestic oil, gas, nuclear. coal and hydroelectric power, then these "supply side" disincentives add up to what is essentially a policy of planned energy dependence by the United States on foreign sources.

Conclusion

Adequate supplies of reliable and competitive energy and an overall energy strategy must become a priority for the next Administration. The NAM strongly believes that America must make progress in all of its energy options in order to meet the challenges of a growing population while increasing prosperity, national security and environmental protection.

Action

The NAM will work actively with this Administration and Congress in the time remaining, and with the Presidential and congressional candidates to urge them to turn their attention to the seriousness of this problem and the need for prompt action to meet these concerns.

Appendix 1: U.S. Energy Profile

- During the 1990's, U.S. electricity generation grew by 22 percent. Although the use of non-hydro renewable energy for electricity generation has increased by a third during this decade, it still represents only about a little over 2 percent of total net generation.
- Hydroelectric power produces about 12 percent of total electricity generation. However, it has been declining sharply in recent years. Delays in Federal relicensing (8-year schedule) burdens applicants with endangered-species and other environmental studies and pre-conditions, exacerbating the delays and the costs. This Administration has even torn down hydroelectric dams. Nuclear energy has increased 26 percent in the past 10 years, and now supplies 20 percent of total generation. However, no new plants are scheduled to begin operating. This Administration has steadfastly opposed, and recently vetoed, legislation that would ensure timely construction of a desperately needed Federal storage facility for spent nuclear fuel. In the meantime, the Administration has breached its contractual obligation to begin removing spent fuel from the nation's nuclear reactors, despite receiving $17 billion in pre-payments from the consumers of electricity. Finally, virtually all nuclear operating licenses are up for renewal by 2015. NRC has indicated it expects no more than 85 of the 103 units will file for renewals. Coal—which currently provides more than 50 percent of total net generation—has increased almost 19 percent in the past 10 years, despite growing hurdles created by administrative agencies. However, no major coal-fired electricity generating stations are being built, despite the fact that coal represents 90 percent of U.S. recoverable fossil energy reserves. Oil use in electricity has dropped dramatically since the 1973–74 Arab oil embargo, off 30 percent in the past 10 years to 3 percent of total generation. Petroleum is still a vital transportation fuel, however, and is the energy source for which we are most dependent on foreign sources—nearly 60 percent of our needs. As a result, petroleum accounts for one-third of our total trade deficit. Meanwhile, domestic crude oil production has fallen almost 20 percent over the past 10 years, as vast areas of onshore and offshore United States have been put off-limits to energy leasing. Worse, value-added refining is moving overseas, with 36 U.S. oil refineries having closed in just the past 8 years. No new major refineries have been built in this country in the past quarter-century, and regulatory hurdles complicate making refinery investments needed to produce adequate supplies of lower-sulfur transportation fuels being required by EPA. America consumed 21.4 Tcf of natural gas last year, about 15 percent of which was used by utilities for electricity production. Domestic natural gas production declined from the early 1970's peak of over 21.7 Tcf a year to 1986's low point of 16.06 Tcf. Production increased to 18.82 by 1994. Has remained relatively stable for the past 6 years, (in 1999 it was 18.71 Tcf). Canadian imports have increased more than 130 percent over the past 10 years (to over 3 Tcf) to meet the increased U.S. demand. The National Petroleum Council (NPC) and the American Association of Petroleum Geologists (AAPG) predict a severe gas supply

shortage in the next 10–15 years unless multiple-use Federal lands onshore and offshore—and the more than 200 Tcf in natural gas reserves inside them—are opened to exploration and production.

Appendix 2: Administration Restrictions on Resource Access

Administration policies and/or regulatory actions that impede or prevent the development of domestic fossil-fuel resources include the following:

• Multi-year moratoria on Outer Continental Shelf leasing and drilling off of the entire Atlantic and Pacific coasts and portions of Alaska and the Eastern Gulf off of Florida. Army Corps of Engineers elimination of nationwide Wetlands Permits—100-year Flood Plain Exclusion (50 million acres).

• Forest Service moratorium on new road construction (40 million to 60 million acres).

• Bureau of Land Management has proposed regulations—a "plain language" rewrite of onshore oil and gas activities, that impose additional requirements that provide no benefits yet cause further delays.

• BLM permitting delays in critical areas like Wyoming (coal-bed methane).

• OCS permitting delays by the EPA and NOAA prevent a valid Federal lease (with 1 Tcf of natural gas) off of Florida, acquired in the mid–1980's, from going forward.

• (Monuments designation initiatives under Antiquities Act (millions of acres in at least seven Western States); already declared Escalante Staircase a monument' abrogating valid oil and gas leases and ending plans for a large low-sulfur coal mine. Expansive interpretations by Commerce Department of Essential Fish Habitat regulations threatening oil and gas activity in Gulf of Mexico Expansive interpretations of Endangered Species Act by BLM, Forest Service, Fish and Wildlife Service causing sometimes indefinite permitting delays BLM's designation of areas as Wilderness Study Areas, which has become de facto prohibitions of multiple use while BLM studies whether to ask Congress to list the area as wilderness EPA Interim Guidance reinterpreting CERCLA release to require daily reports of air emissions from hundreds of thousands of small rural engines would affect oil and gas production and transportation—especially marginal wells Department of Labor reinterpretation of Process Safety Management Regulations to require unnecessary and expensive regulations of remote unoccupied exploration and production facilities

• EPA reluctance to support legislation to clarify that hydraulic fracturing of gas-bearing formations should not treated as "underground injection" under the Safe Drinking Water Act. As many as 60 percent of future gas wells may need to employ fracturing technology Lack of cooperation and coordination between BLM, U.S. Forest Service, EPA and other agencies in implementing National Environmental Policy Act requirements for permitting and leasing processes causing significant delays The Interior Department's Bureau of Land Management State Office in New Mexico this month announced that it would soon begin using new guidelines for approval of San Juan basin drilling permits that could severely affect gas production in the second-largest gas field in the nation. Activity in this mature producing area (that accounts for some 6 percent to 7 percent of the country's gas production. more than half of which goes to California) is within projections of the BLM Resource Management Plan However. while the State office does a new EIS that may lead to improvements in the RMP, BLM is proposing new permitting guidelines that hold the potential to prevent drilling enough wells to even maintain current production levels Redundant NOAA Coastal Zone Management Act consistency regulations that impede OCS exploration and production activities without any additional environmental benefits Proposed DOI (Minerals Management Service and BLM) "plain language rewrite of oil and gas lease forms imposing new requirements and additional administrative burdens will encourage litigation, making it more difficult to drill and produce hydrocarbons on Federal lands.

Appendix 3: EPA Restrictions on Energy Production and Use:

• NOx SIP Call: The EPA's 1998 final rule to reduce nitrogen oxide emissions by 85 percent throughout the eastern United States will result in estimated utility costs of $14.1 billion in capital investments, and an increased annualized cost of $2.7 billion for power plants and other major sources. The rule required the emission-reduction measures to be in place by May 1, 2003. The EPA's refusal to provide flexibility to States in setting their ozone attainment strategy, along with threats to impose a Federal Implementation Plan (FIP) if States did not comply with the State Implementation Plan (SIP) call, placed immense pressure on coal combustion. States have until October 2000 to submit their plans. New Source Performance Standards: In 1998, the EPA issued revised nitrogen oxide (NOx) New Source Performance Standards (NSPS) for all new and modified ("reconstructed") utility and

industrial boilers. A new "guidance" is expected to be issued by OECA before the end of this year that will lower the threshold of what is a "reconstruction," thereby forcing many additional existing power generators to install expensive retro-fit equipment or become subject to enforcement actions. Particulate Matter: The costs of compliance for coal-fired power plants would greatly increase if the EPA's final rule setting new "fine" $PM_{2.5}$ standards and revising the "coarse" PM_{10} standards are found to be valid by the U.S. Supreme Court. New Source Review (NSR): The Clean Air Act requires a pre-construction permit before building or making modifications to facilities that would result in significant new emissions. The Act explicitly allows companies to do routine maintenance and repair, but the EPA wants to force older facilities—particularly coal-burning ones—to install expensive air-pollution control equipment. In addition, the EPA's threats of litigation and heavy-handed enforcement significantly contribute to cost burdens for these plants. For example, in November 1999, the EPA filed lawsuits against several coal-burning utilities, alleging violations of the New Source Review (NSR) rule, claiming that the utilities made major modifications to their facilities and, in doing so, failed to apply for NSR permits. In addition, the EPA is currently preparing to issue a final rule on NSR while also coercing existing sources to meet "best available control technology" (BACT) by a certain deadline.

- Ozone Non-attainment Areas: The EPA efforts to force States to designate areas that are not in "attainment" with the agency's revised "Eight-Hour Ozone Standard" (promulgated in 1997, and in litigation in the Supreme Court) is an attempt to circumvent a possible rejection of the rule by the Court, while chilling economic development and energy use in those designated areas. The EPA threatened to withhold Federal highway funds to States to force State compliance.
- Regional Haze Rules: New rules call for States to establish goals for improving visibility in Class I areas (national parks and wilderness areas) and to develop long-term strategies for reducing emissions of air pollutants that cause visibility impairment. Strict EPA visibility regulations could cost the refining industry $0.4 billion to $1.0 billion—above and beyond the costs incurred for complying with other requirements of the Clean Air Act, such as NAAQS. In addition. oil and gas producers might need to invest between $0.2 billion and $2.5 billion over the next several years, to comply with the proposed rule. Future exploration and development in the United States is likely to be hampered or curtailed, with potentially serious consequences for the nation. Since most new development in the United States is near Class I areas, the efforts of States and Federal land managers to comply with regional haze requirements are likely to preclude timely and efficient development of oil and gas resources.

TMDL Rules: On July 11, 2000, the EPA issued the controversial Total Maximum Daily Loads (TMDL) rule, even though on June 30, 2000, Congress sent to the White House legislation that would have required the EPA to take a closer look at the 30,000 comments received and to rewrite the rule. The EPA delayed the effective . date for the rule until October 2001, after a congressionally imposed prohibition expires. Most electric-utility operations will be affected if a water segment they are located on or near is listed as impaired. The stringent TMDL standards will likely necessitate regulation of air deposition of pollutants into water bodies, thus opening another back door to air-emission regulation.

Btu Tax on Fossil Fuels: The Administration's early advocacy of a Btu tax on fossil fuels would have discouraged use of fossil resources and reduced manufacturers' competitiveness. New Source Review Revisions: The EPA in 1996 issued a proposed rule for a revised NSR program. The EPA is currently preparing to issue the final rule and has been conducting discussions with the regulated community on an alternative ("off-ramp") to the new NSR rule. The off-ramp, as proposed, would work as follows:

Coal-burning utilities will be able to obtain relief from stringent new NSR rule if they, in return, agree to a suite of emission reductions to be achieved by a certain deadline. EPA has discussed the inclusion of CO_2 within the bundle of emissions to be "voluntarily" regulated.

CO_2 Regulation: The EPA issued a memorandum in April 1998, asserting the EPA's authority under the Clean Air Act to regulate CO_2 as a pollutant. It did so in absence of any scientific evidence to suggest that the EPA will be able to make the showing that CO_2 is harmful to human health and the environment, as is necessary to designate a compound as a criteria pollutant.

TRI Reporting: The toxics release inventory (TRI) (under the Emergency Planning Community Right-to-Know Act) was recently changed by the EPA to require electric utilities to report chemical-release data. Additionally, the level at which reporting is required for mercury was lowered by several orders of magnitude. In making these changes, the EPA presented no studies or supporting rationale for why com-

munities should suddenly be concerned about these releases. These reporting requirements—without being based on actual health concerns—further discourage the siting of electricity generating stations.

Mercury: In November 1998, EPA issued a draft Mercury Action Plan to reduce overall mercury emissions. This plan has required expensive testing by coal-fired power plants and is likely to result in a regulatory determination by December that will lead lo costly Maximum Achievable Control Technology standards for coal-fired utilities.

Particulate Matter / Ozone rulemaking: The EPA proposed new NAAQS for Ozone and $PM_{2.5}$ Particulate matter used to be the technical term for soot: however. the new regulatory size threshold set by the EPA (2.5 microns) is so small that it captures individual molecules of sulfates. In essence, this amounts to a back-door tightening of Title IV (acid rain) of the 1990 CAA.

MTBE: Against the advice of scientists, the EPA encouraged billions of dollars in investments to make methyl tertiary butyl ether (MTBE) additives to motor gasoline. Now the agency wants to keep the questionable oxygenate benefits by replacement chemicals that will raise the price of gasoline and require more crude oil to be used to make each gallon of "government gas." Prior to imposing oxygen substitutes, there should be a rigorous reevaluation of the need for an oxygen mandate in gasoline, in light of technological progress in engine manufacture and the increased overall compliance with attainment of the carbon-monoxide ambient air standards.

Federally Permitted Releases: On Dec. 21, 1999, the EPA published an Interim Guidance on air emissions under the Comprehensive Environmental Response, Compensation and Liability Act and the Emergency Planning and Community Right-To-Know Act (collectively CERCLA). The Interim Guidance defines which air emissions must be reported under CERCLA and which are exempt from reporting as a federally permitted release (FPR). Identification of specific hazardous constituents at every emission point in a facility may not be technically feasible in many instances and may be prohibitively expensive. The Interim Guidance incorrectly requires speciation of emissions to qualify for the exemption, effectively eliminating the exemption.

INTERSTATE NATURAL GAS ASSOCIATION OF AMERICA,
10 G STREET, NE, SUITE 700
Washington, DC 20002, April 5, 2001.

Honorable GEORGE VOINOVICH, *Chairman,*
Subcommittee on Clean Air, Wetland, Private Property and Nuclear Safety,
Committee on Environment and Public Works,
U.S. Senate,
Washington, DC 20510.

DEAR MR. CHAIRMAN: On behalf of the Interstate Natural Gas Association of America (INGAA), I am writing to provide additional information for your April 5, 2001 public hearing on the interaction between environmental regulation and energy policy. I request that you make this letter and the attached reports a part of the hearing record. For the record, INGAA represents interstate natural gas pipelines in the United States, interprovincial natural gas pipelines in Canada and PEMEX in Mexico.

In 1998, the U.S. Department of Energy (DOE) predicted that U.S. consumption of natural gas would increase from approximately 22 Trillion cubic feet (Tcf) in 2000 to approximately 30 Tcf by 2010. The INGAA Foundation followed this prediction in 1999 with a study entitled "Pipeline and Storage Infrastructure Requirements for a 30 Tcf U.S. Gas Market." Both DOE and the INGAA Foundation predicted that this demand boost would be driven primarily by a significant increase in the use of natural gas for electric generation, due to its superior environmental benefits. Approximately 6.5 Tcf of the 30 Tcf estimate would be attributable to electric generation.

Because of higher natural gas prices and possible pipeline capacity constraints in some regions of the United States, some policymakers are calling for revitalized use of coal and nuclear power in the future. These same policymakers are questioning whether the United States is too dependent on natural gas for our future.

While INGAA believes and supports the need for balanced energy policy, such a balanced energy policy needs to continue recognizing the positive benefits of natural gas-fired power generation. In fact, the environmental consequences of p? continuing to strive for a 30 Tcf natural gas market by approximately 2010 could result in serious environmental impacts for years to come.

Attached is a recently completed study by the INGAA Foundation entitled "Implication of Reduced Gas Use on Emissions from Power Generation." This study examines a low-use case of natural gas for electric generation of 4.8 Tcf in 2010, a drop of 1.7 Tcf or 24 percent from the predicted 6.5 Tcf figure. Coal replaces natural gas for this 1.7 Tcf capacity drop. This potential drop in natural gas usage would result in the failure to reduce 10 percent of the emissions of mercury and nitrogen oxides (NOx), and 4 percent in carbon dioxide (CO_2) emissions. These 111,730 million tons of NOx emissions alone is comparable to the NOx emissions from 4 million automobiles. The 108 million tons in CO_2 emissions is comparable to similar emissions from 28 million automobiles.

This data provides a compelling case for the Bush Administration and the Congress to continue to develop the exploration, production and pipeline infrastructure needed to reach a 30 Tcf natural gas market in the United States by 2010. To back off now would have serious environmental consequences at the very time citizens are demanding a cleaner environment, and most public opinion polls demonstrate a willingness on behalf of the public to pay reasonably higher energy prices for a cleaner environment.

I hope you find these INGAA Foundation reports useful to your Subcommittee's deliberations, and we would be pleased to meet with you and/or your staff in the future to discuss these issues in more detail.

Sincerely,

CUBA WADLINGTON, JR., *President and CEO,*
Williams Gas Pipeline.

NOTE: Reports referred in letter are retained in committee files.

CLEAN AIR ACT OVERSIGHT ISSUES

FRIDAY, APRIL 27, 2001

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Salem, New Hampshire.

The committee met, pursuant to notice, at 2 p.m. in the media center of Salem High School, 44 Geremonty Drive, Salem, New Hampshire, Hon. Bob Smith (chairman of the committee) presiding.

USE OF METHYL TERTIARY BUTYL ETHER (MTBE)

Present: Senator Smith.

OPENING STATEMENT OF HON. BOB SMITH, U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

Senator SMITH. This hearing of the Environment and Public Works Committee of the U.S. Senate will come to order. Let me say good afternoon to everyone, thank you all for coming.

This hearing is on MTBE. It may not be a household word, unless you have it in your household. Part of the problem is to give attention to this issue. That is why we're here today.

I certainly want to thank the witnesses who will be here for this panel and the second panel. We'll just say for the benefit of those who are watching, we expect this to go about 2 hours overall, so you can plan accordingly.

I want to also thank Salem High School for allowing us to use this room. It's a terrific room for this kind of function.

I'm just going to make a brief statement, then we'll go to the witnesses. Since taking over as chairman of the Environment and Public Committee, I've tried to ensure that New Hampshire residents have a strong a voice in national issues and some local issues, of course, as we develop environmental policy into the next century. In the 2 years prior to my chairmanship, only two New Hampshire witnesses had testified before the committee. With these witnesses today, we have heard from 30. The gentleman who just came in to sit down, Bob Varney, at DES, has been to Washington several times. It does make a difference, because we have a lot of smart people in this State, and it's nice to showcase them around the country.

It certainly played a major role last year in ensuring that our tree farmers in northern New Hampshire didn't lose their business because of a shortsighted EPA Clean Water Act regulation known as Total Maximum Daily Load (TMDL). Acronyms are very prevalent in Washington.

Another issue that has enormous New Hampshire involvement was that of brownfields reform. I'm very pleased to report that on Wednesday, the brownfields cleanup bill passed the U.S. Senate by a vote of 99 to 0. Let me tell you, as Bob already knows, because he has been working on it longer than I have—and I've been working on it for at least 10 years—we haven't been able to get agreement in the Senate. Now to pass it 99 to 0, with Ted Kennedy and Jesse Helms on the same side, all in agreement—it's got to be good. We're very excited about the enactment of this bill. It's going to bring a lot of money into New Hampshire to clean up those sites. But more importantly, it's going to promote the cleanup of brownfields, even without Federal money because contractors now will be allowed to clean them up.

That's not the subject of this hearing. What we're looking at now is something that's called MTBE. The actual name is methyl tertiary butyl ether, but we'll call it MTBE the rest of the day, if you don't mind.

I've asked our witnesses to share with us their expertise and their testimony and their knowledge on this issue in a way that they see fit. This will be very valuable in our efforts to develop the bill to deal with this problem, not only in New Hampshire, but also in other States of the United States. California, for one, has a tremendous problem. There are two very prominent Democrat Senators there, Feinstein and Boxer. We need their help, so this bill will be bipartisan. It is a regional problem, not a partisan one, as you'll find out as we go on.

MTBE is a clean, cheap gasoline additive that boosts octane. It's been added to gasoline for over two decades. So those of you that are watching, and you're wondering what in the world this stuff is, we'll try to quickly mention it. I know the experts will be able to give you a lot more specifics.

The 1990 Clean Air Act Amendments amended the Act to require the use of reformulated gasoline through a Federal clean air program run by the EPA called the RFG program. That law requires a cleaner burning gasoline to be used in certain areas of the country to improve air quality. Other areas, including southern New Hampshire, chose to participate. The RFG program has been successful in achieving air quality beyond the requirements that we expected.

Unfortunately, a major side-effect of MTBE use in gasoline is that is sometimes causes water quality problems. The RFG program mandates the use of oxygenate inert gasoline. MTBE is one of two options currently in use, and the other is ethanol. We'll get into that a little bit later.

The problem, though, with MTBE, is its ability to migrate very quickly through the ground, through the water into the water table. Then it's diffused through that water very quickly. Even at low levels of contamination, MTBE renders water unusable, as we will hear from Mrs. Miller in just a moment, because of its foul odor and taste. In an effort to address the clean air concern, the impact on our drinking water was neglected.

Adequate research and science might have prevented this. But we didn't pay attention to the science or perhaps didn't look for the science. Now we have several billion dollars tied up in cleaning up

our water as a result of trying to clean up our air. Now we have to change the law, perhaps at the State level, Senator Klemm, and certainly at the Federal level.

We need fewer "stovepipe," narrow-vision solutions to pollution problems; and we should find more holistic solutions for our environmental challenges. We should ask ourselves, "What these laws will do to the environment? Can we look at the system in a holistic way, as opposed to viewing it through a narrow scope."

One of the most distressing aspects of MTBE contamination is that the health effects of this gasoline additive are largely unknown. I'm hoping that folks from UNH will have more to say about that. But because of MTBE, New Hampshire has spent a lot of money in order to provide safe water for residents with contaminated wells. The Department of Environmental Services under Bob Varney is one of the best in the country, believe me. I don't say that lightly. That is a fact, and I've talked to almost all of them all over the country.

The State has been providing bottled water as well as installing and maintaining very expensive and extensive treatment equipment. Particularly hard hit have been the communities in the southern interior, such as the homes around Arlington Lake in Salem, Frost Road in Derry and Green Hills Estates in Raymond.

New Hampshire is not alone. Many other States also have had gasoline leaks or spills that resulted in costly cleanups, even the closure of wells. It remains a major problem that will not go away without Federal action, but we need to do it soon.

I'm glad to hear that Governor Shaheen has joined this battle with her recent request to opt out of the RFG program. I'm glad to hear that the State legislature is pursuing creative options to get New Hampshire out of the RFG program. I support those efforts.

We also share the common goal for protecting New Hampshire's water, and I intend to work with the State in every way I can, with every amount of influence that I can muster as the chairman of this committee, to see that we get that done.

Unfortunately, even if allowed, New Hampshire's removal from the RFG program is not enough. It's only a band-aid. It's not going to provide the cure that we need. It's not going to keep MTBE out of New Hampshire. It's not going to clean up existing contamination, and additional measures will be required to maintain air quality. What it might do, if just the RFG issue is dealt with, is raise the price of New Hampshire gasoline, which I don't think anybody's too excited about.

So we've got to find a better way. We've got go beyond our current vision; we have to increase current air quality and water quality assurances.

Last year, I had introduced a bill in the Senate, S. 2962, that offered a comprehensive solution. It provided cleanup money; it banned MTBE; and it allowed the Governors to waive the oxygenate mandate. I believe Mr. Varney testified that it protected the current air quality from backsliding.

So why didn't that bill pass and become law? It did report out of committee, but it died on the Senate floor, like so many other pieces of legislation. Why? Because of competing regional interests across the country. The MTBE producers, the ethanol producers,

the refiners, there are so many. Then you have the regional issues of who has MTBE in their wells and who doesn't.

So due to all these competing interests, many of the proposed Federal fixes just simply died. That was the problem. So any legislation dealing with MTBE will have to go through the Committee on Environment and Public Works. When it does come through there, I intend to have New Hampshire taken care of.

We need to work together, though. The problem is, we need consensus. Everybody can't get exactly what they want. That's what we did with Brownfields, which is why were able to get a 99 to 0 vote. Also we saw a 85 to 1 vote on the restoration of the Everglades, which didn't really pertain to New Hampshire, unless you want your kids to go and see the alligators, and I think you do.

I'm going to make sure any bill that comes in through this committee is one that takes care of us here. It's my intention now, after we hear the information and testimony from the experts from our State, to introduce a bill very similar to last year's.

As each witness testifies, please remember that this is a national hearing. It will get national attention. It is being covered locally by the cable folks, but remember, this testimony will go into the committee's records. I can pass this out to my colleagues in the other 50 States to let them know how much of a problem we have here in New Hampshire, that the chairman of this committee has here in New Hampshire, to be specific. I need help for my constituents.

So thank you, each and every one of you for coming, all of the witnesses and the participants. Let me also say that each of the witnesses, we'll give you about 5 minutes, we're going to turn a light on somewhere. Don't be intimidated by it. If you can wrap it in 5 or 6 minutes, we'd appreciate it. All of your remarks written will be made part of the record. We've allowed time to have folks come up, take the microphone. This will become part of the record of Congress and the Senate. If you can try to do it in a minute or so, we'd appreciate it, especially if there are a lot of people speaking.

If you choose to not make oral remarks, maybe you don't feel comfortable stepping up to the microphone, you can send me written remarks and I will make them part of the record if you get them to me within the next 2 weeks. So that whatever you have to say will be part of the Federal record on this issue.

Let me introduce the first panel now. I'm pleased to have Christina Miller, who is a homeowner in Derry, the Honorable Arthur Klemm, President of the New Hampshire State Senate, and Robert Varney, who is the Commissioner of the New Hampshire DES. I think, Senator Klemm, since Mrs. Miller has this contaminant in her well, I think we'll start with her and move across to you, if that's OK with you.

[Documents submitted for the record follow:]

STATE HOUSE,
OFFICE OF THE GOVERNOR,
Concord, NH 03301, April 16, 2001.

The HONORABLE CHRISTINE TODD WHITMAN, *Administrator,*
U.S. Environmental Protection Agency,
Ariel Rios Federal Building,
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: INTENT TO OPT OUT OF THE FEDERAL REFORMULATED GASOLINE PROGRAM

DEAR ADMINISTRATOR WHITMAN: I write to make you aware of my decision that the State of New Hampshire must seek withdrawal from the Federal Reformulated Gasoline (RFG) program immediately. Therefore, I ask the U.S. Environmental Protection Agency (EPA) to promptly address its procedures for States opting out of the RFG program (40 CFR 80.72) to allow a much sooner effective date than January 1, 2004. I am taking this action because it appears to represent the only rational, and legal, approach available to the State at this time to sharply reduce the levels of methyl tertiary-butyl ether (MTBE) in gasoline supplied to New Hampshire.

As you know, MTBE is a significant and rapidly increasing threat to New Hampshire's groundwater and surface water resources. MTBE is difficult and expensive to remediate because of its high solubility and its ability to move quickly t.hrough groundwater. Because MTBE travels farther in groundwater and does not break down rapidly, it can be difficult to pinpoint the source of the contamination. MTBE has been detected in public drinking water supplies and in private wells, and its remediation is consuming a disproportionately large percentage of the funds we have set aside for all petroleum contamination needs.

New Hampshire is particularly frustrated with existing Federal barriers that prevent States from readily and effectively reducing or phasing-out the use of MTBE in gasoline. The Federal Clean Air Act essentially prohibits States from controlling individual components of gasoline, and it expressly mandates the oxygen content of RFG. Refiners in the east blend MTBE in RFG in concentrations 5–10 times greater than conventional gasoline—because it is the most cost-effective alternative for meeting this mandate. Because the Federal Clean Air Act and 'its associated regulations provide States with virtually no authority to reduce MTBE in gasoline, States that use RFG are essentially compelled to contaminate their precious water resources. This is an unacceptable situation.

From the time we first recognized this problem, it has been clear that there are no simple solutions. As a result, on behalf of the New England Governors, I asked the Northeast States for Coordinated Air Use Management (NESCAUM) to thoroughly study the issues and options surrounding RFG and MTBE. Soon after, EPA's National Blue Ribbon Panel on MTBE was launched. The work products of both of these initiatives—NESCAUM's RFG/MTBE Findings and Recommendations and the Blue Ribbon Panel Findings and Recommendations on the Use of Oxygenates in Gasoline recommended elimination of the oxygenate mandate from the Clean Air Act. The MTBE problem requires a Federal solution, but Congress has made little progress to date and no Federal solution appears imminent.

As a result, the State of New Hampshire is forced to pursue the only legal, rational option that exists for reducing MTBE in gasoline: to opt out of the Federal RFG program. I have thus directed the New Hampshire Department of Environmental Services (DES) to immediately inform EPA Region I of this action, to promptly consult with EPA's regional office to establish the requirements necessary to implement this action, and to expeditiously fulfill those requirements. Since I understand that a strict interpretation of the applicable Federal regulations (i.e., 40 CFR 80) prevents New Hampshire from opting out of the RFG program prior to January 1, 2004, I further request that EPA address these regulations to provide for an earlier opt out date and/or such other relief as may prevent further MTBE contamination of New Hampshire's water resources between now and 2004.

As a former Governor, I am sure you understand the economic and environmental importance of solving the problem of MTBE contamination. From your experience as Governor, you are also aware of the aggressive steps States have taken to replace underground fuel tanks and educate consumers regarding spill prevention and the proper handling of gasoline. Given the volume of gasoline distributed, however, it is ultimately unreasonable to expect that there will be no releases, even with the most diligent gasoline handling. The pollution prevention and source reduction approaches that the States have found to be extraordinarily effective advise us to reduce, and eventually eliminate, the use of MTBE as a gasoline additive in the first 'place.

I look forward to working with you so that New Hampshire can eliminate the risks posed to our groundwater resources by MtBE in the near future. Should you have any questions, please feel free to contact me or DES Commissioner Robert W. Varney at your convenience.

Very truly yours,

JEANNE SHAHEEN, *Governer.*

BILL SUMMARY OF S. 2962 AS REPORTED IN THE 106TH CONGRESS

Federal Reformulated Fuels Act of 2000—Amends the Clean Air Act (CAA) to authorize a State Governor, upon notification to the Administrator of the Environmental Protection Agency (EPA) during the 90-day period beginning on this Act's enactment date, or during the 90-day period beginning on the date an area in the State becomes a covered area as a result of reclassification as a Severe ozone nonattainment area, to waive oxygen content requirements for reformulated gasoline sold or dispensed in the State. Considers gasoline that complies with all other requirements for reformulated gasoline other than those regarding oxygen content to be reformulated gasoline.

Requires the Administrator to promulgate regulations to ensure that reductions of toxic air pollutant emissions and aromatic hydrocarbon content achieved under the reformulated gasoline program before this Act's enactment are maintained in States for which the oxygenate requirement is waived or to apply a specified alternative performance standard to reformulated gasoline sold in such States.

(Sec. 3) Authorizes the Administrator to control the sale or introduction into commerce of any fuel or fuel additive that causes or contributes to air or water pollution that may be anticipated to endanger public health or welfare. Permits States not subject to a prohibition on enforcement of certain State emission control standards to prescribe such control on fuel or fuel additives for water quality protection purposes.

Requires the Administrator to ban the use of methyl tertiary butyl ether (MTBE) in gasoline. Authorizes the Administrator to establish a schedule to phaseout the use of MTBE preceding such ban.

(Sec. 4) Authorizes the Administrator to approve a revision of a State implementation plan that excludes an area from a waiver from Reid vapor pressure requirements provided for ethanol if: (1) the State demonstrates that increases in volatile organic compound emissions resulting from the waiver significantly interfere with attainment or maintenance of the national ambient air quality standard for ozone; and (2) the Administrator determines the exclusion to be reasonable and practicable.

(Sec. 5) Directs (currently, authorizes) the Administrator, for purposes of registration of fuels or fuel additives and on a regular basis, to require manufacturers of such fuels or additives to conduct tests to determine potential public health and environmental effects (currently, public health effects) of the fuel or additive and to meet other existing requirements.

(Sec. 6) Requires motor vehicle fuel sold in the United States in 2008 and thereafter to be comprised (on a 6-month average basis) of a specified percentage of clean alternative fuel. Phases in such percentage requirement, to require motor vehicle fuel to contain 1.5 percent clean alternative fuel in 2011 and thereafter.

Requires all motor vehicle fuel sold in the United States during 2002 through 2007 to contain, on a 6-month average basis, a specified percentage of renewable fuel. Phases in the percentage requirement, to require fuel to contain 1.1 percent renewable fuel by 2007.

Authorizes credit trading programs to permit persons who refine, blend, or import motor vehicle fuel with more than the required clean alternative or renewable fuel content or who manufacture certain energy-efficient vehicles to use or transfer such credits to others for compliance purposes. Permits the use of the vehicle manufacturer credits to provide any portion of the non-Federal share required for an alternative fuel project under Federal-aid highway provisions regarding the congestion mitigation and air quality improvement program or a voluntary supply commitment under the Energy Policy Act of 1992.

Provides for a temporary waiver of this section's requirements upon State petition if: (1) implementation would severely harm the economy or environment of a State, region, or the United States; or (2) there is an inadequate domestic supply or distribution capacity to meet such requirements. Authorizes exemptions from such requirements for small refiners,

Makes violators of this section subject to civil penalties under the CAA.

(Sec. 7) Authorizes the Administrator to approve State implementation plan revisions that apply a prohibition on the sale of conventional gasoline in covered areas (areas requiring the use of reformulated gasoline) to a nonclassified area.

(Sec. 8) Amends the Solid Waste Disposal Act to authorize the EPA Administrator and States to use funds from the Leaking Underground Storage Tank Trust Fund to: (1) carry out corrective actions with respect to a release of MTBE that presents a risk to human health or welfare or the environment; and (2) conduct inspections, issue orders, or bring actions under the underground storage tank regulation program. Authorizes appropriations.

(Sec. 9) Directs the Administrator to publish analyses of: (1) the changes in emissions of air pollutants and air quality due to the use of motor vehicle fuel and fuel additives resulting from the implementation of this Act; and (2) the effects of motor vehicle fuel and fuel additives on public health and the environment.

Requires the Administrator to publish regulations establishing performance requirements to ensure that, as compared with emissions due to the use of motor vehicle fuel and fuel additives during the period of 1998 through 2000, emissions due to the use of such fuel and additives will not be significantly greater on a per-gallon average basis in any region or cause air quality to be significantly worse in any region.

Directs the Administrator to publish regulations establishing performance requirements for such fuel and additives, the use of such fuel and additives, and motor vehicles that are necessary to ensure adequate public health and environmental protection and to achieve specific reductions in the use of compounds or associated emission products that pose the greatest human health risk.

Requires the Administrator to finalize an emissions model that reflects the effects of fuel characteristics or components on emissions from vehicles in the motor vehicle fleet during 2005.

MTBE BACKGROUND FACT SHEET

Methyl tertiary butyl ether has been used as an octane booster in gasoline since the 1970's. The historic levels of MTBE used for octane enhancement are low, approximately 1 percent of the total national fuel market, compared to the levels found in reformulated gasoline being used today, approximately 3 percent of the total national fuel market.

The reformulated gasoline (RFG) program was established by the Clean Air Amendments of 1990. The RFG program requires gasoline in certain areas to meet specific formula and performance standards that are stricter than standards for conventional gasoline. The RFG program sets minimum content requirements for oxygen and detergents as well as limits on the amount of benzene, aromatics and lead allowed in gasoline. The RFG program also limits emissions of toxic air pollutants and volatile organic compounds. The 2 percent oxygen requirement of the RFG program is currently fulfilled by adding either 15 percent MTBE or 10 percent ethanol to gasoline.

The RFG program has been successful, One notable success it that reformulated gasoline in many RFG areas exceeds the statutory requirement to reduce toxic emissions. This over-compliance is due to the dilution effect of the oxygenate additives MTBE and ethanol, relatively toxic-free additives.

When leaked or spilled into the environment, MTBE can cause serious drinking water quality problems. MTBE moves quickly through land and water without significant biodegredation or natural attenuation. Once in undergroundwater supplies, MTBE can be detected by smell and taste at low concentrations. Small amounts of MTBE can render water supplies undrinkable.

Cleanup of MTBE contamination is possible but difficult and expensive. There are several ways to remove MTBE from drinking water. Contaminated water may be filtered, aerated or bioremediated. All options require installation and use of special equipment as well as on-going maintenance.

Existing programs are either not fully funded or are not structured to provide funding to States for cleanup of substances that move quickly and that ruin drinking water supplies at low levels, well below levels that may be hazardous to public health.

The major sources of MTBE contamination are leaking underground storage tanks. Many underground storage tanks have been or are currently being replaced, per a recent EPA regulation, however there remains questions regarding the ability to employ completely sealed fuel storage systems. Other sources include automobile accidents, fueling over-fills and backyard mechanics.

Christina, you're on.

STATEMENT OF CHRISTINA MILLER, DERRY, NEW HAMPSHIRE

Mrs. MILLER. Good afternoon, Senator, representatives and other distinguished guests. Thank you for allowing me to come and speak about my MTBE experiences.

My name is Christina Miller and I am a homeowner and live at 14 Skywalk Drive in Derry, New Hampshire. My husband and I have been living at this address since June 1998. When we purchased this property, a water test was performed and our water measured high in nitrates, so an additional water purification system was installed. No mention of MTBE was made, nor were any tests provided.

In January 2000, we received a notice that our MTBE sample was below the 13 parts per billion limit at 9 parts per billion. We were retested in April 2000 and the reading was then 22. First of all, this indicates that anyone with any detection of MTBE should be cautions, because there can be significant fluctuations. Current studies are all short term in length and are still limited as to the impact to the damage of your liver, kidney and other carcinogens.

Furthermore, another test in May then indicated the percentage had dropped again. But also, MTBE, as a known problem, its dispersion and control is not well understood. Letters we received are very confusing. On page one of a letter from the New Hampshire Department of Health and Human Services dated July 31st, 2000, which had a 9.5 MTBE level indicated that there are no restrictions on water usage. Then on page two it stated, although the MTBE concentration is below drinking water standards, because of the concern about possible fluctuations in the contaminant level, we understand that DES will be installing a point of entry water treatment system.

When the MTBE levels were 22, we were warned not to use the water. The material provided told us how to better store gasoline, making us feel like we were the source of the problem. I don't feel provided us with enough information that made us more comfortable on the effects of MTBE.

Even though I was pregnant and informed the authorities involved in the study, we were not offered water alternatives or informed in any letter about alternative water purification or MTBE's harmful effects on us, never mind my unborn baby. Since we were informed about this problem, I began to do what I consider a considerable amount of research on my own, but almost to no avail. There is not much information found on the effects of MTBE or the problems that it may cause in the long run.

Of all the information that is out there, I have come to the conclusion that there was not enough testing done on MTBE before it had begun to be used in gasoline. In June of 2000, we finally started to receive bottled water. We were provided as much as we needed. Nice, but still a problem to take a shower, to do the laundry, wash our fruits and vegetables, or for cooking, among many other things we use faucet water for but take for granted.

After repeated phone calls and what seemed like lots of convincing, it was finally decided we might qualify for a water purification system. A new water purification system was finally installed at our residence in September. What concerns us also is the

fact that we received no paperwork that the system will be maintained and upgraded as needed for the lifetime of the residence.

Also a big concern of ours is the resale value of our home, as we intend to sell it in the future. We are also still very concerned about our health, which probably won't go away for a while, as there still is no resolution to this problem.

In closing, the NHDES did the right thing in testing for levels across the State, but should provide honest and full disclosure to all residents on MTBE and its possible harmful effects. The NHDES needs to also be proactive instead of reactive. We had to continually call to get results. We still have not been provided any notice of what the source of contamination is.

Finally, if there are long term effects on our health, how does the State expect to respond?

Thank you.

Senator SMITH. Thank you very much, Mrs. Miller.

Mr. Bob Varney, Director of the Department of Environmental Services in New Hampshire. I've had the pleasure of working with him now for, well, probably more years than either one of us wants to admit.

STATEMENT OF ROBERT W. VARNEY, COMMISSIONER, NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

Mr. VARNEY. Thank you, Mr. Chairman. I am pleased to be here on behalf of New Hampshire today.

The issue of MTBE contamination has been of great concern to us here in the State for quite some time. It's even more of a problem in the southern part of our State where we have more gasoline usage and more potential sources of contamination, as well as closer proximity of residences.

We have been very frustrated, quite frankly, in dealing with the MTBE issue. We very much appreciate your leadership in the U.S. Senate in trying to craft a compromise, as you've done recently with the Brownfields legislation, to help us reduce and eventually eliminate MTBE as soon as possible.

Here in New Hampshire, using the best available information on health related issues, we have set a very protective health standard of 13 parts per billion for drinking water, which is the most protective health standard for MTBE in the country. California is the only other State that has set a standard. U.S. EPA has not even set a standard on this nationally. But we moved ahead on our own, because we were very concerned about the long term health effects on our citizens.

We have a substantial amount of information on our website, and have tried the best we can with the limited resources that we have to help various citizens who have been impacted. Overall, 16 percent of our public water supplies have some level of MTBE contamination in them. In Rockingham County, it's even higher. Our private wells are also affected, and it could range, depending on the year, from 14 percent to 25 percent of our wells have some level of MTBE in them.

The interesting thing about this is that it's not always directly correlated to an underground fuel tank issue. We have removed about 15,000 tanks in this State and have replaced them with

about 4,000 state-of-the-art double walled or cathodically protected tanks. They have a 99.9 percent compliance rate for USD regulations which I believe is probably the highest in the country.

Even so, we're still finding MTBE in places where you wouldn't expect it. It appears that some of it may be from homeowner use, in terms of lawnmowers, snowblowers, weed whackers, chain saws and so on, where small amounts of gasoline are impacting local wells. We need to work as hard as we can on public education.

Overall expenses have been substantial. We've spent about $200,000 for various point of entry treatment systems, such as you've heard about today, with very limited funding available. One of our difficulties is having a source that we can look to to pick up the tab for some of these costs. Our projections are that it's going to cost the State as much as a $1 million to deal with the remediation of MTBE by the year 2006, based on current trends. We urge you to look very seriously at the LUST trust fund and other potential sources of revenue that could help the State and help the local communities and local homeowners to be able to deal with this issue quickly and cost effectively.

As you know, there are various tradeoffs regarding MTBE, both air and water. It's not a simple solution. You know the issue well. Just to get that vote out of the committee was quite an accomplishment, I think. We look to your leadership in the future in Congress to try to come up with a national solution for MTBE. We need to work with our neighboring States to ensure that we don't create a boutique fuel problem where we have fuel supplies or huge increase in gasoline costs.

We need to make sure that we're not replacing one problem with another problem, which the ethanol replacement situation could be, not only in terms of cost and availability but also in terms of remediation issues that haven't been fully studied yet and aren't fully understood. For example, the availability of ethanol in groundwater may result in benzene being more persistent in the environment, and that's a known carcinogen. So we may actually increase the risk to public health in the future as it relates to ethanol, and more studies are needed.

Finally, I just want to say that we appreciate your efforts. We need State flexibility to be able to do the right thing. We need to eliminate MTBE as soon as possible, and do it in a way that will have the best overall impact on public health. Keep in mind that our violations for clean air are usually 1 day events. But contamination of MTBE in someone's water supply is a daily or even hourly impact on our citizens. So we need to consider that tradeoff as we look to the future and come up with some permanent national solutions that will be in New Hampshire's best interests.

Thank you, Senator.

Senator SMITH. Thank you very much, Mr. Varney.

Senator Klemm, welcome.

STATEMENT OF HON. ARTHUR KLEMM, PRESIDENT, NEW HAMPSHIRE STATE SENATE

Senator KLEMM. Thank you, Senator Smith.

Let me say I appreciate your coming to the district to talk about this issue. I am here today to bring more awareness to an issue

that affects all of us, my neighbors and many citizens in New Hampshire. As a legislator and a businessman, I am growing increasingly concerned with reports of MTBE manifesting itself in groundwater in New Hampshire, and particularly in this district.

As you've heard, the Commissioner has spoken in great detail about the problems we have. But my understanding is that there are reports of MTBE causing asthma, shortness of breath, headaches and an inability to concentrate. MTBE has been proven to cause cancer in animals and is considered a carcinogen.

Water used for drinking and bathing should have not more than 13 parts per billion per State law. Yet in some communities, such as Salem, levels have been detected as high as 150 parts per billion. The Town reports that over 25 private properties have had positive test results for MTBE. Southern New Hampshire has a high population and a lot of private wells.

The New Hampshire House was unable to pass legislation this past year to ban the substance. But now, alongside key legislators in the House and Senate, we are prepared to go forward and make a difference.

This year, I am working with a bipartisan group of law makers to promote legislation to clean up our water supply and alleviate future contamination. There are three pieces of legislation before the House and Senate this year aimed at taking control of this problem. House Bill 755 relates to groundwater contamination and is being worked on in the House committee. House Bill 758, relative to the sale of gasoline containing ethers, which I am a cosponsor of, has been voted out of committee 13 to 1 and will soon move on to the Senate.

Last, Senate Bill 189, which sets up a gasoline remediation and elimination fund, is being worked on in the Senate Environment Committee and is expected to come out of committee shortly.

In conclusion, I anticipate even more communities will come to the legislature for help in the coming months. I am working out in front on this legislation because I do not think we, as lawmakers, want to be playing catch-up on this issue. I think it is in our best interest to act now to encourage cleaner water for our neighborhoods.

Thank you for hearing my testimony today. I ask you to work with us to move forward in the interest of public health.

Senator SMITH. Thank you very much, Senator Klemm. I want to start by thanking you for your leadership on this issue, and your colleague, Senator Russ Prescott, who could not be here today because of another commitment.

Senator Prescott had a meeting the other night that I attended with some 50 or so constituents, many of whom, like Mrs. Miller, who was there, had this MTBE in their wells. I want you to know that I welcome any efforts on your part and the State's part to correct this problem. It's a good impetus for me to put pressure on my colleagues to say that we need to resolve this issue.

So I welcome your support in that and whatever you pass moving us in the right direction should certainly be a help.

Let me just start with you, Senator Klemm. You have a convenience store, and I just met, along the border, right in this area of Salem, where you have these Windhams. I know, I met with a rep-

resentative group in Washington a couple of days ago of convenience store owners.

One of the problems that they raised with me, they said that we know that we have this problem with some of our tanks, but we just don't have the resources to replace them. Some of these people are on a margin, they have two or three employees. Maybe you could comment on what you're hearing from your colleagues in the convenience store business where you have those tanks, and also what you're hearing from constituents.

Senator KLEMM. Thank you for the question. Fortunately, under Commissioner Varney's leadership, New Hampshire was ahead on this problem. We set up a program for reimbursement for stores to take their tanks out of the ground and have them replaced with double walled tanks and cathodic protection and all of the up to date science that we have to see if any of these tanks are leaking.

As Commissioner Varney has said, there are almost, I guess it's 99.9 percent compliance in the State because of this program. It's one of the ways we're looking at maybe helping, that the MTBE is maybe doing something very similar to the fund we created to replace these tanks to help homeowners in the State.

Senator SMITH. Mr. Varney, it's 99 percent completion on the tanks, is that about right, in terms of replaced tanks?

Mr. VARNEY. We've had about 99 percent compliance with the rule. There are only eight or ten or so tanks left statewide that are not in compliance. One of the ways that we've done that, in addition to the fund that Senator Klemm just mentioned, is one additional provision which has turned out well for us also, and that's a program whereby if an operator can show that they don't have the resources to remove the tank, and in particular, there are cases where they probably don't even sell gasoline any more, they don't have the market and don't have the funds to remove the tank.

We can actually step in and, in agreement with the owner, who shows that they don't have the resources, can actually remove the tank for them and then place a lien on the property. The property is then a clean property that has higher value, we've eliminated the threat to the neighborhood in terms of a leaking underground tank. For some of these property owners, the property may be their major asset. So at some point in the future, we'll be reimbursed when there's a transfer of property.

That's worked out very well because it's minimized the impact on the small business owner that's struggling to survive.

Senator SMITH. You've obviously done an incredible job here in the State. I wish other States had done as well in terms of replacing those tanks. The obvious fact, though, that jumps out at you is that you have 99 percent or so completion of the replacement of the leaking tanks. Yet we still have 6,000 plus wells contaminated in New Hampshire, and they're growing.

So it has to say that there are other sources. You mentioned a few, whether it be the lawnmower or whatever. Also I think you might add to the list the fact that when you put the nozzle back on the pump after you've pumped your gas, it may run off there. Certainly boats on the lakes for surface water, not groundwater.

Where are the lion's share of the other contaminants, do you think? What corrective action, if we've gotten the tank problem

taken care of, what other corrective action do we have to take to stop this increase in wells being contaminated?

Mr. VARNEY. Well, a couple of things. One is the homeowner use that I mentioned previously. The other is simply discovering tanks that no one knew existed.

Senator SMITH. So there may be more out there that we don't know about?

Mr. VARNEY. There may be other tanks out there that we're unaware of that even in some cases the property owner is unaware of. Every day I hear of different stories of people finding tanks that no one knew were there. So the universe increases over time as properties are redeveloped, as people look to finance and perhaps do some site research and investigation.

So those would be the primary uses. But also keep in mind that we use gasoline for our automobiles and for many uses. Any spillage that's associated with those uses, even in very small amounts, can contaminate a well.

Senator SMITH. Let me ask the same question of both of you. We have in the Federal Leaking Underground Storage Tank program, the acronym, they used to call it LUST, and that didn't sound too good. So we took the L off, and it's now the Underground Storage Tank program. Had a little trouble with that acronym.

We have about $15 billion in that Federal program right now. Would you both be supportive of using some of the money in a State like New Hampshire, where we've met our compliance obligations on the tanks, for the most part, as we find new ones, as you said we might, would you be supportive of using some of the dollars in that fund for remedial help for people like Mrs. Miller, who have the problem in their wells? Is it appropriate to take that money from that program, which is really designed to stop the tanks from leaking by replacing them or sealing them, but would you be in favor of taking some of those dollars and putting them toward immediate and urgent help for those who are in need?

Mr. VARNEY. Yes, I would.

Senator SMITH. Is that appropriate, in your opinion?

Mr. VARNEY. Yes, I do think it's appropriate, and I think there's a logical nexus in regard to that issue. I really do. I think that the resources need to be there. The States are struggling to do the best they can with their limited resources. Having the UST trust fund available to us as a resource could make a huge difference and improve our ability to respond quickly and provide the funding and the followup there that's needed by the local citizens.

Senator KLEMM. I also agree with what Commissioner Varney has said. We are working in the State house in concord to come up with a program very similar just to treat the MTBE problem, very similar to the Underground Storage Tank Fund. I think that if there is money available at the Federal level to help the citizens with their MTBE problems, I think we should use that money.

Senator SMITH. I think we just got item No. 1 in our Federal legislation to use dollars in that Underground Storage Tank for the help of people like Mrs. Miller.

Mrs. Miller, let me ask you, as a person really living with it, it's easy for us to sit here and talk about it, but you're living with it in your well, what is you greatest concern? What is the thing that

bothers you the most about this? What is it that you really are concerned about more than anything else?

Mrs. MILLER. Probably the greatest concern that we have is that we don't right now, in our area, we don't know where it's coming from. They've done a lot of testing in our area. They come back quarterly to take a sample to see if it changes. It does for us. It went all the way from 4 to 22, and no one really knows when it rains if it's worse, if it's dry if it's worse. It's something that not too many people know much about.

So I guess that's what concerns us the most, is that it will be affecting our health. We do have the system, but now we have to deal with the system. For us, we were lucky, because our basement was unfinished. So it took up almost a quarter of our basement, because they ended up finding we were high in radon, too, which ended up having another whole system for us.

So I think that's what concerns us the most. I mean, the look, we can get over the look of the whole system in our basement, because it's good for our health now that we have good water. But I think overall we're concerned, because how do we know if it's going to get worse or better? I guess there just needs to continue to be more research on it.

Senator SMITH. Commissioner Varney, do you have any specifics that you can share with us at this point as to where the source might be for this vein of water that's causing this, if in fact we've sealed most of the tanks in the area that we know of? I don't mean to put you on the spot. It's not a hostile question. I just was curious if you know what that source might be, or the predominant source here in this area.

Mr. VARNEY. I don't. Greg McGarry from our staff, who is working on that issue, is here, and may know some more about it.

Senator SMITH. Greg, why don't you just come up, identify yourself for the record.

Mr. MCGARRY. We're seeing a difficult situation [inaudible] contaminate groundwater and bedrock [inaudible] water flowing [inaudible] unlike groundwater in the soil, it's pretty much [inaudible]. Consequently, we are having difficulty making a determination where that [inaudible].

Senator SMITH. So again, when you say backyard mechanics, are there extensive examples of that in this area?

Mr. MCGARRY. No, there's probably one or two [inaudible]—washing parts [inaudible] leaking gasoline [inaudible] contaminated gasoline [inaudible] backyard.

Senator SMITH. Sometimes extra funds wouldn't do the job, because you wouldn't have the science to work it anyway. But in this particular case, right here in this area, if additional funds either at the State or Federal or both level were to be provided to do more studies on these kinds of sources, would this be helpful, or are we pretty much just going to——

Mr. VARNEY. Yes, absolutely, Senator. We are, as you can imagine, with the increase in MTBE contamination, we're stretched thin on this issue. We have very limited resources and we're trying to deal with multiple sites, multiple problems, multiple sources of pollution, where it's pollution you can't see, you're not sure where it is, you're not sure where it came from, you're not sure when it oc-

curred. To do all of the investigation work in a timely and accelerated fashion, you need resources available to be able to do that, to be able to bring on additional consultants who would work under our direction would accelerate the process substantially.

Senator SMITH. You have done or are doing a study on this aren't you?

Mr. VARNEY. Yes, we are.

Senator SMITH. Has that been completed or do you know? Has that study been completed, sir?

Mr. MCGARRY. No.

Senator SMITH. What's the timeline on that, roughly?

Mr. MCGARRY. [inaudible] depending on the hydraulics used, depending on the concentration [inaudible] so it's literally a moving target that's very difficult to get a handle on on a technical basis.

Senator SMITH. When you think about the number of wells that are now contaminated, you could probably extrapolate to 30,000 or 40,000 wells or more over the next few years if this continues. But whether there's MTBE in the gasoline or not, the fact that there might be gasoline or whatever it is in your drinking water or in your bathing water is not a comforting thought.

Now, tell how the problem is exacerbated by the fact that it is MTBE in the gasoline as opposed to just gasoline moving into the water without MTBE. If we took MTBE out these folks are still going to have gasoline in their water.

Mr. MCGARRY. Probably they're not.

Senator SMITH. All right, that's what I want to hear.

Mr. MCGARRY. Probably they're not. The vast majority of public and private wells or water supplies that have been affected contain only MTBE or extremely low concentrations of other gasoline additives.

Senator SMITH. It moves quickly where the rest of those liquids don't.

Mr. MCGARRY. Right, the soil can tend to hold back some of the other gasoline components, bacteria in the soil is also capable of consuming much of those gasoline components at low concentration. But MTBE moves very quickly, bacteria, not particularly thrilled with consuming the MTBE, in part because it's a man-made compound.

Senator SMITH. I might want to have you, Nancy, when you come up here, expand on that a little bit yourself. I'd be interested in hearing that. Thank you very much, Fred.

Mrs. Miller, is there anything now that any of us need to do to help you in the immediate? We all know we're trying to get this taken care of. But is there anything at the Federal level or at the State level or at the DES level or whatever to help you? Is your water OK now as far as the treatment that you're getting? What are your needs that you want to let us know about right here now that we can deal with?

Mrs. MILLER. I think our water right now is fine. I guess [inaudible] to let us know [inaudible] as well as [inaudible] get a letter from the DES explaining what the level means. I guess the only thing we were concerned about was that we do have the system and they do maintain it, we don't pay anything for it, it's all paid for by the State. I guess just having something letting us know

that. I mean, we don't plan to move. But if we do, who's to say that the people that are going to buy it believe us that we don't pay for anything? I mean, it's very nice that we don't pay for it. I don't think I would believe it if I went to a house to buy it that everything's free right now.

I guess that's what I find it hard to believe, that we will never have to pay for it. I don't want the system to just sit in our basement, if the money runs out and then we will have to pay for it, then that will make it a problem for us.

Senator SMITH. Thank you very much. Does any other witness wish to make concluding remarks before we move on to the next panel?

I want to thank you all for being here. We appreciate it. If you'd like to stay, I want to go to the Q&A period, we can have everyone come up and maybe some of the members of the audience may have a question. If you have to leave, we understand.

Thank you. One other question. Is what Mrs. Miller's problem is fairly reflective, fairly symptomatic of everybody else's problem in this region? Are there people out there that don't have the equipment that she has in her basement, or ar we getting there? Are there people out there that are really suffering right now, can't use their water? Where are we on that?

Mr. VARNEY. We have been very quietly working with local homeowners for many years around the State dealing with gasoline contamination in their wells, helping not only to provide bottled water initially and point of entry water treatment systems but even locating new supply sources to put in a community public water supply so they would have a water line instead of an individual well.

So it's something we've been dealing with for a long, long time. Because of the characteristics of MTBE, the problem is worsening and it's putting a big strain on our resources here in the State. So any Federal support, Federal funding that could be provided would be put to very good use.

Senator SMITH. Thank you very much to all of you for your testimony, especially Mrs. Miller, thank you.

As the next panel comes up, I want to take a moment to introduce the two folks who are sitting behind me. Chris Hessler does all the clean air issues for me on the Environment and Public Works Committee, as one of the deputy staff directors on that committee. Of course Melinda Cross, who assists Chris and helps me a lot. She's from Newmarket. So somebody from Newmarket made good and moved out into the world.

So I'm delighted to have both of them with me. For all of you that have technical questions, they would probably be the best ones to ask, either formally or informally.

I'd like to introduce the second panel. Moving from right to left, Dr. Nancy Kinner, who's a professor at the University of New Hampshire. Bill Holmberg, who's a resident of Bowe, New Hampshire, and biofuels producer. Patty Aho, Maine Petroleum Association. It's great to have all three of you here. We appreciate your coming and providing you testimony.

Again, same rules. You have 5 or 6 minutes to summarize. Your written statement will be made part of the record and if you wish

to add anything to it, you'll have 2 weeks to do that, if you find something else you need to add to it.

So I'll start with you, Dr. Kinner.

STATEMENT OF NANCY KINNER, PROFESSOR OF CIVIL ENGINEERING, UNIVERSITY OF NEW HAMPSHIRE

Ms. KINNER. Thank you very much, Senator.

If we could have the lights down. What I'm going to talk today about is really going to tie in with the first panel. It's about the fate, transport, and remediation of MTBE in groundwater.

I just wanted to give you a little bit of background. I'm the director of the Bedrock Bioremediation Center, which is a U.S. EPA funded research center at the University of New Hampshire. We have a national test site for remediation of chlorinated solvents, and will be opening up a site on gasoline MTBE. One of our main goals is to actually do independent third party testing of innovative and emerging technologies for treatment of these contaminants in bedrock.

If we look at MTBE, as became clear in the first panel, it's very soluble in water. It's readily dissolved into groundwater or into precipitation, so that if we have a release, for instance, of uncombusted fuel, that MTBE in the gasoline can dissolve in precipitation and then be carried down as rainfall to the earth's surface, and then as runoff go into either surface water or infiltrate into the groundwater. If we have some kind of a gasoline spill or release, the MTBE will travel with that gasoline down through the soil and then the gasoline, because it's insoluble in water, and lighter than the water, will pool on top of the groundwater, and then the MTBE, because it's so soluble in water, will dissolve into the groundwater.

To give you an idea of the scope of this, if gasoline contains about 10 percent MTBE and the temperature is 77 degrees Fahrenheit, the solubility of MTBE is such that we could have up to 5 million micrograms per liter of MTBE in water right below that gasoline. To put it in perspective, the MTBE advisories and regulations range anywhere from 70 micrograms per liter, which is the EPA health advisory, down to the 13 micrograms per liter primary drinking water standard in New Hampshire.

Once MTBE gets into that water, it stays there. It won't adhere to rock or soil, as Fred mentioned earlier. This is unlike other gasoline contaminants, benzene, toluene, naphthalene, that all like to stick to surfaces. But MTBE moves. It travels along at the same velocity as the groundwater.

So if the groundwater in an area moves in inches per year, the MTBE will move in inches per year. If it moves in feet per day, it's moving very rapidly with the water.

As a result, plumes of MTBE can travel for miles from the source, potentially. One gallon of gasoline can contaminate up to 4 million gallons of groundwater with MTBE. So that if we talk about remediation, we need to have upwards of 10,000fold reductions to meet those regulatory and advisory levels. Now, remediation in different environments is progressively harder. If we look at surface water, it's relatively easy. It's an oxygenated environ-

ment, relatively easy to see where the water's going and to pump out the contaminated water.

As we move to soil and then to bedrock, treatment gets progressively harder, because it's difficult to know where the water actually goes in the soil and bedrock. We don't know the pathways because we can't see them like we could a river.

If we look at remediation technologies, they break down into two broad categories, what we call ex situ treatment, which is to pump the water out of the ground and treat it at the surface. We have a small unit like that on Mrs. Miller's well, that's called a point of entry unit, where we're just treating her water.

Ex situ contrasts with in situ. In situ treatment is where we actually do the treatment in the ground. Now, ex situ treatment has some problems associated with it. To treat the groundwater completely, we must get all the contaminated water out of the ground. That's hard to do, because MTBE spreads so far and so wide in groundwater. We don't know where those pathways are.

This is unlike those other contaminants we were talking about that stick to the soil and we know they're very localized. In situ remediation primarily centers on using the microbes that live in the ground to degrade the MTBE. These microbes are naturally occurring, and they basically use that MTBE as an energy source, just like we would use hamburgers. They degrade it to CO_2 and water.

The microbes, however, need other materials to do that degradation. For example, they need oxygen or nitrates. The advantage of in situ treatment is that we don't have to pump all of that water out of the ground to treat it. However, there's no free lunch, because the natural rate of in situ treatment is relatively slow. For example, if the concentration of MTBE was about 1,000 micrograms per liter, it would take 13 years with the natural rate of microbial degradation to get down to those advisory levels.

Also, we have another problem with these microorganisms in that sometimes they don't take the MTBE all the way to CO_2. They'll stop at an intermediate organic, something like tert-butyl alcohol, which is not a very good contaminant to have, either.

In some cases what we can do is what's called enhanced in situ remediation, and in this case, we add materials to the ground to accelerate that natural rate of remediation. That's called bioremediation. For example, out at a naval air station in California, they've added oxygen to the ground and in that case, the concentration of MTBE in 1 year has gone from about 800 to 7 micrograms per liter.

The challenge here, though, is distributing those materials in the ground.

Senator SMITH. Could you just take a second and go into the cost of that? Is that cost prohibitive? Can you give us any idea on that?

Ms. KINNER. On that particular site, it's not cost prohibitive. Obviously it costs several million dollars to do the whole thing. But you're cleaning up the whole plume of groundwater, not just the water that's coming up in somebody's well. It's on the same order of magnitude of cleanup of other contaminants.

So in conclusion, the problem with MTBE is its overwhelming solubility in water, and its desire to stay there and to travel with

that groundwater. To put this in perspective, MTBE ranks as the fourth most produced organic chemical in the United States. There were about 10.5 million gallons of MTBE produced per day in 1998. So there's a lot of MTBE out there. Even if we banned it today, the MTBE pollution in the groundwater would continue to be a huge problem nationwide, because it keeps on moving and gets degraded very slowly.

So I think what we need to do is certainly put some money into the search to develop and test innovative technologies to deal with this problem.

Thank you, Senator.

Senator SMITH. Thank you very much, Professor Kinner.

Let me express my apologies to Jeff Rose, who I didn't know was sitting there. I apologize, Jeff. Jeff Rose does all of my environmental work here in the State. He has set up one other hearing and a number of other meetings and works very closely with the Department of Environmental Services and all the folks here in the State. I'm pleased to have him here, and apologize. I didn't know you were sitting back there, Jeff.

The next guest is Mr. Holmberg. Please proceed.

STATEMENT OF WILLIAM C. HOLMBERG, PRESIDENT, BIOREFINER

Mr. HOLMBERG. Mr. Chairman, thanks for the opportunity to be here today. I have just learned a great deal from Dr. Kinner and may change my presentation based on what she had to say.

Senator SMITH. Well, if you learned something, it will be worth it, right?

Mr. HOLMBERG. Right. Maybe I should wait until I hear from the other person here.

I've been involved in the area of biofuels for about 26 years, in the government, in the private sector, and managing association programs. I'm not going to focus a great deal on the issue of MTBE, because you're doing a wonderful job of covering that issue here. But I want to thank you for this opportunity. Also, thank you for the fact that you came to the environmental inaugural ball in January and made a very impressive speech, and added to the success of that effort in Washington. Thank you for that.

Senator SMITH. You might have to speak up a little louder, Bill, or put that microphone closer to you.

Mr. HOLMBERG. The primary issue before you today is MTBE, and I fully agree that it should be banned and phased out of the gasoline pool. I ask that you consider a phase-out schedule that accommodates the reality of the problem and the economic consequences of such action.

Consequently, I suggest that you set up a legislative process so that the States are authorized to make the decision, rather than making a decision at the Federal level. Because it's different in every State, different circumstances, different levels of MTBE utilized, different contamination of the groundwater. Also there's the issue of a basic public relations attack on MTBE from those who benefit from the demise of that particular gasoline additive. I'm not suggesting that's the case here at all. I'm just suggesting that nationwide, that creeps into the formula.

It's interesting to note that MTBE is used in many parts of the world, continually so, for the last 10 years. Dr. Kinner just pointed out that it's still in great use. But it's interesting to note that the amount of public outcry has diminished significantly. I think that's probably because the wells are being cleaned up, and the tanks are being sealed up. Again, back to that attack by those who have a vested interest in the demise of MTBE they are relaxing their attack, and that helps.

It's also interesting to note that the people who launched that covert attack are the same folks that did not support you legislation last year. I think you recognize that that's probably the case.

The advance of the biorefinery concept that I have been working on, which is the conversion of cellulosic biomass to biofuels, bioenergy and biochemicals, is of great importance to the northern New England States. Because, essentially, you have no fossil reserve or gas or coal, and you're dependent on some form of transportation fuel. Given the present path we're on, that dependence is simply going to increase with the passage of time.

What you do have in these three northern New England States is vast reserves of biomass. They can be converted into biofuels, biochemicals and bioenergy, electricity and thermal energy. It not only includes agriculture and forestry residues, but it includes rights of way, park, yard and garden trimmings, the clean biomass portion that goes to the dump. We here in New Hampshire have done a tremendous job of cleaning up or recycling biomass. It ideally is set up for a biorefinery.

With gasoline prices possibly reaching $2 a year, and as people are beginning to talk about energy, I think it's clear to appreciate that we've got to find a way to reduce our dependence on all those fossil fuels that are imported into New Hampshire, principally the transportation fuels. Biomass presents that opportunity.

There is action required on two fronts. One is a steadily expanding market for biofuel. The renewable fuels standard that was in your legislation last year, S. 2962, reported out of your committee, is the best instrument to achieve that. The Renewable Fuels Act of 2001, S. 670, is out there now being considered. I ask that you include a renewable fuels component in your legislation, or co-sponsor S. 670.

When you start thinking out of the box, then we have to recognize that over the past almost 50 years, that hundreds of millions of dollars of Federal funds have been spent on the technology to convert cellulosic biomass to biofuels, biochemicals and bioenergy. The oil and gas industry estimates that that is in excess of $7 billion. We've got to find a way to take those hundreds of millions of dollars and put them to good work for the New England States.

Thank you.

Senator SMITH. Thank you very much, Mr. Holmberg.

Ms. AHO.

STATEMENT OF PATRICIA W. AHO, EXECUTIVE DIRECTOR, MAINE PETROLEUM ASSOCIATION

Ms. AHO. Thank you very much, Senator Smith. I'm Patty Aho. I'm the Executive Director of the Maine Petroleum Association. We are a division of the American Petroleum Institute, and as such, I

also oversee the issues of concern to our members here in New Hampshire.

As you indicated in your opening remarks and as the other two members of my panel have indicated today, a great deal of the focus of attention during the last few years has been on ethers and gasolines, specifically MTBE. But as the discussions regarding MTBE have occurred, there have also been discussions regarding the use of ethanol as an alternative to the use of MTBE in gasoline. I'd like to address you very briefly in regard to ethanol issues that we would face here in northern New England, in New Hampshire and in Maine, regarding ethanol.

As was indicated briefly by Mr. Holmberg, ethanol is not widely available here in northern New England. There is very little, if any, that is currently available. Ethanol is primarily available in the midwest, and that poses some questions in regard to the use of ethanol in gasoline here in New Hampshire or here in northern New England.

Over the last few years, there have been a number of various forum and studies that have occurred regarding the availability of ethanol and the infrastructure that would be needed here in order to use it and make it more widely available. Last year, the Coalition of Northeastern Governors hosted a forum here in New Hampshire regarding bioethanol, the economic issues, the infrastructure issues it would mean to northern New England, as well as to the northeast.

In Maine, we have a State agricultural products utilization commission that has recently contracted to do a feasibility study on creating a bioethanol refinery in northern Maine. A subcommittee of your committee recently heard from the executive director of NESCAUM, the North Eastern Sates for Coordinated Air Use Management, who indicated that yes, you could bring ethanol into the northeast and the New England area. The question becomes at what cost.

Unfortunately, the cost has become an issue and we've seen that the Commissioner of the Department of Environmental Protection in Connecticut has recently even indicated that price ranges may be from 3 to 11 cents per gallon right now, if you look at ethanol as a substitute for MTBE. The cost and availability are clearly issues here in northern New England.

Coupled with that, though, is the infrastructure question that it would take in order to provide ethanol in our gasoline. Your terminals provide you product into New Hampshire in the Portsmouth-Newington area. You also receive product from the Portland Harbor area as well a the Boston harbor terminals. Those terminals don't have the infrastructure needed right now in order to support ethanol. Ethanol needs to be separated and segregated before it can be blended into the gasoline. Those terminals don't have the equipment for blending ethanol into gasoline when it's picked up by trucks and taken to gasoline stations.

Gasoline stations in New Hampshire or Maine and northern New England right now also probably might need to do other types of retrofits in order to make sure that the underground tanks and pipes are compatible for ethanol-containing gasoline. So there are clearly availability and infrastructure problems.

These discussion arise usually in terms of can we use ethanol as a replacement for MTBE in reformulated gasoline. The reason for that obviously is because of the 2 percent oxygenate mandate that's required under the Clean Air Act for the Reformulated Gasoline Program.

So we would encourage you to repeal the 2 percent oxygenate mandate part of that so that the Reformulated Gasoline Program and refiners do not have to meet that particular oxygenate mandate. We think that then discussions regarding alternatives to the use of MTBE would take different tones and also would have different solutions available if the 2 percent oxygenate mandate were actually repealed.

We appreciate very much the opportunity to present information to you this afternoon and we will continue to work with you, your committee, as well a the State legislators and regulators on these particular serious issues that we're all facing. Thank you very much.

Senator SMITH. Thank you very much, Ms. Aho, for your testimony. We appreciate it.

On that RFG requirement, isn't it true that if we did repeal the RFG mandate or waived it, that it would have no impact on clean air itself? Does it harm the air to remove that mandate?

Ms. AHO. To the extent that I think you would still be able to have fuel formulas that provide a clean air benefit, no, I don't think you would be harming the air.

Senator SMITH. Again, the problems associated with using ethanol in New Hampshire, you spoke correctly, I think, about the cost, the estimates do run up to 11 or 12 cents a gallon more. Maybe Dr. Kinner could comment on this, what about the impact of using it on the air itself, in terms of what ethanol would do to the air here in New Hampshire or in New England as opposed to other regions of the country?

Ms. AHO. I think I will defer.

Ms. KINNER. To the extent that ethanol increases certain air emissions, then you would have to take those into account. Volatile organic compounds can be increased with the use of ethanol. So that would be one of the, not necessarily tradeoffs, but it would certainly be one of the considerations that any State environmental group would have to take into consideration.

Senator SMITH. Mr. Holmberg?

Mr. HOLMBERG. Two points. One is if you take the 2 percent oxygenate requirement out of RFG, that means you pull out either MTBE or ethanol, both high octane additives. Refiners have to get octane someplace, and they routinely will turn to the aromatics. That brings in the benzene issue, and benzene is a known carcinogen.

So we have to be very careful about what we replace in gasoline in terms of taking out the oxygenate.

Senator SMITH. Would you be supportive of legislation, however, that would not guarantee ethanol all the market if we replace, if we take out MTBE, but would allow ethanol to compete in areas where it's not an environmental problem, or to compete? Would you have any problem with legislation that did that, or are you insisting on a mandate for ethanol?

Mr. HOLMBERG. I'm not insisting on a mandate and——

Senator SMITH. You are or not?

Mr. HOLMBERG. Not. And your legislation last year didn't call for a mandate, either.

Senator SMITH. It didn't, but the ethanol people blocked my bill.

Mr. HOLMBERG. That was the point I was trying to make.

Senator SMITH. So their market was tripled in my legislation, basically on a free market approach. But the bill was blocked by ethanol Senators coming to the floor, coming to vote before, because it didn't have enough.

Mr. HOLMBERG. That's one of the key points that I wanted to bring up in my testimony, that there's rationale for the existing ethanol industry to oppose the advance of ethanol from cellulosic biomass. They want to control the market and they want to have access to their ability to control the price structure. They don't want too much corn going into that industry. There's competition involved. Increased production threatens the tax incentives. There are just lots of reasons why the major ethanol producers are opposed to the kind of ethanol industry I think the nation needs and should be instituted here in the northern New England States.

Senator SMITH. So you're saying that ethanol can be used here?

Mr. HOLMBERG. It can be used here. It can be made here.

Senator SMITH. You disagree with that?

Ms. AHO. No, sir, I don't. It can certainly be used here. Efforts are underway to study the feasibility of creating a bioethanol refinery plant in Maine. So there are efforts underway to see if it can be made here as well.

I don't disagree with either of those two points. What I do have problems with, though, is in people searching or looking toward ethanol as the panacea or solution to simply removing ethers from gasoline. It's in those discussions that then we run into trouble in northern New England, because if you were to do that as of, say, the beginning of next year, we don't have the ethanol availability here nor do we have the infrastructure here to support that in order to use ethanol in gasoline.

Senator SMITH. Dr. Kinner, in watching your presentation there, you have a, aren't you working on something? Can you tell me a little bit about that, the Bedrock Bioremediation Center there?

Ms. KINNER. We're looking at chlorinated solvents, which behave quite differently than MTBE or gasoline. But the whole point of that study site is for us to actually develop the methods to monitor and to remediate chlorinated solvents in bedrock. In particular, we're looking at competent or deep bedrock, which is a very difficult problem to deal with.

So we actually have our first test going on starting this summer, an independent evaluation of a commercial product which is to remediate TCE in bedrock. So we actually set up a full test array and actually monitor very carefully whether or not that TCE is being degraded and what it's being degraded to, to make sure that that's an acceptable compound as well.

Senator SMITH. In your presentation, you talked about the pump-and-treat cleanups and trying to solve all the problems. If we proceeded down that road now in terms of dollars, putting dollars into that kind of holistic approach of trying to clean up the entire aqui-

fer, if you will, are we just maintaining or just treading water? If MTBE continues to come into the supply, are we staying ahead of it by doing that, or are we wasting money?

Let me qualify "wasting money." We're not wasting money if we're helping people be able to use their water, obviously. But if we were to put a lot of money into that approach, will we ever get ahead of it that way or do we have to do that in combination with getting at the source? Are we staying ahead if we didn't get the source, we haven't found the solution to the source, are we still staying ahead?

Ms. KINNER. I think in most remediationsites, one of the first things that you try to do is to locate the source and eliminate the source. That's a pretty standard rule of thumb. I believe in the case for Mrs. Miller, the difficulty there is that it's a bedrock well. So finding the source is much more difficult.

To give you an analogy why that's hard, if you think about contaminant moving through soil, it's like a contaminant moving through the streets of Manhattan, lots of pathways, you can pretty much get from point A to point B pretty easily. But if you look at roadways in northern New Hampshire, there are very few, and you don't always know where they're going if you're on one of those logging roads.

So when you're looking in bedrock, you don't know where that contaminant came from, because it's not just a direct path from a higher elevation to a lower elevation. So it makes it very difficult to find the source in bedrock. In some cases, it may be that it is almost impossible to find the source so we have to remediate the water that's contaminated as a fall-back position.

Senator SMITH. Carl Sagan asked a question many, many years ago, I can't remember how many—30 or 40, I guess. He said, "Someday we're going to have this little rover and we're going to shoot it up to Mars and we're going to run it all around Mars' surface. It's going to take samples and send it back." Everyone said, "What is he talking about, how is that going to happen?"

I'm asking you to look into the future a little bit. If we were to take an approach on this to work very closely with the Mrs. Millers out there, and help them through remediation, put the dollars into the remediation, and say, "We're going to buy on to all of this other pump and treat. We're going to leave that alone, because in 20 years, 25 years—you can give me your best guess—we're not going to be producing automobiles that burn gasoline any more. Therefore, we're going to take our problem away. We're going to go to hybrid automobiles or hydrogen vehicles. We're not going to be filling them up at the pump with gasoline."

Are we going to hit Armageddon before we get to that point, with the manufacture of automobiles to such a point that it's going to cause us so many environmental problems we're never going to recover, or should we just put the money into the research to get there sooner with the automobiles, the hybrid and hydrogen vehicles?

Ms. KINNER. I think certainly, if we look into the future, gasoline for fueling vehicles may be eliminated. But I think the short-term problem for somebody like Mrs. Miller is, she's only the tip of the iceberg. These MTBE plumes are moving. So we get more and more

people impacted as those plumes move. Those systems are extremely expensive when you look on an individual scale.

For instance, Commissioner Varney mentioned that they'll be spending upwards of a million dollars. The systems are expensive to put in. Economy of scale is not with you on a POE (point of entry) unit. They're also very expensive to maintain. So that by just treating those individual wells, it's somewhat problematic in the short term.

Senator SMITH. Right. But if we assume that we were to treat those just as we're doing now for Mrs. Miller but put money into moving quicker to get at the source, which is the automobile, the fuel used in the automobile or are you suggesting we do all three? In other words, do the remediation, do the kind of research, the pump and treat, the research you showed up on the slide, and at the same time move forward as quickly as we can toward cleaner, more efficient automobiles?

Mr. KINNER. I think if we can eliminate gasoline being used, it would save a lot of problems on a large scale.

Senator SMITH. So the sooner, the better?

Ms. KINNER. Yes. But I do think that no matter what, looking at the projections that are out there, we have an MTBE problem here for a long time to come. Because once it gets into the environment, that degradation is very, very slow.

Senator SMITH. We have no idea how long that degradation takes at this point?

Ms. KINNER. It varies in different environments. Because on the slide, I was mentioning that typically, the organisms use oxygen to do the degradation. But in many of these aquifers, there is no oxygen present, because they're very deep down and the only source if oxygen is from the air diffusing down into the environment. So 13 years is somewhat perhaps optimistic in some of these deeper situations. I believe Mrs. Miller's well is down about 300 feet.

Senator SMITH. Thank you very much.

Mr. Holmberg, I just want to be sure, do you support an ethanol market mandate or not?

Mr. HOLMBERG. I support the provisions that were in your legislation last year and in S. 670.

Senator SMITH. Which gives them a portion of the market but allows for the flexibility of areas such as New Hampshire or California or some other place to use another alternative if they wish?

Mr. HOLMBERG. Yes. I would like to make the point that ethanol, when you talk about hybrids, electric vehicles or fuel cells, that ethanol is the preferred fuel for fuel cells production of hydrogen. Once you start that process, the opportunity to expand the ethanol industry in northern New England is tremendous, and the market for ethanol is assured all the way out to any future that I can see, because of the ability to convert it to hydrogen.

Senator SMITH. Does any witness have anything they wish to add?

[No response.]

Senator SMITH. I want to say thank you to this panel. It was a fantastic panel, as was the first one, very informative.

Before we go to the Q&A for the folks in the audience, I just would like to make a couple of announcements. I want to certainly

thank Channel 17, Salem Cable Access, for their gavel to gavel coverage, and New Hampshire Public Television, who is also covering this. These aren't things like missing planes in China, this is pretty heavy stuff and it's very difficult to understand, and we very much appreciate your covering this. I know it's of fantastic interest to your viewers, and I commend you for doing it.

One other announcement, lest I forget. On May 30, we intend to have a hearing—somewhere in the sea coast, I don't think we've pinned it down just yet. We're going to be bringing, at that hearing, a lot of new technology that's quite incredible. It's really something you don't want to miss. We have a number of people who are going to be testifying and talking about hydrogen vehicles, maybe give you a chance to ride in a hydrogen bus, hybrid car, and see some new technology and some incredible things that are happening on all of the environmental issues, air, land and water. It will be a very exciting hearing. It's called the New Technologies hearing.

Also to remind everyone that if you wish to add testimony or put testimony in the record, we'll keep the record open for 2 weeks, until 2 weeks from today.

So with that, if the other witnesses are still here, I would invite you to come back up. Maybe you could slide another chair up or something. Then if the people in the audience have questions, if you would just walk up to the microphone and please identify yourselves for the record.

I do have a sign-in, so what I'll do is I'll start with that. If you signed up here I'll call you in the order you've signed up, and then if there's somebody else that wants to ask a question beyond that, then feel free to do it.

Richard Norris. Use that microphone right there. Please feel free to direct your question to any of the witnesses or any of the panel behind me, my staff or me. Preferably the staff and the witnesses.

STATEMENT OF RICHARD NORRIS

Mr. NORRIS. Thank you, Mr. Chairman. I said earlier to you that I would be quite brief, and I will. The reality of being brief is enhanced by your announcement that you plan a technology hearing later in which a subject matter that interests me will be expanded on, and that is the question of going to a different source of energy. Separating hydrogen from water, for example, hydrogen from oxygen. Because the contaminant we get from that is water, again, that goes on the ground. Your concern is of course within the environment.

I'm just concerned about one thing, and that is the old story about the Arkansas traveler who's only concerned with the hole in his roof when it rains. I hope that you will keep your attention on what we can do to improve our sources of energy and the possibility of hydrogen is one of them. We are alerted to it by, I think, is it Dean Kamen and his first group that is talking about a small personal motor vehicle that would be powered by hydrogen.

The point for me is simply that hydrogen, as a source of fuel, is becoming real, and I hope you and your committee will keep it in your mind. I won't say more, because I'll go and watch carefully for your hearing on the sea coast on technology.

Senator SMITH. Dean Kamen is a very bright guy, and I'm hoping we'll be able to have him testify. Maybe he'll announce what this new little gadget is, but don't hold your breath on that one.

I hope I can read this—Doug Bogan, is that correct? Doug Bogan.

STATEMENT OF DOUG BOGAN, DIRECTOR, NEW HAMPSHIRE CLEAN WATER ACTION

Mr. BOGAN. My name is Doug Bogan, I'm New Hampshire Program Director for Clean Water Action. It's a national environmental group obviously concerned about water quality issues. Senator Smith, I would like to thank you for putting together this program today and commend you for making this issue a priority. Because it has been a priority of my organization and others in State and throughout the country for some years.

I mostly have comments, and may have a question or two along the way. But I do feel that in the discussion that we've had so far today the origins of this problem have been given short shrift. There hasn't been enough discussion of why we have MTBE in our gasoline to begin with. From our perspective, having watched this for many years, the story of MTBE is really a sordid tale of willful neglect on the part of the Government, miscommunication between different agencies, particularly within the Environmental Protection Agency itself, and really a determination to seek really the cheap fix with regard to air quality.

Now, some of you know that my organization has been involved in air quality issues as well as water quality issues. We certainly want to see cleaner air in New Hampshire and throughout the region. But we do feel that the use of MTBE and the whole Reformulated Gasoline Program was really flawed from the get-go, because it really tried to solve the problem of air pollution through tinkering with the fuel formula for gasoline rather than really going to the source of the problem, the fact that we use so much gasoline, to begin with, and that we don't use it efficiently, and that it's not burned cleanly, and that MTBE is not really the best solution to that problem.

Then again, of course, we have the ensuing problem of water contamination that was known 10, 15 years ago. We know that EPA scientists were aware of it. Evidently it didn't get passed on to the right officials at the right time. We really feel that there was a neglect of the available data then. We obviously know a lot more about the problem now. We do feel that the Government, both at the State and Federal level, needs to move on to admit that there were mistakes made, but to use the available science to solve this problem.

It really comes down to the basic metaphor we use a lot, I actually just heard it last night at a meeting in UNH talking about Rachel Carson, that if you come into your house and you see water running down the stairs from the bathroom upstairs, and you go up and you find the bathtub has been running, overflowing, and it's spilling out over the floor, well, you could go grab a mop and a bucket and you could try to mop it all up. But the much simpler and real long term solution to the problem is you go up and you turn off the tap.

I think that's the real problem we have here, is that we're not doing enough to turn off the tap to deal with the problem at its source. So we encourage you to pursue that. We do feel that the people here today and through the last few years that have become aware of this problem, whether indirectly or directly through their own drinking water, deserve a better answer, and they deserve a better solution than, well, we'll just treat your water and we'll provide you bottled water. They really need to know that the problem is going to be solved, that the source will be eliminated.

We feel that the people should not have to worry about the safety of their drinking water. Everybody has a right to clean, safe drinking water. We shouldn't have to live in fear of whether there will be health damage many years down the road because of contaminants like MTBE as well as the many other ones that we know about.

So I do want to point out that I don't think it was mentioned here today that the State of New Hampshire, as I understand it, was not required to use MTBE to use the Reformulated Gasoline Program. The State opted into the program with the certain purpose of reducing air pollution in the region. But as I said before, we don't feel that it was the best way to go about the problem. It may have been cheaper, but we're seeing the consequences now, that there are many, many costs that weren't taken into account.

Just a real quick calculation of some of the costs of remediating these private wells. I've heard an estimate of 6,000, 7,000 wells that may be exceeding the State's new standard for MTBE. It's estimated that it may cost $4,000 for the immediate cost, capital cost of setting up the remediation and another $1,000 per year after that. That all adds up to about $35 million for these 7,000 wells throughout the State in the first year, and then another $7 million each year after that. That's a huge price to pay, if people even know and find out that they have contaminated water. Many people probably won't find out until it's really too late.

So we should be avoiding those kinds of costs, we should address the problem at the source. We do feel that there are alternatives and we feel that we need to get to the source of the problem with air pollution, too. I know, Senator, you've been doing a good job looking at that issue, particularly with the power plants that need to be cleaned up. We now know that they are a much more addressable source of the nitrogen oxides that lead to smog that MTBE was mainly originally created to address.

So I do want to commend you, Senator, for making this an issue, making it a priority. I also want to applaud you for your leadership in State and particularly in the U.S. Senate to get something moving on this issue so that we can have safer drinking water in the future.

Senator SMITH. Thank you very much, Doug. I'd like to make a response to your question from a political sense, but before I do that, if Bob or Nancy or anybody wants to make a comment on the technical aspects of his question. I don't know the history of when you put the MTBE here in the State in regard to the requirement, but if you wish to comment on that.

Mr. VARNEY. Sure. The opt-in by the State of New Hampshire was first of all done at a time when the concerns about MTBE were

not readily known to our agency as well as to the State legislature or Governor's office, etc. We also know about the fuel distribution system in New Hampshire, and we looked at it analytically and determined that we were going to get RFG fuel whether we opted into the program or not, given our relationship to the markets, to ourselves.

By opting in, we were able to take credit for clean air reductions that would be associated with that opt-in provision and be able to include it in our State implementation plan. So it's pretty easy now to sit back as a Monday morning quarterback and look at, we should have done this, we should have done that. But at the time there were no negative comments from any environmental group. In fact, we were applauded for opting in at that time from the environmental community here in New Hampshire and in New England. Other States did the same.

The key for us is having the flexibility so that we cannot doubt and do it in a way where we don't have to sacrifice water quality for the sake of clean air, where we can opt out and do the right thing, eliminate the oxygenate requirements and be able to opt out sooner than the current EPA regulations allow us to do. Having that kind of flexibility available to the States is what we need.

Senator SMITH. Anybody else wish to comment? Mr. Holmberg.

Mr. HOLMBERG. On the history, the reason that oxygenates came along in reformulated gasoline with the passage of the Clean Air Act was that as lead was being phased out of gasoline, the level of aromatics in gasoline went up amazingly. This was a real threat to human health and contamination of the groundwater. So that's why the oxygenates came in in 1990.

Senator SMITH. And I'll just add the political. Certainly the U.S. Congress deserves its share of the blame. In 1991 or 1990, when the Clean Air Act was amended with this provision, there was very little science, really, done. Some speculate that there was science there that we didn't look at. Whether that's the case or not, there was a mad rush to clean up the air. We didn't do enough research on this particular product, in my view. Therefore, all of us collectively made a mistake, but I think made a mistake with good intentions.

I think it certainly lends a lot of credence to the argument that we ought to investigate and thoroughly analyze the science as we know it. Unfortunately, there's not a lot of exact science in some of these issues. That's the problem.

Did you want to comment, Dr. Kinner?

Ms. KINNER. Yes. The one thing I think that needs to come out here is that these point of entry systems that have been installed are not treating the problem in the groundwater. They are just treating what comes up to that person's well. That problem is only the tip of the iceberg of what's out there. So that if we just use POE systems I admit we're treating people's water, like Mrs. Miller, which we have to do, but we're still leaving that contaminant in the groundwater, polluting the vast majority of the groundwater. So I think we need to look at a broader based solution to what is in the environment.

The other thing I'd add is I think before you go to a solution like ethanol, you really have to think about what are the implications

of that ethanol when it gets to the groundwater as well, and how is that going to interact with things like benzene and toluene which sorb on the soil and they move more readily with ethanol present. So I think before we jump into that solution we ought to do a little bit of background research as well.

Mr. BOGAN. I do have a couple questions, if I may.

Mr. Varney, isn't it true that the State had an opportunity back in 1998 to opt out of the program, and the State of Maine I believe did do at that time? Could you explain?

Mr. VARNEY. Sure. As you know, Doug, and it's been explained to you on numerous occasions, New Hampshire and Maine are in different categories as it relates to the Clean Air Act. So what they're able to do, because they did not have an approved SEP, was to be able to opt out of the program. Whereas, with us, where we did the right thing and had an approved SEP, approved by the Federal EPA, we have this 2004 requirement placed upon us as it relates to opting out.

Second, Maine has not banned MTBE. That's been widely reported by various parties. There is still MTBE in Maine. So they have reduced their MTBE as we're trying to reduce it. But the analogy to Maine, we're comparing apples to oranges. It's a very different situation in New Hampshire, because we're treated differently under the Clean Air Act.

What we're trying to resolve is to have the Federal Government reward us for doing the right thing and don't penalize us for doing the right thing, which is what the current situation is.

Mr. BOGAN. Wasn't there a choice, though, at the time, of how you would meet the requirement to deal with the air pollution problem? I mean, you didn't have a gun to your head that you've got to use MTBE or you've got to——

Mr. VARNEY. No, we didn't specify MTBE. We have RFG, which is a regional fuel. We don't have a State specific fuel. We don't have the authority to specify the characteristics of fuels according to Federal law. So we're using every authority that's available to us under the current laws and regulations that exist at the Federal level. That's what's guiding us at this time.

Senator SMITH. The next person on the list is Mary Ellen Martin. Mary Ellen, if you'd like.

While you're coming up, let me just indicate, the idea, the intention here in terms of the thrust of Mr. Bogan's question is to ban MTBE, to waive the oxygenate requirement, not backslide on the Clean Air Act. By that, I mean not walking away from the Clean Air requirements.

The problem politically we have, I know it's very frustrating for me as a Senator from New Hampshire, and indeed, the chairman of the Environment and Public Works Committee, to have to say this. But we have some really tough competing interests that we've got to work on, which is why this hearing is helpful in getting this information back. No. 1, you've got the MTBE producers.

You may say, so? Well, we told them to produce this product and they did it. They have their own interests in Congress. I think Texas and Utah, I believe, are the predominant States that produce MTBE. Maybe they want some kind of transition money to move into something else. So do we buy them off by providing remedial

help, Mrs. Martin, and at the same time providing help to them? That's an issue. I'm not saying that's what we'll do, but that's an issue.

Second, you have the refiners. They have certain requirements. You have the ethanol producers. They are a huge, huge voting block in the U.S. Senate, and they are tough customers. Whatever you feel about ethanol, the point is, it really gets down, in some cases, to profit versus the health of our citizens.

Frankly, I'm going to put health first. That's what I hope I can convince my colleagues of back there. We gave you triple the market, and you want all of the market and we can't get this taken care of. That's not right. That's the message I'm taking back. Whether we win that argument or not, I don't know. But I think we win it morally, that's for sure. If we can get it done politically, then we'll get this done.

I don't want to create false impressions. It's tough. It's going to be a tough, tough issue. I intend to do everything I can to get it done. The folks at New Hampshire DES have been tremendous in their help, not only with their political help but also with their knowledge and input as we try to draft a bill. But this will be all helpful as we go back to draft legislation.

I know that we've talked to Senator Prescott the other night, Senator Klemm, too, there were some people at that meeting who said, what do we do, do we pass a bill at the State level or what do we do. I wouldn't discourage anybody from passing whatever they thought. I think it's anything you want to pass you feel deals with the problem from the State perspective to be helpful. If it doesn't fit with the Federal law, then it's my job to try to get the Federal law changed to fit with what New Hampshire's done.

So you don't hurt me at all in my effectiveness by doing it. So feel free to do whatever you need to do in that regard.

Mary Ellen Martin.

STATEMENT OF MARY ELLEN MARTIN

Mrs. MARTIN. I loved that last statement, sir. Thank you for that last statement. That will be a great help to Senator Klemm and I in the next couple of weeks.

I'd like to begin by just answering a question that you posed, Senator, on the difference between the cleanup of gasoline with and without MTBE. I just happen to have in my little extensive tote bag back there a reference. The health and environmental assessment of MTBE that was done by U.C. Davis, reported in November 1998. The cost to remove MTBE from drinking water is 40 to 80 times higher than treating for conventional gasoline with no MTBE. The cost to remove MTBE from groundwater is 50 to 100 percent higher than treating for conventional gasoline with no MTBE.

So adding to the already copious testimony of the need for treatment, I would like to agree with Mr. Bogan to some degree. We've covered that very extensively. We are swimming in this stuff, we have to address treatment of this stuff. But we really need to address the issue of preventing this stuff from getting into our water in the first place. This is one of the primary directions of legislation

which Senator Klemm and I and several of the local senators who are also sponsoring have going in New Hampshire.

USTs are not a problem in the equation in New Hampshire. I understand that in other parts of the country they are, but they're irrelevant here. The talk of cleanup as it continues to affect more and more citizens I think is going to be more and more frequent, by more and more bodies and more and more interest groups.

I think Mrs. Miller and her neighbors in Derry, as well as the folks here in Salem deserve a little bit of more explanation as to why we are sitting here in this mess to the degree that we are. While Commissioner Varney and I spoke 3 years ago when I began to try and move this elephant up the mountain, i.e., address this issue of MTBE in our water supply, nevertheless, when we had that opportunity to opt out, when we had all the knowledge that Maine had at that time, and Maine's own field people had discovered the plume of MTBE back in 1986, and taken it to a national awareness level.

So the knowledge was out there. I don't think anyone would condemn us for what we did back in 1990. Granted, we're not on the primary cutting edge of information and maybe shouldn't be expected to be. But what we did or didn't do in 1997 I think we could bring into question, as well as how we proceeded from that point.

Now, I'd like to make note of the fact that addressing the issue of the parts per billion was done as a result of a legislative initiative. This was not something we proceeded on within the Department, as well as the notification level was something that was mandated to the Department by the legislature.

At this point in time, I would like to ask Commissioner Varney why he seems to have felt from 1997 to the present that the credit that we were obtaining for using MTBE in the RFG program, the credits we obtained that were being applied one way or another to meet your requirements under the Clean Air Act, why those credits seemed more important than moving forward on water, why that issue has been a roadblock in every of the six or seven pieces of legislation we've tried to move forward in the past 6 years, while the escalation of the water problem in every one of our issues and every one of our hearings has been given short shrift, while we constantly focused on these counterfeit air credits.

Second, I just feel that as far as the citizens of our State are concerned, while we appreciate the struggle of the two Goliaths that Bob's having to deal with up in Washington, the two Goliaths being agriculture and the oil industry, that's political perception and it's kind of a long way away from your neighbors and the people here in Derry who are dealing with those wells.

What we're doing here in New Hampshire can have immediate relevance to your situation. We have constantly been told over the course of this 3 years that we could not act as a State to address the additives or formulation of fuel. Repeatedly, repeatedly we've been told this. Yet under Section 211(C)(4)(a) of the Clean Air Act, where it specifically says, indeed, that no State or political subdivision may prescribe or attempt to enforce any control or prohibition respecting any characteristic or component of a fuel or fuel additive in a motor vehicle or motor vehicle engine, that is, however, pre-

scribed by the statement for the purpose of motor vehicle emissions control.

None of the legislation we have brought forward has been for the purpose of motor vehicle emissions control. It has been to address the pollution of our water and the pollution of our people. That legislation has not been able to move because we have been repeatedly told that we did not have the authority to address this.

In addition, Senator, we now have a legal opinion which I've provided to your staff out of a firm in Washington, DC. which indeed does say under our State police powers, we have every authority to address the preservation and prevention of the pollution of our water, as well as the public health interests of our citizens.

So at this point I would just like to close by saying, we intend to move forward with this with legislation next week. There's action in both the House and the Senate, and I would encourage any and all citizens in New Hampshire who are concerned about this issue to stay plugged in for what's happening next week. Because we are going to move it next week.

Senator SMITH. Thank you very much.

I see this lady was trying to get the microphone and I don't have—come on up, because the next person I have is a man, and I know that's not you.

STATEMENT OF MARGO HARRISON

Mrs. HARRISON. I apologize for the way I'm dressed. I was planting trees today as part of a town program for planting trees.

I wanted to thank Dr. Kinner, your presentation was wonderful. The main point, a great deal has been said today about everybody's special interest and how long this is going on. Of course, everyone, motherhood and apple pie, clean air, clean water, this is the proposition. We're 90 percent water. There was a thing at the Motor Vehicles Department that 80 percent of New Hampshire is covered with trees and the rest is underwater.

I have a couple quick questions and then get to the point. I had understood from reading the paper that MTBE is very volatile. We have a lot of lakes in town. If it spills from people filling their boats up with gas or whatever, it just evaporates and we don't have to worry about it. But the impression I'm getting today is au contraire, that if it spills and then it somehow gets into the, sinks to the bottom of the lake or you're filling your boat up before you take off, you're adding to the problem.

A neighbor of mine who enjoys his snowmobiles very much spills enough gas in his driveway so that he was sweeping it down the driveway into the street. We called the fire department. It seemed to us there was so much gas, the fire department said, don't worry about it. Well, should you or shouldn't you?

Anyway, my main point is, I walk around my neighborhood every day trying to get in shape. There are dozens of gas cans that people use to fill up their boats. They're tipped over, upside down, they're all over the place. Now, why not public education? Why not give out flyers every time people fill up their car with gas? Where is all this stuff? Here are all these specialists who know about this, but we don't until we have a problem with our wells.

It would be very easy to hand things out at gas stations or wherever people pick up this potentially lethal chemical and help people handle it better. There are two streets up in my neighborhood where we're paying half a million dollars to put in a special water line because there are some contaminated wells. Well, I don't know if it's deep rock contamination, I doubt it, most of the wells around the pond I live on are just a couple of hundred feet deep, if that.

So there's probably people working under boats or their cars or whatever. But they didn't know. It seems to me that we should address that as well, very aggressively, so that people know to look and don't find themselves pregnant with a contaminated well, rather than after the fact.

Well, I would just like to urge that more along that line be done and that your slide show have much wider distribution, Dr. Kinner. Very, very well done. Thank you.

Senator SMITH. Could I have your name, please?

Mrs. HARRISON. Margo Harrison.

Senator SMITH. Thank you.

Does anybody have a response?

Ms. KINNER. She asked a question about the volatility of MTBE. When you think about MTBE and its volatility, you're correct, it is much more volatile than something like benzene in gasoline. But that's only if you have a beaker of it sitting right here and air above it. The minute we put that MTBE in gasoline, now it's in something it likes to be in. So it may still be volatile, but it then gets into water, its volatility goes down very, very low, because this is something it likes to be in even more.

So it's a question of where you like to be when you think about those things, it's a relative scale. Does that explain it for you? Ms. Aho. I would like to respond to that. The American Petroleum Institute has tried to disseminate quite a bit of information in regard to the proper stewardship of gasoline. You're absolutely correct, everybody has to handle gasoline appropriately, not just the terminals or the gasoline station operators, but all of us as homeowners as well.

We have materials on our website that we try to get out to people in the State of Maine. We have worked with the Department of Environmental Protection to make sure that information like that is disseminated. We'd be more than happy to work with the Department of Environmental Services here as well to get that information out to homeowners in regard to proper handling and care of gasoline.

Senator SMITH. The only other name that I have on the list here is James Robodosi. Come on up, and if there's anyone else, please feel free to just come up and we'll take your question.

Mr. ROBODOSI. Good afternoon, thank you very much for being here. Thank you, Senator Smith.

My name is Jim Robodosi. I live on Blake Road. I started the Blake Road neighborhood, bringing the water up to our area. We have 32 homes in our area that have wells, 28 of our homes contaminated with MTBE. We were able to pass the amendment to get water brought up to us, that will be some time in August hopefully.

I can feel with Mrs. Miller, how she is. We have 6.9 in our parts per billion of MTBE in our wells. The gentleman down the street

has 160 parts per billion. But the thing that kind of made me think was that, a question that you asked Mrs. Miller, what can we do to make you feel more comfortable or whatever, and she said that she has a filtration system in her home.

Dr. Kinner took my point right away when she made the point that it only takes care of the small picture, right where it is, and doesn't take care of the whole picture. I'd still be leery, because the MTBE is still in the ground, even though it is filtered.

My other question is, our reservoirs, and we have large filtration systems, but from what I understand, they're sand filtration systems. Does sand filter out MTBE? Because as I understand, the homes in our area that have the filtrations are all activated charcoal. I just want to make the point that you folks are all doing a great job here, the big picture. But us small people, we're an orphan site, which wasn't brought up at all. We don't know where ours came from.

I'm not a backyard mechanic, and I don't like to be stereotyped that way. I have no idea how it got there. Yes, we'd like to get water up there and taken care of. But I'm not sure, 13 years or more, that's a long time.

Also, I just want to let people know that the small people, myself, my neighbors and whatever, are dealing with this every day. We have to pay $350 a year for 20 years to have water brought up to our homes, because there's no funding for orphan sites. There's only funding for the LUST fund. I think we need to look into orphan sites now.

Thank you very much. Have a good afternoon.

Senator SMITH. Thank you very much.

Yes, sir, just identify yourself, please.

STATEMENT OF HAL LANG

Mr. LANG. Thank you. My name is Hal Lang, and I'll identify myself three ways. One is an enlightened user of gasoline products, such as chain saws, etc., as a selectman for the town of Paloma, where you have 20 to 30 wells contaminated with MTBE, and as a member of the legislature sitting on the Science, Technology and Energy Committee, where we've heard bills on MTBE for the last 3 years.

First of all, I want to commend you for what you're trying to do, what you've attempted in the past year and continue to do and for holding this. I would make several recommendations for solving the problem, and I think the first and most important one is getting relief from the RFG requirement in New Hampshire. That is one method to stop at least the bulk of the stuff getting into the environment. At least give us a chance to try and get a handle on what's in there now.

I think, and it would be a question that maybe could be answered by understanding the basic reasons for having RFG is probably moot. With the later model vehicles, with improvements and especially if we go to low sulfur fuel, we really get the benefits we would derive, we would get with conventional gasoline. A comment there, we've dealt with conventional gasoline for years, we know how to deal with it. It is a problem, it's a toxic chemical. But at least we did not create the problem we have now with MTBE.

The other thing is education. The woman is absolutely correct. I mentioned I was an enlightened user. When I fill up my chain saws now, I try to make sure I don't spill any gasoline, and when I do, I have something to catch it. Because I'm now aware that I can contaminate my own well with a minor spill. The people of this country, this State and this nation, need to have an appreciation of what they can do themselves. I think it will help change behavior, because that is obviously a source of contamination.

I would urge you as another method in which you propose is pushing forward as quickly as you can the requirement for more energy efficient vehicles and boats. Obviously marine vehicles are a major source of untreated gasoline, unburned gasoline getting into our surface waters, because they're very inefficient. We know that these, for instance, four stroke versus two stroke marine engines are much more efficient than the two strokes. They put less raw gasoline into our surface waters and therefore would help reduce contamination.

I think there are several avenues we can look. We identify the problem and look at all the items, the methods of pollutants getting into our waters. We should deal with each one of those. There's things we can do at the local level, at the State level, we would hope you would help us at the Federal level.

I think again the idea of your non-gasoline vehicles, moving that, that will benefit this country immensely. We're talking about we need to drill in the Arctic national wildlife to get maybe a couple of days worth of supply. We can solve that immediately if we just made these things more efficient by 5 percent. Going obviously with hybrid vehicles and pushing that technology, that is where the major investment can be made and where there is a big payback.

I think again the problem with the legislation, as you're aware, Senator, is that it was very specific. It should have allowed us the flexibility for solving the problem. I'm sure you've taken that message, but I would urge you to take it again. Give the States the flexibility of finding ways to solve the clean air issues with the most efficient way that we can do. Let the manufacturers do it. The testimony we hear often from the American Petroleum Institute is, we've been told we had to use 2 percent. So go tell them, I'll remove that. I understand the problems that you have with that.

Finally, as was mentioned before, there is a House bill coming up next Thursday, House bill 758, which came from my committee, it was sponsored by Representative Martin. The big issue, the contention point is, what is the most rapid way and most effective way for New Hampshire to get out from under the RFG requirement. I'm under the impression certainly that when we opted in, even though it was a voluntary opt-in, not mandated, we cannot opt out in 2004.

It is the opinion of some that, to heck with that, we will just mandate that we won't allow gasoline to come into the State with MTBE or a high percentage of MTBE. But the testimony we hear is that you can do all you want, the distributors are under Federal mandate to bring it in. Now, what we are directing in the modified version of House bill 758 is Bob Varney and DES to submit by no later than next January the commission request for opt-out in the hope that we can get that as quickly as possible.

So if I could get a comment on that, are we doing the right thing?

Mr. HESSLER. I think the short answer is that it's useful to explore all of the potential avenues at the State level. There are a variety of legal opinions, some of them need to be tested as to whether they actually have some authority that folks would like to see explored, such as the authority to ban a specific substance, like MTBE.

If that, the main problem with a State specific answer is that you could easily wind up with a State specific gasoline, which would be substantially more expensive than either RFG or your conventional gasoline. So that's why the Federal solution, which would allow the gasoline producers to provide a single cleaner burning fuel than RFG without this MTBE problem for all the States that want to use the RFG, would not only take care of your air quality problem but would also protect the gasoline prices. So that's the value of the Federal approach on this.

Mr. LANG. I guess the basic question, what gets us there quicker and surer?

Mr. HESSLER. I think that's a political question——

Mr. LANG. There's two different answers to that one, too. We know that for certain if we direct opt-out by 2004, that's certain, I think. But I'm not sure that's the quickest and most efficient way to get that.

Mr. HESSLER. Certainly if legislation were to go through before 2004, that would enable the nation's gasoline producers to respond more quickly. I think the real difficulty there, though, as Senator Smith pointed out a couple of times during the hearing, this is somewhat of a titanic clash of interests. He put forward a very reasonable bill that's market oriented, was the least expensive solution to the problem, and yet it didn't pass muster for policy reasons.

So there's a very high political hurdle in Washington that he has been trying to take on directly. So we'll continue to work in his direction and try and get over that hurdle. But I don't think that precludes folks at the State level doing all they can as well.

Mr. LANG. Mind if I ask a couple more questions? I really appreciate your taking the time to listen to them.

Is there any way that the EPA can grant us opt-out? Can they grant us absolution, or whatever we need, or some permission, if we come up with an alternate fuel that doesn't have 2 percent oxygenate requirement, doesn't meet the 2 percent oxygenate requirement but we can demonstrate we can keep our air clean, has EPA the ability to give us permission to opt out?

Mr. HESSLER. Lots of people could answer this, but I'll simply say that the current Federal regulation says that those States that have opted in may not opt out until 2004. The primary logic for that was to not allow for fragmented gasoline markets, where folks were either opting in and out at odd times, driving up the number of specialized gasolines that the gasoline producers would have to supply around the nation. That was the purpose for that 2004 date.

I think that what's happening here at the State level may test whether there's an opportunity to change that. I don't know if anybody else wants to comment.

Mr. VARNEY. That was actually the subject of a letter from Governor Shaheen to EPA Administrator Whitman recently on that very issue, to reevaluate the EPA rulemaking that includes that 2004 provisions, and to revise that rule so that opt-out can occur faster. So we've already made that request to the head of the EPA as part of the submission last week.

Mr. LANG. One final comment, maybe it's a question. First of all, I want to thank Dr. Kinner for the comments she made. I think one of the problems we had when we entered into this thing with RFG, we really didn't evaluate the implications, the total implication of switching to this form of fuel. When we talk about things like ethanol, I think we need to evaluate it. Because some of the things I understand, some of the byproducts of ethanol are formaldehyde. That's my understanding, I may be wrong in that. Again, what are we going to get ourselves into?

So there's no, to me, gasoline is a toxic chemical with different variety of toxic compounds, and we'll replace it with a different toxic compound, we need to understand the full implications before we move in any single direction. I do appreciate those people that understand that, and I think give us the wherewithal to determine our own destiny and we'll get there.

Senator SMITH. Let me just make one point. I'm not here to axe the ethanol industry, they have performed a valuable function in helping throughout the country to meet the clean air requirements. But the issue here is that if you ban MTBE, then there is going to be a race to the market, if you will. Ethanol feels they can fill that. All we're saying is, you can fill it wherever you can fill it, if it doesn't harm the region where they fill it.

That's not the position of the majority. Not all, the majority of the ethanol States is, the majority of the ethanol States are adamant that they get the market, period. That's why the legislation that I have, which I thought was pretty reasonable, but I'm not saying it's just because of me, but we had support for the legislation, but not enough to get it through. We moved to the direction of the ethanol by providing about triple the market. That was not enough.

Again, I think it's important to understand here, this is not about filling the market for ethanol. This is a health concern here, there's an environmental concern here. I think we have to make that point. To me, it's not—well, it's somewhat different, but it's similar also in the sense you've got floods in the midwest. We don't say, well, we don't have any rivers in whatever, in some States, therefore we're not going to help you where you're flooding.

We have a problem here, we have a problem in California as well, and there are other regions in the country where this is, using ethanol is a problem. So I'm not against ethanol, I'm just against it being forced to be used in New Hampshire or any other State where it's not good to use it right now. Maybe the infrastructure in the future, or maybe the mix problem that causes the smog, maybe that's resolved down the road.

You're right, formaldehyde is a byproduct. Let's not create more problems. Let's go slowly here. I think usually, with the States opportunity to opt out, what the States know is usually best. But we do have some Federal law here that has to be, the Federal law has

to be changed, otherwise we pass something that may be in violation of Federal law, you'll be in $25,000 fines or something.

So we want to be sure we work this together. That's why it's helpful to have this dialog.

Mr. LANG. Thank you very much, Senator. I really wish you Godspeed on this journey, and anything we can do in the State, I'm sure you know you can count on us to help you.

Senator SMITH. We appreciate it very much.

Let me make this last question.

STATEMENT OF HOWIE GLEN

Mr. GLEN. Thank you, Senator.

My name is Howie Glen, I live in Salem. I came here today because I've been in the gasoline business for 44 years. So I wanted to come and listen.

I have to just emphasize to Senator Klemm to please do whatever you can to get this additive out of the gasoline. You can handle that. I have to, I just want to commend Commissioner Varney. I've watched him over the years and I've dealt with him over the years. I am an independent gasoline station operator, I have two small stations. In the last 11 years, thanks to all the rules and regulations of DES, I have spent approximately $350,000 of my money to keep my stations clean.

Last week, I heard people say that you were dropping the ball on the air quality. Last week, one of my stations, I had to spend $7,000 to upgrade a vapor recovery system because DES ruled that they were going to use California standards and it was out of code. So I had to have that done.

I think that anybody that can have a 99.9 percent rating deserves a lot better than some of the things I heard here today about the Department of Environmental Services. I think that they's done a job, I think they're trying to control the issue, they come and inspect my stations. Although you don't like to have it done, you're glad it's done once they leave and say everything's all right. Then it's OK, he's a good guy. Say it's bad, that's a different issue.

I have to commend them. I think they've done an excellent job, they've worked hard with what they've had to work with. People complain about a contaminant in a well, and I own a station that's comparatively close to these people on Blake Road. I have one and it's been checked.

We do what we have to do, we try to run a clean business and we try to make a living. But when you have to take over a period of 11 to 12 years $350,000 out of your pocket to stay in that business, a lot of times you say, maybe it's time to close up and give in to the big guys and let them have it. But we've fought it, we'll continue to fight it. We do what we have to do.

I commend you, Commissioner, I think you've done an excellent job. Senator Klemm, I know you can do what has to be done to get it out of the product. Thank you very much.

Senator SMITH. Don't give in to the big guys yet, hang in there.

Anybody else? All right. Go ahead. Let's try to make it as quick as you can.

STATEMENT OF BOB MAGUIRE

Mr. MCGUIRE. I'll be very brief, Senator. My name's Bob McGuire, I'm a representative from here in Salem.

I just want to cal your attention to a floor bill that we have, it's House bill 758 in the Senate. Essentially what it does, it may take care of a couple of issues, some concern was expressed earlier, a couple of issues. One was the mandate, once removed, doesn't put a time specific date or levels for the removal of the MTBEs. The floor amendment, the correct amendment to House bill 758 does do that. It does have a specific time schedule and limits on the MTBE, time period by which they have to be removed.

Those are two concerns that we have. There's a group that may be a little more proactive, and there seems to be tendency to be. Our attitude is to take of the Mrs. Millers and the other people from the Blake Road area here as quickly as possible, and be their advocates. That's where we are.

So we are requesting that DES, our fellow representatives and members of the Senate do familiarize themselves with this floor amendment, and if it's at all possible, for us to receive as much support as possible for it. Thank you again for your good work.

Senator SMITH. Thank you very much, Bob.

Mr. COBURN. Thank you, Senator, I'll try to be equally brief. My name is Ken Coburn, and I work for Bob Varney, running the air division.

Senator you recognized the presence of your staff members, Chris Hessler and Melinda Cross. I want to recognize on behalf of the State their efforts. There was a period in June and July last summer when I made 5 day trips to Washington in a 10-day period, spending innumerable hours with Chris and Melinda, negotiating with Senator Bond's staff and Senator Grassley's staff and Senator Daschle, the ethanol States, trying to get a deal done. As you know, that was put forth by yourself in S. 2962, an excellent bill. I urge that you put forth a similar effort this session.

One of the reasons that those efforts were so difficult may be of interest to the committee and perhaps to the viewers is that for frame of reference, all Federal support of State air programs, all 50 States, through EPA's budget, is about $200 million a year. The ethanol subsidy is about $800 million a year. One company of that takes home $400 million a year, twice as much as all Federal assistance for State air programs.

It's unconscionable. A State ban is not the way to go. There's no State ban that I'm aware of that has proven effective. The only place where they have been effective is in the States that have solely used ethanol in the first place. A Federal solution is necessary.

So in terms of what we're seeking, we do want the oxygenate mandate repealed so that we're neither required to use MTBE or nor ethanol. We'd like it to be sooner than 2004 if that's at all possible. We would like incentives for new technologies. I'm certainly pleased that you're bringing that hearing to New Hampshire, and options for other alternatives like mass transit and then certainly remediation funding.

I think I can speak for all of us in the State and DES and on behalf of Commissioner Varney that we stand ready to assist in that quest however we can. Thank you very much.

Senator SMITH. Thank you very much, Ken. I think in reference, one of the dangers we face is that out of frustration and anger, and I know that the California Senators are about at that point, is to just simply throw your hands up and say, OK, let's just ban it, period. What happens then is that the ethanol folks move into the market. That's not good for New Hampshire.

So it's very, very complicated. I'm not making excuses, but it is very, very complicated to try to work through this and to deal with the regional and competing interests. We're going to do our best. I appreciate your comments, Ken, I appreciate yours, Commissioner Varney is working with us and providing the technical help that we need to try to work through that.

I thought we had a deal that would work, but unfortunately, that didn't happen.

I want to in closing say thank you again to all of the audience for being here and those who asked questions. Certainly we thank the witnesses, Christina Miller, who's a resident of Derry who has this in her well, and Commissioner Varney, Senator Klemm, Professor Kinner, Bill Holmberg, and Patty Aho. Thank you so much for being here. I thank my three staff members as well, Jeff Rose, Chris Hessler and Melinda Cross.

Also again in closing, I thank Channel 17—you get a little commercial here—Channel 17, Salem cable access, for covering this and also New Hampshire Public Television. We'll see you on May 30 with another hearing that will be of interest. We're going to work very hard in the next 30 days to try to work this out, to try to get some resolution to this MTBE issue at the Federal level, which hopefully will complement what's going on at the State level.

Final point, Mr. Holmberg?

Mr. HOLMBERG. Please understand that Big Ethanol has their own agenda and that agenda sometimes does not coincide with the best interests of the nation.

Senator SMITH. You're correct on that.

Mr. HOLMBERG. We have to work with others to counterbalance that power.

Senator SMITH. They are tough, but they are very important.

Mr. HOLMBERG. I'd like to make the point that it is unfair to condemn the fuel ethanol industry because of the sins of a few corporations. Let's work together to bring a clean ethanol industry into New England.

Senator SMITH. Absolutely. Working together is the only way you're going to get anything accomplished.

Thanks again to everyone, and let me also remind you that if someone has a question or comment that you would like to submit for the record, you have 2 weeks to do it. Just send it to the committee in Washington, the Environmental and Public Works Committee, and we'll put it in the record.

This hearing is adjourned.

[Whereupon, at 4:05 p.m., the committee was adjourned, to reconvene at the call of the Chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF CHRISTINA MILLER, DERRY, NH

Good Afternoon, Senators, Representatives and other distinguished guests. Thank you for allowing me to come and speak about my MTBE experiences.

My name is Christina Miller and I am a homeowner and live at 14 Skylark Drive in Derry NH. We have been living at this address since June 1998. When we purchased this property, a fairly thorough water test was performed and our water measured high in nitrates so an additional water purification system was installed. No mention of MTBE was made nor were any tests provided.

MTBE

During 1999, the MTBE problem was highlighted in many States across the country and examined in TV and other news reports. During the New Jersey investigation U.S. Rep Bob Franks NJ, reported that "The Environmental Protection Agency knew about potential threats to public health and drinking water supplies years before the agency allowed the widespread use of a potentially cancer-causing gasoline additive to combat air pollution. The 1987 EPA internal memo assessing the health effects of MTBE noted that it could be toxic, causing neurological problems or tumors when inhaled or absorbed by the skin. The memo also stated that the chemical had been found in groundwater in four States, affecting up to 20,000 people." USC and others have investigated the linkages of liver disease and cancer related problems.

This is a Problem Across all America—Not Just New Hampshire

So far, tens of thousands of private drinking water wells and a handful of municipal water supplies have been contaminated by MTBE in the United States and further spreading of the chemical through underwater springs and aquifers is likely, say researchers. Among the worst examples of MTBE pollution so far are South Tahoe, California, where about half the drinking water wells have been contaminated, and Santa Monica, California, where 80 percent of the public water supply has been contaminated. Both cities now have to import water from elsewhere at costs of up to $3 million a year. In Maine, more than 5,000 private drinking water wells were found contaminated, forcing residents to hook into municipal water lines. The MTBE predicament could be costly for oil and gas companies who are already being held responsible for some of the pollution, according to the Environmental Protection Agency (EPA). Estimates for cleaning up MTBE are around $1 million per well, because current cleanup technologies for the chemical are limited. Several lawsuits around the country name gasoline operators as defendants in MTBE contamination cases, including ones filed by the South Tahoe Water District, a San Francisco-based environmental group called Communities for a Better Environment, and a group of five private citizens in North Carolina, to name a few. A number of energy companies, including Shell Oil, are responding to the threat of more numerous legal challenges by sponsoring research into microbial treatment—the cheapest MTBE remediation technology currently available. Microbial treatment uses bacteria to breakdown MTBE into its harmless components. Other methods of cleanup are significantly more expensive and include absorption using activated carbon, photo-oxidation using ultra violet light, and chemical oxidation using substances like hydrogen peroxide. Because of the financial and technological hurdles, many contaminated areas have yet to be cleaned up—and are instead simply sectioned off to reduce spreading while more cost-effective treatments are found. While MTBE's destructive nature in water may have come as a surprise to most, officials at the EPA say the chemical's troublesome characteristics were never a mystery to them—even before the U.S. Clean Air Act went into place.

My Experience

In January 2000, we received a notice that our MTBE sample was below the limit (9 parts per billion). We were retested in April 2000 and the reading was 22. First of all this indicates that anyone with any detection of MTBE should be cautious because of these significant fluctuations. Current studies are all short term in length, and are still limited as to the impact and damage to liver, kidneys and as a carcinogen. Further more, another test in May then indicated the percent had dropped again. Thus, although MTBE is a known problem, its dispersion and control is not well understood.

Letters we received are very confusing. On page one of a letter from NH Department of Health and Human Services dated July 31, 2000, (with a 9.5 MTBE level) indicated that there are "no restrictions on water usage", yet on page two it stated "although the MTBE concentration is below drinking water standard, because of the concern about possible fluctuations in the contaminant level, we understand that DES will be installing a point-of-entry water treatment system."

When the MTBE levels were 22, we were warned not to use the water. The materials provided told us how to better store gasoline and I don't feel provided us with enough information that made be more comfortable about the effects of MTBE. Even though I was pregnant and informed the authorities involved in this study, we were not offered water alternatives or informed in any of the letters about alternative water purification or MTBE's harmful effects on us, never mind my unborn baby. Since we were informed about this problem, I began to do what I a considerable amount of research on my own. But almost to no avail. There is not much information found on the effects of MTBE or the problems that it may cause in the long run. Of all the information that is out there, I have come to the conclusion that no one has done enough testing on MTBE.

In June of 2000, we finally started to receive bottled water. We were provided as much as we needed. Nice, but still a problem to take a shower, do the laundry, wash our fruits and vegetables, and for cooking, among many other things you use faucet water for, but take for granted. After repeated phone calls and what seemed like lots of convincing, it was finally decided we "might" qualify for a water purification system.

The System

A new water purification was installed finally at our residence in September. What concerns us also, is the fact that we received no paper work that this system will be maintained and upgraded as needed for the lifetime of the residence and our ability to resell our home in the future may be directly related to proving the status of this system. We are also still very concerned about our health, which probably won't go away for a while since there still is no resolution to this problem.

In closing, the NHDES did the right thing in testing for levels across the State but should provide honest and full disclosure to all residents on MTBE and its possible harmful effects. The NH DES needs to also be very proactive. We had to continually call to get results. We still have not been provided any notice of what the source of contamination is. Finally, if there are long-term effects on our health, how does the State expect to respond?

STATEMENT OF NEW HAMPSHIRE STATE SENATOR ARTHUR KLEMM

Thank you Senator Smith. Let me say, I appreciate your coming to the district to talk about this issue. I am here today to bring more awareness to an issue that affects all of us, my neighbors, and many citizens in New Hampshire.

As a legislator and a businessman, I am growing increasingly concerned with the reports of MTBE manifesting itself in the groundwater in New Hampshire and particularly this district.

The Commissioner will go into more of the technical details but my understanding is that there are reports of MTBE causing asthma, shortness of breath, headaches, and an inability to concentrate. MTBE has been proven to cause cancer in animals. It is considered a carcinogen.

Water used for drinking and bathing, should have not more than 13 parts per billion. Yet in some communities, such as Salem, levels have been detected as high as 150 parts per billion. The Town reports that over 25 private properties have had positive test results for MTBE. Southern NH has a high population and a lot of private wells.

The NH House was unable to pass legislation this past year to ban this substance. Now, alongside key Legislators in the House and Senate, we are prepared to make a difference.

This year, I am working with a bi-partisan group of lawmakers to promote legislation to clean up our water supplies and eliminate future contamination.

There are three pieces of legislation before the House and Senate this year aimed at taking control of this problem.

HB 755, relates to groundwater contamination. That bill is still in the House Committee.

HB 758, relative to the sale of gasoline containing ethers. I am co-sponsor of that bill which was voted out of committee 13–1 and will soon move on to the Senate.

And last, SB 189, sets up a gasoline remediation and elimination fund. This bill is still in the Senate Environment Committee, they are expected to vote on it soon.

In conclusion, I anticipate even more communities will come to the legislature for help in the coming months. I am getting "out in front" on this legislation because I do not think we, as lawmakers, want to be playing "catchup" on this issue. I think it is in our best interest to act now to bring cleaner water to our neighbors.

Thank you for hearing my testimony today. I ask you to work with us to move forward in the interest of the public's health.

STATEMENT OF ROBERT W. VARNEY, COMMISSIONER, NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

INTRODUCTION

Good afternoon Mr. Chairman, members of the committee. My name is Robert Varney; I am the Commissioner of the New Hampshire Department of Environmental Services ("DES" or the "Department"). I am pleased to be here today to present the State of New Hampshire's views on the gasoline additive methyl tertiary butyl ether (MTBE), the effect this compound has had on the water resources of our State, and the costs associated with the investigation and remediation of MTBE contamination. Our testimony also addresses the significant constraints imposed by the Clean Air Act Amendments of 1990 on the State's ability to remove MTBE from our gasoline supply. Thank you for this opportunity to address this important issue with you.

BACKGROUND

MTBE was first introduced in the 1970's to help replace lead in gasoline. MTBE's desirable blending characteristics, its relatively low cost, and its favorable impact on—octane rating made it an attractive gasoline additive. As a result, it was mixed with conventional gasoline at concentrations of approximately 2 percent by volume in regular grades and up to 9 percent in premium grades. In addition, the use of ethers, and in particular MTBE, was dramatically increased in 1995 with the introduction of Federal reformulated gasoline (RFG) requirements as part of the 1990 Amendments to the Federal Clean Air Act (CAA). Because its high oxygen content enables more complete combustion (reducing CO emissions, particularly in carbureted engines), and its relatively low vapor pressure reduces evaporative emissions (reducing VOC and air toxics emissions), MTBE was chosen by most refiners to meet he Federal oxygenate requirement (minimum 2 percent oxygen by weight) for RFG when it was mandated in the CAA. The presence of MTBE (and other ethers) in RFG also dilutes the concentration of more harmful toxics and carcinogens that are normally present in gasoline, such as benzene. The CAA requires the use of RFG in certain ozone nonattainment areas, and RFG was adopted for use in New Hampshire's ozone nonattainment areas (the State's four southeastern counties) in 1991 to help meet New Hampshire's emission reduction obligations under the CAA.

There is no Federal maximum contaminant level (MCL) for MTBE in drinking water. New Hampshire law requires that the State drinking water standard, for any compound for which no Federal standard exists and where the compound has been shown to cause cancer in laboratory animals, must be protective to a risk of one cancer incidence in a population of one million. In 1990, in consultation with the New Hampshire Department of Health and Human Services (DHHS), DES adopted a State criterion for MTBE of 100 parts per billion (ppb). In 1997, this was lowered to 70 ppb, again after consultation with DHHS based on a review of more recent studies on the health effects of MTBE.

In 1999, DES and DHHS, at the request of the State legislature, performed further review of the available information on the human health effects of MTBE, focused particularly on research and analysis performed since 1997. As a result, in May 2000, DES set New Hampshire's MTBE standard at 13 ppb. One other State, California, has also adopted a State MCL of 13 ppb. Nationally, New Hampshire and California now have the most stringent MTBE drinking water standard.

MTBE IN PUBLIC WATER SUPPLIES AND PRIVATE WELLS

New Hampshire first monitored for MTBE in drinking water in 1987. From 1987 to 1995, a total of 92 public water supplies reported first-time detects of MTBE, for an average of 11 new public water supply detects per year. In 1996, after one full year of RFG use in New Hampshire's four southeastern counties, 35 public water supplies reported first time detects of MTBE. Since 1996, an average of 40 public water suppliers per year have reported first time detects. DES believes that the observed increase in average new detects from 11 per year to 40 per year is directly related to RFG usage in New Hampshire.

In the year 2000, 16.2 percent (or 187) of public water supplies had reported MTBE detects. In the four RFG counties, the percentages are higher than statewide averages, ranging from 18.6 percent in Merrimack County to 24.5 percent in Rockingham County. In contrast, the six "non-RFG" counties have MTBE detects in just

over 8 percent of public water supplies. This further confirms the relationship between RFG in gasoline and MTBE in groundwater.

Fortunately, the detected concentrations of MTBE are between 0.5 and 5 ppb in approximately 85 percent of public water supplies with detectable MTBE, as compared with the MCL of 13 ppb. Only 2 of the 8 systems that currently have MTBE concentrations above 13 ppb do not have treatment systems installed, and these two are expected to take corrective action over the next several months.

New Hampshire has about 200,000 private residential wells that provide approximately 35 percent of the population with its drinking water. These wells are largely unregulated, in contrast with public water supplies that are subject to the rigorous standards established in the Safe Drinking Water Act. As a result, comprehensive water quality testing of private residential wells rarely occurs, although it is widely recognized that contaminants with significant public health implications exist in these wells at predictable frequencies, including radon, arsenic and MTBE. Consequently, this population of wells has not been universally tested for MTBE. In December 2000, DES announced an ongoing private well testing initiative to increase public awareness of the need for periodic and more extensive water testing for contaminants of concern, including MTBE.

Although the available data are limited, we know that MTBE contamination has had an impact on a significant number of private residential wells. For the period from 1995 to 2000, of 269 private wells tested by the DES laboratory, 39 (14 percent) experienced detections of MTBE, with concentrations below the 13 ppb MCL in 27 wells (10 percent) and above the MCL in 12 wells (4.4 percent). In the year 2000 alone, 105 private wells were sampled, and MTBE detected at levels below the MCL in 24 wells and above the MCL in 5 wells. This indicates an increasing trend in both the number of residential wells sampled—which we attribute to the increased attention to MTBE—and the rate of MTBE detection. Not surprisingly, these detection rates are comparable with those found during a 1998 study by the State of Maine, in which MTBE was detected in 15.8 percent (or 150) of 951 private wells sampled. Considering the available date from New Hampshire and Maine, with approximately 200,000 residential wells in New Hampshire, it is reasonable to project that between 30,000 (15 percent) and 40,000 (20 percent) of New Hampshire's wells may have detectable levels of MTBE, with levels above the 13 ppb MCL in around 8,000 wells (4 percent).

STATE FUNDING FOR REMEDIATION AND WATER TREATMENT

The State of New Hampshire has taken aggressive action to address MTBE contamination.. Among the specific measures the Department has undertaken are the following:

- In 1998, DES set in motion a process to reduce the risk to citizen exposure to MTBE-contaminated drinking water. DES began having all drinking water laboratories do what DES's lab had already been doing: test for MTBE along with other volatile organic compounds they routinely analyze for in drinking water samples.
- DES requested all public water suppliers to notify their consumers whenever MTBE has been detected in concentrations over 5 ppb.
- All municipal public water supplies have been tested for MTBE. (None currently exceed the State's drinking water standard.)
- DES has implemented an educational outreach plan for the prevention of gasoline spillage. This ongoing effort includes: radio and television public service announcements; DES web page information; numerous press releases, interviews with news media; presentations at public forums; conference displays; and coordination with other organizations. In cooperation with Northeast States for Coordinated Air Use Management and the private sector, DES also launched "Gas Care," a national spill prevention program that Governor Shaheen participated in launching through the taping of a video news release.
- DES has continued its aggressive underground storage tank (UST) program that replaces old, sometimes leaking tanks with new, state-of-the-art tanks throughout the State. This program has a compliance rate of nearly 100 percent. Over 13,000 old tanks have been removed and replaced with over 4,600 owner-purchased and installed new leak-resistant tanks. The success of this program has translated into a substantial decline in UST gasoline leaks.
- DES sponsors an active household hazardous waste collection program that includes collecting old gasoline. DES contributes $250,000 annually to municipalities for this program, which serves 150 communities statewide.
- In 2000, the Legislature passed and Governor Shaheen signed HB 1569 which instructed DES to analyze levels of MTBE in all grades of gasoline in the six counties outside the reformulated gasoline area. DES expanded the scope of the study

to include gasoline sampling in all ten of the State's counties. The analyses found MTBE and four other oxygenates in gasoline. This finding was unexpected, and resulted in a requirement for the reporting of analytical results for these other oxygenates in drinking water and groundwater. DES has also requested the New Hampshire Department of Health and Human Services to review the data available regarding these compounds to determine if drinking water standards should be established for these contaminants as well.

• DES and the New Hampshire Marine Trades Association instituted a "Clean Marine Initiative", aimed at reducing pollution from motorboat outboard engines. In an effort to achieve quicker introduction of the new low pollution marine outboard engines, DES and the Marine Trades Association entered into an agreement to promote the sale of these cleaner engines. Twenty one dealers have signed the agreement, setting high goals for the sales of low pollution marine engines, half of all engines sold in the year 2000 and more than 90 percent by the year 2003, well ahead of the mandated introduction of clean marine engines in 2006. (This initiative received an Environmental Merit Award from EPA-New England last week.)

• In the summer of 2001, DES will undertake a focused investigation of private water supplies near automobile junkyards, which we suspect may be a source of groundwater contamination, including MTBE. Thirty junkyards will be chosen at random throughout the State and sampling will be conducted of private wells near each of these facilities to determine if groundwater has been affected.

Through 1999 when the drinking water criterion for MTBE in New Hampshire was 70 ppb, the number of private wells that were known to have had a concentration of MTBE exceeding that level was small. To deal with MTBE contaminated wells, nine point-of-entry (POE) treatment systems were installed by the Department of Environmental Services through 1999. However, with the reduction in the drinking water standard to 13 ppb and an increased awareness by the public of the MTBE contamination, the number of POEs installed in 2000 was 25. The installation costs alone of those treatment systems was nearly $160,000. The installation cost, coupled with short term bottled water use and sampling and maintenance of the nine systems previously installed, resulted in a total POE cost due to MTBE contamination in excess of over $190,000.

More significant than the costs that the State of New Hampshire incurred last year for non-UST sites is the projected future costs associated with the investigation and remediation of MTBE contamination. The assessment of MTBE contaminated sites has absorbed significant personnel resources, and based on our best estimates of the number of new sites we expect to discover in the future, this demand for contracted engineering work and DES staff time will increase significantly. We are estimating, and need to budget for, a total cost for engineering consulting services for the investigation and remediation of MTBE contamination of $150,000 per year for the next 5 years. This is in addition to the more than $1,000,000 in State personnel time that we estimate will be needed to deal with MTBE contaminated sites. Moreover, there will continue to be a need to install POE treatment systems for those homes whose wells have been contaminated by MTBE. We have every reason to expect that the number of POEs needed in the coming years will increase, with the cost of installation of new systems increasing from $150,000 next year to $270,000 5 years out. The operation and maintenance expenses for all of the POEs installed by the State increasing to well over $100,000 per year in the next few years. We are also preparing to deal with the need to extend public drinking—water supplies in those areas where there has been widespread contamination of private wells. For our budget planning purposes, we are estimating a need for $200,000 per year to address the State's cost share for the extension of public drinking water supplies in those areas. In sum, we project total annual costs of $740,000 in 2002, increasing to $991,000 in the year 2006 to deal with MTBE contamination at non-USTR sites..

These costs are for only those sites not associated with contamination from leaking underground storage tank facilities. For UST sites, we estimate that approximately 200 such systems have been installed specifically to treat MTBE, of which 100 are currently in operation. The estimated costs associated with these systems is over $1 million for installation, plus $1,600 per year per system for annual operation. Current operation and maintenance costs for the 100 systems are estimated at $160,000 per year.

Currently, two existing dedicated State funds and a federally funded program are being used to investigate and provide water treatment systems to residents whose drinking water is contaminated by MTBE. For MTBE contamination associated with a leaking underground storage tank (LUST), the funding sources consist of the LUST Trust Cooperative Agreement with the U.S. Environmental Protection Agency and the State Oil Discharge and Disposal Cleanup Fund (ODD Fund). The ODD Fund is available for reimbursement of owners of underground storage tanks who

incur costs in cleaning up oil discharges in groundwaters and surface waters and soils of the State. This Fund cannot be used when the source of the problem is either unknown or not associated with a LUST site. Expenditures from the LUST Trust Cooperative Agreement are similarly limited to LUST sites alone.

The New Hampshire Oil Pollution Control Fund (OPCF) is used to fund the investigation and cleanup of MTBE contamination from unknown sources or sources not associated with a LUST site. The OPCF is funded by a fee of $0.001 per gallon of petroleum imports into the State, and was originally established principally to clean up a major petroleum spill in surface waters such as Portsmouth Harbor, the Piscataqua River, and Great Bay. The costs previously discussed for the installation and operation of private treatment systems for MTBE removal were funded solely from the OPCF. As the number of private and public water supplies discovered with MTBE contamination increases, the demands on the OPCF for treatment and remediation will become a major drain on this fund. Long-term use of the OPCF for MTBE related issues will rapidly deplete the fund, leaving the State vulnerable to a major spill in the River and Great Bay and without sufficient funds to clean up extensive MTBE contamination.

The State of New Hampshire and its municipalities, its businesses, and its citizens have expended considerable funds in addressing MTBE contamination of public water supplies and private wells. It is entirely proper for the Federal Government to provide funding assistance in the cleanup of "orphan" MTBE contaminated sites. The Federal Government currently assesses $0.001 per gallon on all petroleum products sold in the country. The revenue from that tax, which in fiscal year 2000 amounted to $189 million, is placed in the Federal LUST Trust Fund. The Trust Fund currently has a balance of about $1.5 billion. Interest alone from the Fund nearly equals the annual appropriation of—approximately $70 million that goes to EPA for the LUST Trust Cooperative Agreements to the States. The Trust Fund was established to assist the States in the cleanup of contamination caused by gasoline only from leaking underground storage tank sites. Thus, addressing these "orphan" MTBE contaminated sites from the Fund has not been permitted. New Hampshire believes annual appropriations from the Fund should at least equal revenue to the Fund, including interest. This would amount to over $200 million per year being returned to the States for the cleanup of contamination. In addition, individual States should be permitted to use a portion of those moneys for remediation of MTBE sites not associated with leaking underground storage tanks. This will provide a minimum of Federal support to assist States in dealing with the unforeseen and unintended consequences of reliance on MTBE as a fuel additive.

CLEAN AIR ACT CONSTRAINTS ON NEW HAMPSHIRE'S ABILITY TO ELIMINATE MTBE FROM THE STATE'S FUEL SUPPLY

As set forth above, there is abundant evidence that MTBE has become a significant and rapidly increasing contamination threat to the State's groundwater and surface water resources. MTBE is difficult and expensive to remediate. Further, it can be difficult to pinpoint the source of the contamination, and we are finding that an increasingly disproportionate part of the funds we have dedicated for petroleum remediation are caused by contamination problems related primarily to MTBE. We have aggressively undertaken preventive and remedial measures to address this contamination epidemic. New Hampshire also has aggressively pursued avenues to reduce and eliminate MTBE from our State's gasoline supply, but the State is severely limited by the Federal Clean Air Act in what measures it can take.

The Clean Air Act (1) prohibits States in almost all instances from controlling individual components of gasoline and (2) expressly mandates the oxygen content of RFG (the "oxygenate mandate"), leaving States with practically no authority to implement and enforce regulations to reduce MTBE levels in gasoline. Refiners use MTBE in conventional gasoline to help meet performance standards, and in RFG (which typically contains 5–10 times as much MTBE as conventional gasoline) because it is the most cost-effective alternative for meeting the oxygenate mandate in the East. Thus, virtually all gasoline supplied to the Northeast contains some level of MTBE. Even if it were legal to control MTBE at the State level, to do so could result in the supply of a gasoline that is actually more hazardous to public health and the environment than what we currently have. Also, it would most likely result in the requirement of a formulation for gasoline that is not presently available, which potentially exposes consumers and businesses to extreme variability in pricing and supply. Attachment A, a memorandum to Commissioner Robert W. Varney from DES's Air Director Ken Colburn, provides a more comprehensive discussion of the barriers that States face relative to reducing MTBE levels in gasoline.

In addition to the difficulties States face in trying to enforce actions to reduce MTBE levels in gasoline, there is also an absence of workable substitutes for MTBE. The only currently possible alternative to MTBE to meet the oxygenate mandate is ethanol. However, ethanol is not considered to be a workable substitute for States in the Northeast. Although not final, a recent study entitled Health, Environmental, and Economic Impacts of Adding Ethanol to Gasoline in the Northeast States, conducted jointly by the New England Interstate Water Pollution Control Commission (NEIWPCC) and the Northeast States for Coordinated Land Use Management (NESCAUM), helps to identify the impacts to public health, the environment, and the regional economy of widespread use of ethanol as a gasoline additive in the Northeast. The State of Connecticut currently has by statute instituted a ban on MTBE beginning in January 2003. However, knowing that a ban of MTBE in the presence of an oxygenate mandate would essentially result in an ethanol mandate, and in consideration of the preliminary findings of the NEIWPCC/NESCAUM study, the State's Department of Environmental Protection (DEP) recently wrote to environmental leadership in the legislature recommending that the effective date of the MTBE ban be delayed. Attachment B contains a copy of the letter from the Connecticut DEP to the State's Legislative Environment Committee which provides more information on the concerns with using ethanol in gasoline. It is clear that ethanol does not provide the solution to this problem.

Ultimately, the only rational and legal action that is currently available to States to reduce MTBE is to opt-out of the Federal RFG program. This would eliminate the oxygenate mandate and reduce the need for oxygenate additives such as MTBE and ethanol. For these reasons, New Hampshire Governor Jeanne Shaheen last week issued Executive Order 2001–02, which directs DES to take immediate steps to opt out of the RFG program. Attachment C contains copies of Executive Order 2001–02 and a letter of intent from Governor Shaheen to EPA Administrator Whitman. Even that action, however, prevents timely action to reduce MTBE, as the existing Federal regulation pertaining to RFG opt out requests (40 CFR 80.72) prohibits an effective date for opt out earlier than January 1, 2004.

As you know from your efforts on S. 2962 in Congress last session, States have few options to address MTBE in light of current Federal law. The Clean Air Act needs to be revised to eliminate the oxygenate mandate. New Hampshire, as have other States, has enjoyed the notable air quality benefits of the RFG program, and would prefer to maintain RFG's considerable air quality upside. We also respect the desire on the part of Federal policymakers to maintain regional consistency in fuel formulations. However, New Hampshire alone uses roughly 650 million gallons of gasoline per year. We also have one of the most successful tank replacement programs in the nation. Given the volume of gasoline that is distributed, it is unreasonable to expect that there will be no releases into the environment, even with the most diligent handling. To address the problem of MTBE contamination, we must pursue a pollution prevention approach that reduces, and ultimately eliminates, the use of MTBE as a gasoline additive.

Thank you again for this opportunity to provide the State of New Hampshire's perspective on this important issue.

ATTACHMENT A

STATE OF NEW HAMPSHIRE,
DEPARTMENT OF ENVIRONMENTAL SERVICES,

TO: Robert W. Varney, Commissioner
FROM: Kenneth A. Colburn, Director Air Resources Division
DATE: March 8, 2001
RE: State Level Regulation of Ethers in Gasoline

Purpose

As you know, legislation is proposed this session in New Hampshire to restrict the use of gasoline ethers such as methyl tertiary-butyl ether (MTBE) in the State (i.e., HB 755, HB 758). The purpose of this memo is to examine the implications of regulating the total ether content of gasoline at the State level.

During the last 3 years, there have been significant efforts in New Hampshire's Legislature to reduce and/or phase-out the use of MTBE as a gasoline additive because of its negative impact on the State's water resources. Specifically, MTBE, when introduced into the environment, travels much more readily in groundwater than gasoline, and is not broken down (biodegraded) as rapidly as most other components of gasoline. Although the legislative focus has generally been on MTBE, its negative characteristics are believed to be shared by other gasoline ethers, including

tertiary-amyl methyl ether (TAME), ethyl tertiary-butyl ether (ETBE), and di-isopropyl ether (DIPE). Because of their favorable blending characteristics (e.g., relatively high octane, low vapor pressure), ethers have been used in gasoline for over 20 years. However, the use of ethers, and MTBE in particular, was dramatically increased in 1995 with the introduction of Federal reformulated gasoline (RFG) requirements as part of the 1990 Amendments to the Federal Clean Air Act (CAA).

DES's own efforts to monitor the presence of ethers in gasoline, and to track the presence and treatment of ethers in ground and surface water supplies, show that removing ethers from gasoline could reduce contamination of New Hampshire's water resources resulting from gasoline spills and leaks. However, State legislation to control individual fuel components conflicts with Federal statutory and regulatory requirements relative to fuel formulation, and may have significant environmental, regulatory, and economic ramifications.

Background

MTBE was first introduced in the 1970's to help replace lead in gasoline. MTBE's desirable blending characteristics, its relatively low cost, and its favorable impact on octane rating made it an attractive gasoline additive. As a result, it was mixed with conventional gasoline at concentrations of approximately 2 percent by volume in regular grades to 9 percent in premium grades. In addition, because its high oxygen content enables more complete combustion (reducing CO emissions, particularly in carbureted engines), and its relatively low vapor pressure reduces evaporative emissions (reducing VOC and air toxics emissions), MTBE was chosen by most refiners to meet the Federal oxygenate requirement (minimum 2 percent oxygen by weight) for RFG when it was mandated in the CAA. The CAA requires the use of RFG in certain ozone nonattainment areas, and RFG was adopted for use in New Hampshire's ozone nonattainment areas (i.e., the State's four southeastern counties) in 1991 to help meet New Hampshire's emission reduction obligations under the CAA. The presence of MTBE (and other ethers) in RFG also dilutes the concentration of more harmful toxics and carcinogens that are normally present in gasoline, such as benzene.

It is not clear when other ethers (TAME, ETBE, DIPE) were introduced into gasoline, but DES studies have shown that they are often present in both conventional gasoline and RFG. Although commissioned for the purpose of studying the volume of RFG that is delivered outside areas where it is required, DES's Study of Reformulated Gasoline Distributed Outside of New Hampshire's Four County Nonattainment Area [1] published in December 2000, revealed that other ethers are used in gasoline supplied in New Hampshire. Out of 180 samples tested, 162 were found to contain TAME, in concentrations varying from 0.2 percent to 5.5 percent by volume. ETBE and DIPE were found in only a few samples, generally in low concentrations. These findings do, however, indicate that efforts to reduce MTBE contamination in water resources should include consideration of all gasoline ethers (TAME, ETBE, DIPE).

Control of Gasoline Additives

Designed to maintain consistent national fuel specifications, the language of Section 211(c) of the CAA leaves little flexibility for States to regulate fuels and fuel additives. Section 211 (c)(4)(A) of the CAA specifically prohibits States from prescribing or attempting to enforce any control or prohibition of a fuel or fuel additive.

Section 211 (c)(4)(C) describes how a State can petition EPA, via a revision of its State Implementation Plan (SIP), to allow it to regulate a fuel additive (a process referred to as "securing a Section 211(c) waiver"). However, EPA is authorized to approve such requests only if it determines that State regulation is necessary to achieve or maintain a national ambient air quality standard (NAAQS). MTBE is used a component of gasoline by refiners and is not required to be a part of either conventional gasoline or RFG. The performance requirements of gasoline do not change whether MTBE is used or not. In addition, as an oxygenate, MTBE is considered to be helpful in reducing carbon monoxide (CO) emissions from vehicles. [2] Thus,

[1]The Study of Reformulated Gasoline Distributed Outside of New Hampshire's Four County Nonattainment Area is available on the DES web site. See http://www.des.state.nh.us/ard/rfgstudy.

[2]Oxygenated fuels were introduced in the late 1980's as a mitigation strategy for CO nonattainment areas (e.g., Denver, New York City). The presence of oxygenates, such as MTBE, in gasoline helps promote more complete combustion of the fuel, which reduces CO emissions, particularly in older technology vehicles. However, the CO benefit of oxygenates in gasoline is negligible in today's cars, and the CO benefit in the overall fleet is reduced as older vehicles are replaced by new vehicles.

it would be extremely difficult to make a case that reductions in the use of MTBE in New Hampshire would contribute to attainment or maintenance of a NAAQS.

The Administrator of the U.S. Environmental Protection Agency (EPA) has the authority to control or prohibit fuel additives, but only if an acceptable justification for the action is provided, including consideration of all available relevant medical and scientific data. In response to the growing concerns regarding MTBE in water, EPA appointed an independent Blue Ribbon Panel of experts to investigate the use of oxygen additives in gasoline. In the final report, entitled Blue Ribbon Panel Findings and Recommendations on the Use of Oxygenates in Gasoline,[3] the Panel called for a significant reduction in the use of MTBE in gasoline, and recommended that Congress and EPA take action to lift the oxygen mandate. EPA has shown support for the Panel recommendations and has encouraged Congress to pass legislation that responded to the Panel's recommendations. To date, legislation that would solve this problem has not moved forward. EPA is also taking action to control MTBE under the Toxic Substances Control Act (TSCA) as a backup to the needed congressional action. However, a TSCA rulemaking is procedurally burdensome and may take several years to complete.[4]

Some States have adopted rules to regulate MTBE. However, in the absence of an approved Section 211(c) waiver, a State may not be able to defend enforcement of such a rule, and could be subject to litigation for implementation of a rule that conflicts with Federal law. Regardless, EPA would continue to enforce RFG in New Hampshire as it has traditionally done. If gasoline supplied to an RFG area continues to meet the RFG specifications, EPA probably won't take any action. However, if a State rule on gasoline resulted in deliveries that did not meet RFG specification, a supplier/distributor who delivered such fuel (or a retailer who sells it) could be subject to Federal fines of $25,000 per day. Given the alternative between meeting the intent of a State rule that is not enforceable and complying with Federal requirement that is, suppliers would almost certainly choose the latter.

Two notable instances where States have proposed restricting or banning the use of MTBE and been challenged are California and New York. In both cases, the Oxygenated Fuels Association (OFA, which represents MTBE manufacturers) has filed complaints against the States for controlling of a fuel additive in violation of Section 211 (c)(4)(A).

Neither suit has yet been resolved, but it does appear that OFA has a strong case in both States based on Section 211(c) of the CAA and Federal supremacy.

Some States that have implemented rules to regulate fuel characteristics and/or components have not been challenged. The State of Minnesota adopted a rule that effectively bans MTBE as a gasoline additive. The State did not seek a Section 211(c) waiver. The State has not been challenged on this rule, in part because there is a ready supply of ethanol (and political support for its use) to meet the oxygen requirements of RFG where it is required. The State of Maine has implemented a rule which controls the vapor pressure of gasoline in certain parts of the State. Even though this rule is not technically enforceable under Section 211(c), the gasoline industry has complied voluntarily with the rule. In addition, Maine represents only a small portion of the regional gasoline market, and any party who might be inclined to challenge the rule has thus far chosen not to do so.[5]

Potential Economic Impacts

When DES studied the distribution of RFG in New Hampshire last fall,[6] some combination of ethers was found in all 180 samples analyzed. Of the 140 samples taken from areas outside where RFG is required,[7] all contained some concentration of MTBE and/or other ethers, although only seven of the samples contained enough oxygen (2 percent by weight) to possibly certify as RFG. The gasoline supply and distribution industry has testified that virtually all gasoline (both RFG and conventional) currently supplied to New Hampshire, and the region, contains some concentration of MTBE. Thus, a State prohibition on gasoline ethers would in effect re-

[3]Report of EPA's National Blue Ribbon Panel on MTBE, see http://www.epa,gov/otag/consumer/ftjels/oxypanel/rec721.pdf.

[4]See also http://www.epa.gov/otag/consumer/fuels/mtbe/f00010.htm.

[5]Maine's unique status with respect to policy and fuels is discussed further in a separate memorandum.

[6]The Study of Reformulated Gasoline Distributed Outside of New Hampshire's Four County Nonattainment Area is available on the DES web site. See http://www.des.state.nh.us/ard/rfgstudy.

[7]RFG is presently required to be sold in Hillsborough, Merrimack, Rockingham, and Strafford Counties, also referred to the State Implementation Plan as New Hampshire's "four county area." The four county area includes all of New Hampshire's classified 1-hour ozone nonattainment areas. This area represents roughly 70 percent of the State's gasoline consumption.

quire a boutique fuel that is not currently available in this region, making it more likely that such a rule, or its enforcement, would be challenged.

Given a reasonable amount of time to respond, it may be possible that conventional gasoline (which has no specific requirement relative to the oxygen content) without ethers can be supplied to New Hampshire. However, because RFG is presently required to contain 2 percent oxygen by weight, the supply of gasoline that meets the standards for RFG without any ether additives is much more in question. In addition, MTBE is used as an octane enhancer in gasoline. The extent to which there may be a problem for refiners to meet their octane goals in gasoline without the option of ethers is unknown.

The two major reports completed to date which assessed alternative gasoline formulations and oxygenate options are NESCAUM's RFG/MTBE Findings and Recommendations[8] and EPA's Blue Ribbon Panel Findings and Recommendations on the Use of Oxygenates in Gasoline[9]. Both reports concluded that MTBE and ethanol are the only practical alternatives for meeting the oxygenate mandate in the short term (2–4 years). Unless the oxygenate mandate in RFG is relaxed through congressional action, a prohibition or control on ethers in gasoline would effectively create an ethanol mandate. Because of its alcohol characteristics (e.g., affinity for water, increased evaporability), ethanol must be transported and stored separately from other products, and requires a specially refined base gasoline product, known as RBOB,[10] for blending. In addition, a terminal operator must modify the facility (i.e., install additional plumbing) to allow blending of the ethanol.

In the summer, the vapor pressure (measure of evaporability relative to temperature) of gasoline is required by EPA to be lower than in the winter to help limit evaporative emissions of volatile organic compounds (VOC) from gasoline. Ethanol tends to raise the overall vapor pressure when blended with gasoline, thus RBOB must have a lower base vapor pressure than comparable feedstock gasoline used for MTBE blending. RBOB can be produced cost-effectively for wintertime blending with ethanol because the vapor pressure requirements are not as restrictive. However, the cost of producing RBOB for summertime blending (when the vapor pressure of gasoline is required to be lower) has made ethanol use in the summer economically infeasible in the Northeast because it cannot compete with MTBE/ether blends.

Ethanol is used predominantly in areas where it is produced, such as in the Midwest, where ethanol is in ready supply, support for its use is strong, and the oil industry has responded to the demand for RBOB. At the present time, the only supplier using ethanol in the Northeast is Getty, who made a commitment over 10 years ago to use ethanol in wintertime gasoline blends in some areas along the east coast. Getty originally made the commitment because its projections suggested that they could supply ethanol blends cost effectively. Getty's supplier of ethanol is Archer-Daniels-Midland, which transports it by both rail and barge to Getty terminals. The RBOB necessary to blend with the ethanol is supplied via special contract with a single refinery in Lyndon, New Jersey, and thus ethanol blending is limited to areas proximal to that particular refinery. Conversations with officials from Getty indicate that none of the gasoline distributed to its facilities in New Hampshire contains any ethanol. DES testing of gasoline samples this past fall (see footnote 1) supports that conclusion. An additional downside to ethanol blending from the standpoint of terminal operations is that separate storage must be dedicated to ethanol at a time (winter) when extra storage for heating oil would be extremely useful.

In recent bills proposing to control MTBE, the gasoline supply and distribution industry has testified to the operational complications of supplying gasoline blends to New Hampshire that are not presently available in this region. In addition, potential price and supply volatility increases as the number of suppliers decreases. Given New Hampshire's small share of the regional gasoline market, the number of suppliers willing to make a special "boutique" gasoline for the State is likely to be limited. It is extremely difficult to predict the impact that requiring a unique gasoline for New Hampshire would have on supply and pricing.

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[8]Prepared by NESCAUM at the request of New Hampshire Governor Jeanne Shaheen in her capacity as Chair of the New England Governor's Conference, see http://www.nescaum.org/RFG/RFGPh2.shtml.

[9]Report of EPA's National Blue Ribbon Panel on MTBE, see http://www.epa.gov/otaci/consumer/fuels/oxypanel/rec721.pdf.

[10]RBOB is Reformulated Blend for Oxygenate Blending. It contains no oxygenate, has low octane, and is made specifically for blending with ethanol.

Potential Health and Environmental Impacts

There may also be unanticipated health and environmental impacts from regulation of gasoline ethers. NESCAUM's report (RFG/MTBE Findings and Recommendations, see footnote 4) found, among other things, that:

" . . . gasoline refiners that supply the Northeast have overcomplied with RFG toxic performance standards by more than 75 percent, in part due to the presence of MTBE. This substantial margin of overcompliance may be lost if MTBE (which is used both as an oxygenate and an octane enhancer) is reduced or eliminated from RFG."

In order to prevent increases in air toxics that are likely to accompany decreases in MTBE and other ethers, it may be necessary to seek additional controls on those components of gasoline that directly result in air toxic emissions (e.g., benzene, aromatics, and olefins). However, as mentioned previously, approval of a Section 211(c) waiver request is contingent on EPA finding that such a request is necessary to achieve attainment of a NAAQS. Since there is no NAAQS for air toxics, a Section 211(c) waiver request that includes measures designed solely to reduce emissions of air toxics is not likely to be approved by EPA.

The impacts to groundwater from spills of ethanol blend gasolines have not been fully studied. Preliminary studies by the New England Interstate Water Pollution Control Commission (NEIWPCC) on the characteristics of ethanol, storage issues, and impacts resulting from releases of gasoline containing ethanol suggest that, while ethanol blends overall may be better than MTBE/ether blends from the standpoint of groundwater contamination, other toxic constituents of gasoline (e.g., benzene, toluene, ethylene, xylene) may actually travel further through the groundwater with ethanol blends. This is because organisms in the soil which break down petroleum products prefer ethanol over other components of gasoline. However, the NEIWPCC report is expected to conclude that this result would still be preferable to having MTBE present in gasoline.

Conclusion

At the present time, virtually all gasoline supplied to New Hampshire contains at least some MTBE and/or other ethers.[11] In addition, because MTBE is the additive of choice for meeting the Federal oxygenate mandate in RFG, gasoline in areas of New Hampshire where RFG was adopted (Hillsborough, Merrimack, Rockingham, Strafford counties), contain significantly higher levels of MTBE and other ethers.

Because of the potential for contamination of water resources by MTBE and other ethers from releases of gasoline into the environment, the desire to take action at the State level to ban or restrict their use is justified. However, the existing language of Federal statute, specifically Section 211(c) of the Federal CAA, places significant restrictions on States' ability to regulate the use of ethers in gasoline. Legally, a State can only enforce its own regulation of fuels if it has EPA' s blessing (an approved waiver from Section 211(c) of the CAA). The States of New York and California have adopted State bans on MTBE, and their actions have been challenged by MTBE stakeholders, who appear to have a strong case. New Hampshire should monitor these cases closely to help assess its ability to defend potential actions to regulate ethers in gasoline and the associated legal expenses.

In addition to possible legal challenges, because virtually all gasoline supplied in this region contains some concentration of ethers primarily MTBE), the implementation of a rule that regulates the ether content of gasoline may create a "boutique" gasoline in New Hampshire. Some States, including Minnesota and Maine, have implemented rules which regulate gasoline formulation in an effort to reduce the use MTBE as a fuel additive, and the gasoline industry has complied voluntarily. This is believed to be because, in both instances, the formulation required has been reasonably available in the region. A ban on ethers in New Hampshire would effectively be a requirement to supply a new gasoline formulation, particularly in areas where RFG is required (i.e, New Hampshire's four county area, roughly 70 percent of the State's gasoline consumption). Requiring a gasoline that is not commercially available may have significant impacts on the supply and pricing of gasoline, and the extent of these impacts are difficult to predict.

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[11]See the DES special study "Study of Reformulated Gasoline Distributed Outside of New Hampshire's Four County Nonattainment Area ", available on the DES website: http://www.des.state.nh.us/ard/rfgstudy.

ATTACHMENT B

STATE OF CONNECTICUT,
DEPARTMENT OF ENVIRONMENTAL PROTECTION,
March 14, 2001.

SENATOR DONALD E. WILLIAMS,
REPRESENTATIVE JESSIE O. STRATTON,
Co-Chairpersons, Environment Committee,
Room 3200, Legislative Office Building,
Hartford, CT 06106.

RE: ANNUAL REPORT PURSUANT TO PUBLIC ACT NO. 00–175, AN ACT CONCERNING THE USE OF MTBE

DEAR CO-CHAIRPERSONS WILLIAMS AND STRATTON: This is to followup to my letter of 12/29/00 updating you on the status of the Department of Environmental Protection's (the "Department's) efforts pursuant to Public Act No. 00–175, An Act Concerning the Use Of MTBE. According to this act, the Department is required to submit an annual report to the Environment Committee outlining the Department's progress on a plan to eliminate methyl tertiary butyl ether ("MTBE") as a gasoline additive. As stated in my letter of 12/29/00, the Department decided to delay the submission of our annual report to await the completion of the regional study evaluating ethanol as an alternative to MTBE. This study, conducted by the Northeast States for Coordinated Air Use Management (NESCAUM) and the New England Water Pollution Control Commission (NEIWPCC) while not yet final, contains several significant findings, which warrant your attention and consideration.

The findings outlined in the NESCAUM/NEIWPCC study lead the Department to conclude that the ban on MTBE effective in the year 2003 is not prudent for the State of Connecticut and we recommend that the Environment Committee consider changing the date of the ban. If this action is not taken, Connecticut's position in the region as the first and only State to ban MTBE while required under the Clean Air Act to comply with the Federal Reformulated Gasoline Program (RFG) will likely result in one of several undesirable options. These options could include the delivery of special or non-compliant gasoline or an increase in the price of gasoline conservatively estimated in the range of 3–11 cents per gallon. If the legislature does not initiate a legislative change this session the Department is prepared to recommend changing the date in the next legislative session.

These conclusions are based on the findings highlighted in the attached summary. If there are any questions regarding the Department's activity regarding MTBE, please contact Tomn Tyler, my Legislative Liaison, at 424–3001. Thank you for your consideration of this matter.

Sincerely,

ARTHUR J. ROCQUE, JR., *Commissioner.*

ANNUAL REPORT PURSUANT TO PUBLIC ACT NO. 09–175

AN ACT CONCERNING THE USE OF MTBE

The following is a synopsis or the key findings from the NESCAUM/NEIWPCC study.

Background

The Federal reformulated gasoline program (RFG) was designed to reduce emissions from motor vehicles. To comply with the RFG program, gasoline must achieve a set of emission performance standards and meet a minimum oxygen content requirement. Currently, approximately three-quarters of all gasoline sold in the northeast market is RFG. Refiners have opted to sell an RFG blend containing MTBE at 11 percent by volume, which translates into approximately 1 billion gallons of MTBE sold annually in the Northeast. The RFG program has provided substantial reductions in emissions of smog-forming pollutants, benzene and other hazardous air pollutants from motor vehicles. However, substantial evidence indicates that the unique chemical and physical properties of MTBE pose an unacceptable risk to the region's potable water supply. The challenge facing policymakers is to maintain the air quality benefits of RFG while reducing the threat that MTBE poses to the region's water resources.

Cost Implications of Eliminating MTBE

MTBS and ethanol are the only two oxygenates currently produced in quantities sufficient to meet the demand created by the RFG program. Therefore, under current Federal law eliminating MTBE represents a de facto mandate for ethanol. The

consequences of introducing hundreds of millions of gallons of ethanol into the region's gasoline pool by 2003 will have significant economic impacts by potentially increasing the cost of gasoline in Connecticut by a range of 3–11 cents per gallon. However, the 2003 date puts Connecticut on a more accelerated phase-out schedule than other States regionally or nationally and this may result in costs outside the range or the projected 3–11 cent increase per gallon. The increase in cost is the result of several key factors:

- Fuel Reformulation Costs—Formulation changes associated with eliminating MTBE are likely to increase the cost of gasoline production due to the need for process changes and equipment modifications as well as the inclusion of replacement blend components which are more expensive than MTBE. Critical factors in the cost effectiveness equation are the timeframe for phase-in, the relative supply and demand for fuel constituents, and the longer term prospects for developing ethanol production capacity in the New England.
- Infrastructure Costs—Due to ethanol's unique properties, notably its affinity for water, a new infrastructure to transport millions of gallons of ethanol from the mid-west and internationally will need to be developed. The existing distribution systems have water infiltration problems that cause ethanol to separate out of gasoline. Ethanol will require different handling and transport methods than have been used for MTBE. California has estimated that U wilt cost approximately $60 million and will take up to 24 months to modify storage tanks. Unloading facilities and the installation of blending equipment at distribution terminals. The NESCAUM/NEIWPCC study estimates that the cost for the Northeast would be roughly $48 million.
- Economic Costs—Projections show that in 2003 approximately 13 billion gallons of gasoline will be sold in Connecticut. A one-cent per gallon increase translates to about $15 million of outflow from the State. Since most RFG is produced outside the region, increased gasoline prices represent a substantial outflow of economic resources from the regional economy. The NESCAUM/NEIWPCC study cites a 1999 U.S. Department of Energy report estimating that the average cost of RFG produced at east coast refineries would increase by 3.9 cents per gallon if all MTBE were replaced by 2004 under a nationwide ban on ethers. Connecticut is the only State in New England that has banned MTBE by 2003. This makes projecting potential increases in gasoline prices difficult. While difficult to predict with accuracy, unilateral action by Connecticut will result in per-gallon increases in the cost of gasoline beyond those predicted for national or regional actions. The NECAUM/NEIWPCC study clearly shows that a longer lead-time that enables a coordinated regional phase-out of MTBE would translate into cost savings on projected increases in gasoline prices.

Environmental Impacts of MTBE v. Ethanol

Gasoline spilled or leaked into the environment is a major source of water pollution, and at elevated levels, gasoline and its constituents can adversely affect drinking water quality. Both ethanol and MTBE exhibit a high solubility in water and high mobility in the subsurface. Because it biodegrades quickly in the environment, ethanol poses significantly less risk to water resources than MTBE. However, in certain instances, the environmental transport properties of ethanol can make other gasoline constituents more soluable in groundwater, and potentially inhibits the degradation or other more toxic components in gasoline such as benzene end toluene. While the potential increases in exposure from ethanol do not compare with the risks born by MTBE, it raises another issue for consideration and management.

Waiver Request

Under Section 211(k) of the Clean Air Act States may receive a waiver from the oxygenate requirement of the RFG program. This is not to be confused with a waiver from the use of MTBE. The State of California submitted a waiver request to the U.S. Environmental Protection Agency (EPA) in 1999. At the time of this writing, EPA has yet to even propose a decision in response to California's request. While the Department intends to seek a waiver as part of a regional strategy a waiver request will not serve as a timely solution for Connecticut in the absence of a waiver, an amendment to the Federal Clean Air Act would be required to enable the State to comply with RFG requirements. Non-compliance will result in Federal sanctions and the loss of millions of dollars in transportation funding. In addition, Connecticut will still need to make up the difference in the emissions shortfall that has been credited to the RIG program.

Public Education and Outreach on Effective Gasoline Management

There are opportunities fur enhancing current public education and outreach efforts on the importance of a safe and effective gasoline management. Department

has already initiated a public outreach effort and has met several times with representatives from petroleum marketing and fuel additive industry groups to establish a campaign to educate the public on the proper handling of gasoline. This group plans to utilize aspects of a campaign called "Gas Care" that was launched by the Alliance for Proper Gasoline Handling in 2000. Also, the Department's efforts in enhancing compliance with the I–95 Federal Underground Storage Tank regulations have served as an important measure in promoting effective gasoline management. However, while Department's efforts have resulted in over 8,500 tanks now in compliance with these requirements, there are over 5,100 non-compliant tanks remaining. This universe represents a labor-intensive effort which currently is severely understaffed.

ATTACHMENT C

EXECUTIVE ORDER 2001–02

An order pertaining to reducing water contamination resulting from the use of Methyl tertiary Butyl Ether (MTBE) in Reformulated Gasoline

WHEREAS, MTBE has become a significant and rapidly increasing contamination threat to groundwater and surface water resources in the State of New Hampshire; and

WHEREAS, 16 percent of New Hampshire's public water supplies have some level of MTBE contamination; and

WHEREAS, 27 percent of the private well samples analyzed for MTBE by the Department of Environmental Services' laboratory in the year 2000 had some level of MTBE and 4 percent had MTBE concentration in excess of the State's drinking water standard of 13 ppb; and

WHEREAS, a study conducted by the Department of Environmental Services found MTBE in all gasoline across the State, at levels up to 12.4 percent, and that other oxygenates with similar characteristics to MTBE were found in all ten counties, with levels up to 5.5 percent; and

WHEREAS, MTBE is considered a potential human carcinogen at high doses by the U.S. Environmental Protection Agency; and

WHEREAS, due to its high solubility in water and its ability to move quickly through groundwater, MTBE from leaking storage tanks and spills tends to move further than other components of gasoline and is more difficult to remediate; and

WHEREAS, MTBE does not break down as rapidly as other gasoline constituents once released into the environment; and

WHEREAS, the State of New Hampshire and its citizens and businesses are incurring significant costs to deal with the increasing presence of MTBE contamination, namely in undertaking remedial steps to remove the threat of continuing contamination at individual sites, providing alternative drinking water supplies to homes affected by MTBE contamination, and substantially increasing staff time spent on MTBE contaminated sites and related issues; and

WHEREAS, the State of New Hampshire has aggressively pursued all available, legal options to reduce the concentration of MTBE in gasoline sold in the State and the threat posed by MTBE contamination in its water resources, including:

- Initiating exhaustive assessments of MTBE and a task force to seek a regional gasoline solution; working with dealers to promote cleaner marine engines; and helping to launch a national public education program regarding the proper handling and disposal of gasoline;
- Conducting one of the strongest underground storage tank replacement programs in the country, achieving a compliance rate of over 99 percent;
- Establishing a new safe drinking water standard for MTBE of 13 parts per billion, the most protective primary drinking water standard in the country; and
- Formally requesting relief from Federal requirements; and

WHEREAS, MTBE was added to gasoline in the mid–1 970's to help replace lead because it added octane and improved combustion in gasoline engines, resulting in cleaner emissions; and

WHEREAS, Title I of the Federal Clean Air Act Amendments of 1990 (CAA) mandated significant emission reductions from New Hampshire's ozone nonattainment areas (i.e., Hillsborough, Merrimack, Rockingham, and Strafford counties), and in order to help satisfy these requirements, in 1991 New Hampshire decided—by opting in to the Federal Reformulated Gasoline (RFG) program—to require cleaner-burning gasoline in these counties starting in 1995; and

WHEREAS, because the CAA expressly mandates the oxygen content of RFG, requiring that it have at least 2 percent oxygen by weight, RFG contains approxi-

mately 11 percent MTBE by volume—five to ten times the amount historically found in gasoline in the Northeast; and

WHEREAS, because the ability of States to regulate the properties and composition of gasoline—including its oxygen content—is expressly limited by the CAA, State action to ban MTBE is unlikely to withstand legal challenge; and

WHEREAS, even if MTBE were eliminated, the CAA oxygen mandate would still force New Hampshire to use other oxygenates—such as ethanol—that are not readily available, could lead to unacceptable price and supply impacts, and need to be analyzed to ensure that we understand public health and environmental issues associated with these alternatives; and

WHEREAS, despite these and other actions, the number of MTBE detections in the State's water resources continues to rise, and despite the State's vigorous efforts to advance Federal legislation to eliminate the CAA oxygen mandate, neither Congress nor the U.S. Environmental Protection Agency appear likely to address this problem in the foreseeable future; and

WHEREAS, the only remaining option available to the State of New Hampshire is to opt out of the Federal RFG program and to make up for the emission reductions that RFG provides by adopting other emission control measures; and

WHEREAS, the air quality benefits that have been achieved through the RFG program should be maintained, and diminishing or "backsliding" from these air quality benefits is unacceptable from the standpoint of public health; and

WHEREAS, protection of New Hampshire's economic well-being, natural environment, public health, and quality of life demands that the State's air and water quality be enhanced simultaneously, rather than treated as mutually exclusive goals;

NOW, THEREFORE, I, JEANNE SHAHEEN, GOVERNOR of the State of New Hampshire, by the authority vested in me pursuant to Part II, Article 41 of the New Hampshire Constitution, do hereby order and direct the Department of Environmental Services (DES) to prepare and submit to the U.S. Environmental Protection Agency the documentation necessary for New Hampshire to opt-out of the Federal Reformulated Gasoline program immediately, pursuant to my request that the Administrator of the U.S. Environmental Protection Agency revise the Code of Federal Regulations Title 40, Part 80, Subpart D, Section 80.72(c) to allow for an accelerated opt-out of the Federal Reformulated Gasoline program; and

FURTHERMORE, I order and direct DES to work with the New Hampshire General Court to adopt in this legislative session any provision necessary to accomplish this goal, including control measures sufficient to replace the emission reduction benefits achieved by RFG, to provide adequate funding and statutory flexibility for remediation of MTBE-contaminated sites and water resources by extending the sunset date of the Oil Discharge and Cleanup Fund to January 1, 2010, and increasing the reimbursable limit of that fund from $1 million to $1.5 million for MTBE (and other petroleum) contaminated sites; and

FURTHERMORE, I order and direct DES to continue to promote and participate in efforts to develop acceptable regional or Federal approaches to reduce the threat of MTBE contamination, including but not limited to elimination of the oxygen mandate, waivers from Federal fuel requirements, cleaner reformulations of fuels, and other such measures; and

FURTHERMORE, I order and direct DES to analyze and transmit to my office and the General Court, the results of any State, regional or national studies on the environmental fate and transport of ethanol in air, surface water and groundwater, to ensure a full understanding of the potential environmental and public health consequences of ethanol as an alternative to MTBE; and

FURTHERMORE, I order and direct DES to analyze and transmit to my office the results of litigation concerning MTBE, and to recommend any actions which, based on the outcome of the litigation, may allow the State to better address the issue of MTBE contamination; and

FURTHERMORE, I order and direct DES to take all reasonable steps to encourage the Federal Government to appropriate adequate funding to States for the costs incurred to remediate MTBE-contaminated sites and water resources and to prevent future contamination.

Given at the Executive Chamber in Concord, this sixteenth day of April, two thousand one.

STATEMENT OF WILLIAM C. HOLMBERG, PRESIDENT, BIOREFINER

My name is Bill Holmberg. I am a resident of Bow, New Hampshire. I have been involved in environmental issues, renewable energy, as well as biofuels and other transportation fuels, since 1971. My involvement includes government service at

EPA, FEO/FEA and DOE, president of energy-oriented associations and startup companies promoting the biorefinery concept in the private sector.

Thank you Mr. Chairman for the opportunity to present thoughts which I believe are of importance to Northern New England and the nation in terms of energy, the environment and economic well being. First, I want to congratulate you for your position on ANWAR. I believe it wise, and will briefly explain why later in this testimony. I also want to thank you for attending and speaking at the Environmental Inaugural Ball in the nation's capital this past January. You helped make the Ball a great success.

The primary issue before you today is the fate of MTBE. I agree that MTBE should be banned and phased out of the gasoline pool. But, I ask that you consider a phaseout schedule that accommodates the reality of the problem and the economic consequence of such action. May I also suggest that leaving the decision up to the States has merit because of the different perceptions of the problem in the separate States? This is primarily due to the status of leaking underground storage tanks, the movement of groundwater and its relationship to the aquifer, the amount of MTBE used in a State, and the focus of public relations attacks by those benefiting from the demise of MTBE. I appreciate the distribution problems of providing different fuel formulations to individual States; but, perhaps the States in a region (New England, for example) could coalesce in the best interests of the environment, water quality, and the economics of the region.

It is interesting to note that MTBE is still widely used in many parts of the country, but complaints have subsided appreciably. Again, dealing with the underground storage tank problem is likely the primary reason. In addition, I believe the relaxation of the public relations attack is also a contributing factor. I ask that you consider the possibility that the forces that covertly orchestrated those attacks are the same forces that failed to support your MTBE legislation that was successfully reported out of the Environment and Public Works Committee during the last Congress. That failure is geared to the reality that these forces are determined to control the ethanol market, and have little interest in seeing the industry expand into the routine use of cellulosic biomass as a feedstock to produce ethanol.

The advance of the biorefinery concept (the conversion of cellulosic biomass to biofuels, bioenergy and biochemicals) is of vital importance to the Northern New England States. These States essentially have little significant fossil fuel reserves—oil, gas or coal. They have, however, vast reserves of cellulosic biomass—agriculture and forestry residues, rights-of-way, park, yard and garden trimmings, and the clean biomass portion of municipal wastes that go to landfills. Those biomass reserves are renewable and represent the sustainable economic and energy security of New Hampshire, Vermont and Maine, other New England States, and large regions elsewhere in the nation.

Mr. Chairman, $2 per dollar gasoline prices, and perhaps higher, are being predicted for this summer. This situation could only worsen in future years. But, a reasonable transition to an ever increasing reliance on biofuels made from feed grains and cellulosic biomass as well as Biodiesel made from oil-seed, animal fats, tallow and used cooking oil, will slow the rise in cost of fossil-based transportation fuels and also bring healthy, new competition to the marketplace and a new industrial base to the region.

This long sought-after transition requires action on two fronts:

- A steadily expanding market for biofuels. The Renewable Fuels Standard that was included in your legislation last year, S. 2962, as reported out of your committee, can best achieve this goal. I seek your consideration of again including that provision in your new legislation, or as an alternative, cosponsoring S. 670, the Renewable Fuels Act of 2001.
- New, "out-of-the box" thinking and action to commercialize the emerging biorefinery concept through concentrated, aggressive and coordinated government actions at the Federal and State levels. Studies on the value of including biomass as feedstocks to produce biofuels, bioenergy and biochemicals, and accompanying research, have been going on for more than half a century. Hundreds of millions of dollars of public funds have been spent. The American Petroleum Institute sites a number in excess of $7 billion.

This year alone, the President's budget calls for well over a $100,000,000 to be spent by DOE and USDA. Only biopower (electricity and thermal energy) have achieved a modest level of success.

There are increasing levels of biochemicals entering the marketplace, but this technology was well developed before the advent of petrochemical feedstocks. The first gallon of cellulosic biomass ethanol has yet to enter the marketplace.

The nation needs a "man on the moon" type priority approach to truly launch the Biorefinery concept. The Northern New England States need a cooperative and aggressive program to take advantage of their most promising energy resource—biomass—and to put it to work to the benefit of New Hampshire, Vermont and Maine. The technologies to launch the process are in hand today. The bureaucratic and political will to harness these technologies come up short. I seek your support for a "man on the moon" approach to overcome these shortcomings and I would be pleased to work with your staff to develop a plan. Perhaps a good place to start this planning is in the Conservation Center of the Society for the Protection of New Hampshire Forests. You saw their innovative approach to energy on Monday. Thank you for speaking at their Earth Day event.

In terms of ANWR—given available data, it is possible to calculate that, with passage of last year's S. 2962, or this year's S. 670, there will be more gallons of finished fuel entering the transportation market by 2010 than if exploratory and production drilling at ANWR proceeds.

Furthermore, if the increased ethanol production were reacted with isobutylene to produce ethyl tertiary butyl ether (ETBE), the amount of non-petroleum based automotive fuels would be twice the amount of finished product that could be produced at ANWR. ETBE is being used in Europe in increasingly large volumes as a clean-burning gasoline additive with great success, with no reported problems. In addition, butane, the feedstock used to produce isobutylene, is in surplus supply because of the need to reduce the vapor pressure of gasoline sold in several parts of the nation during summer months. The phaseout of MTBE (also containing isobutylene) will exacerbate that surplus, as will the increased production of natural gas that frequently contains natural gas liquids that include butanes.

Therefore, with the passage of S. 670, the need for oil from ANWR is marginalized. Add ETBE to the process and the need for ANWR is further diminished.

You have expressed concern over the ozone forming potential of ethanol in gasoline. This concern is well founded in ozone non-attainment areas during the summer months. This is caused by the increased vapor pressure of the fuel when ethanol is added to gasoline in small amounts. There are two available solutions to the problem and two on the horizon:

- Oil refiners can provide lower vapor pressure gasoline for blending with gasoline. This is done in the Chicago/Milwaukee region.
- Ethanol can be used as E–85 in flexible fuel vehicles—the vapor pressure problem goes away when the amount of ethanol in gasoline exceeds 22 percent.
- Ethanol is converted to hydrogen, which is then used as an automotive fuel in an engine or fuel cell.
- Ethanol is used as ETBE, which has superior blending characteristics, but only after it is well established here in the U. S. that ETBE does not cause problems in water supplies. The Environmental Research Group at the University of New Hampshire could explore this issue.

The solutions to the automotive fuel problems are in hand. Aggressive, concerted and regional actions are needed to release them into full commercialization. You expressed concern about the importation of ethanol into States like New Hampshire. Two considerations:

- The provision in S. 670, giving a 1.5 credit to biomass ethanol compared to 1 credit for starch or sugar-based ethanol, coupled with aggressive, regional actions, should soon make it possible to soon produce ethanol here in the New England States; and
- S. 670 contains carefully designed protections for Northeastern refiners and motorists. First, the Clean Alternative Fuels Program section allows refiners to meet their gradually increasing targets by trading credits, rather than having to purchase the physical "wet barrels" of alternative fuel, including ethanol. In this way, refiners can make the best choice based upon fuel availability and pricing, and transportation considerations. In addition, the legislation allows for suspension of the requirement if the EPA Administrator and Secretaries of Energy and Agriculture determine that insufficient supplies of ethanol and other alternative fuels could distort motor fuel prices.

I am taking advantage of your offer to modify my testimony based on what we learned or heard at your hearing. Several points:

- One of the main justifications for including the oxygenate requirement in reformulated gasoline (RFG) in the Clean Air Act Amendment of 1990, was the steps the major oil companies took to provide needed octane while lead was being phased out—which they, of course, fought. Their octane preference was aromatic hydrocarbons—benzene, toluene and xylene (BTX). Benzene is a known and potent car-

cinogen; toluene and xylene, to some degree, convert to benzene in the combustion process as well as in the catalytic converters. As I recall, BTX levels were raised from about 20 percent of the gasoline content, when lead was used, to about 32 percent after lead was no longer available. There are additional problems with BTX in vehicle performance and in the efficiency of catalytic converters. Perhaps the main issue here is that the public can get used to the more invisible cancer threat of BTX, but the smell, taste and concern about MTBE demands action. That action is appropriate, but the results should not be more BTX.

- Ethanol should be the answer, but that ethanol should be produced in all regions of the country from the most available feedstocks—for NNE, biomass is the logical feedstock.
- Concerns about ethanol were raised at your hearing:

1. Formaldehyde emissions. I don't think that is the case. Formaldehyde emission should come down. Acetaldehyde emissions may increase and lead to formations in the atmosphere that should be watched. Studies to date indicate no significant consequences. The attachment covers this issue.

2. Leakage of 95 percent ethanol (plus the denaturant) from storage tanks in terminals where the ethanol, a solvent, would react with previously spilled fossil hydrocarbons and transport the blend into the groundwater. Because there is BTX in those hydrocarbons, benzene could then be detected in this water. That concern should be investigated and followed by the Environmental Research Group at the University of New Hampshire. The attachment also covers this issue.

3. That tactics of certain elements of the ethanol industry, in terms of not supporting S. 2962 at the critical point in the legislative process. These elements have a vested interest in controlling the capacity of the industry and the feedstocks being used—the biomass resources of Northern New England do not fit into their corporate goals. As I said in my closing comments, "Please do not taint the future fuel ethanol industry with the sins of a small, in number, but a powerful part of the industry."

It's important to understand that the vast renewable biomass reserves of New England and the nation (that go beyond forest and wood-lot residues and include waste streams identified above) represent unwanted competition to the most powerful industries in the world. To the most powerful—they are very profitably processing fossil hydrocarbons (domestic and foreign), and we are proposing to process local, renewable, living carbohydrates. To the powerful carbohydrate processing businesses—they can command the starch and sugar feedstocks, and we are proposing to process the yet uncontrollable cellulosic fraction of biomass—including massive carbohydrate waste streams. Complicated, but just bringing up the issues can be an important first step leading to a better understanding of the difficulties in birthing the biorefinery industry.

Thank you, Mr. Chairman, for this opportunity to express my thoughts and to be of service to Northern New England and the nation.

Fate, Transport and Remediation of MTBE

Nancy E. Kinner

Director, Bedrock Bioremediation Center
Professor of Civil/Environmental Engineering
University of New Hampshire
Durham, NH

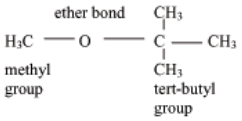
April 23, 2001

Testimony before the
United States Senate Committee
on Environment and Public Works

Salem, NH

I. Fate and Transport of MTBE in the Environment

The fate of methyl tertiary butyl ether (MTBE) in the environment and remediation of ecosystems once they are contaminated with it are directly related to the compound's chemical and physical properties. MTBE is comprised of a methyl (CH_3 group) bonded by an oxygen atom to a butyl (C_4H_9) group.



The C-O-C linkage makes this compound an ether. Ethers are generally hydrophilic (water-loving) and are therefore very soluble in water. For example, the solubility of pure MTBE in water is 50,000 mg/L. This differs greatly from the other natural constituents of gasoline (i.e., petroleum hydrocarbons) that consist of carbon and hydrogen alone and are relatively insoluble in water. In contrast, pure benzene, one of the gasoline hydrocarbons that most readily dissolves in water, has a maximum solubility of 1780 mg/L. MTBE is generally 30 times more soluble in water than the hydrocarbon constituents in gasoline (Table 1). If MTBE is released into air, as a result of incomplete combustion of fuel, it will readily dissolve into precipitation because it is 42 times more soluble in water than air. Hence, during precipitation events MTBE is transferred from the atmosphere to the aqueous phase.

Once MTBE is dissolved in water it prefers to stay there. Most gasoline hydrocarbons, such as benzene, are readily removed from water to air. Henry's Constant expresses the ratio of a compound's concentration in air relative to its concentration in water at a given temperature. The larger the Henry's Constant, the more volatile a compound is (i.e., the more readily it moves from water to air). The Henry's Constant for MTBE is 0.022 at 25°C. This contrasts to benzene with a Henry's Constant of 0.22 at 25°C. Compounds with values ≥ 0.05 are considered very volatile. This does not mean, however, that MTBE is not volatile. For example, if a container

Table 1
Water Solubilities of Hydrocarbon Compounds

Compound	Solubility	
	Solubility (mg/L) at 20ºC	
Aromatic gasoline hydrocarbons	*from conventional gasoline*[a]	
Benzene	18	
Toluene	25	
Ethylbenzene	3	
Xylenes (total)	20	
Chlorinated solvent compounds from the pure compound	*Solubility (mg/L) at 20ºC*	
trichloroethylene (TCE)	1440	
perchloroethylene (PCE)	240	
	Solubility (mg/L) at 20ºC	
Alkyl ether compounds	*from RFG*[b]	*from oxyfuel*[c]
methyl *tert*-butyl ether (MTBE)	4700	6300
ethyl-*tert*-butyl ether (ETBE)	1300	1750
tert-amyl methyl ether (TAME)	1400	1850
di-isopropyl ether (DIPE)	1200	1600

[a] Assumes release of a conventional gasoline containing 1% benzene, 5% toluene, 1.5% ethylbenzene, and 10% total xylenes.
[b] Assumes release of reformulated (RFG) gasoline containing 2.0% by weight oxygen, which would correspond to 11.1% MTBE, 12.9% ETBE, 12.4% TAME, or 12.9% DIPE (all by volume).
[c] Assumes release of oxygenated gasoline containing 2.7% by weight oxygen, which would correspond to 15.0% MTBE, 17.5% ETBE, 16.8% TAME, or 17.4% DIPE (all by volume).

Source: Johnson et al., 2000

of **pure** MTBE was open to the atmosphere, it would be 2.6 times more likely to volatilize into the air than would **pure** benzene under the same conditions. The important distinction is that MTBE becomes relatively non-volatile once it is dissolved in water.

When gasoline is released from a leaking underground storage tank or vehicular accident, the MTBE is dissolved in the gasoline. Typical, concentrations of MTBE in reformulated gasoline (RFG) or oxygenated fuel (oxy fuel) range from 10 to 15%. Because MTBE is soluble in gasoline as well as water, it will partition itself between both phases. For example, the concentration of MTBE in water at 25ºC in contact with a gasoline containing 10% MTBE will be 5000 mg/L (5,000,000 µg/L). While this concentration is an order of magnitude lower than if pure MTBE were present, the massive environmental implications of this (5,000,000 µg/L) solubility are clear if one contrasts it to the existing USEPA health advisory concentration of 70 µg/L (a 10,000 fold difference). The concentration of MTBE must be <20-40 µg/L to avoid taste and odor problems. Some states, such as New Hampshire and California, have set strict primary drinking water standards for MTBE. In New Hampshire, the standard is 13 µg/l. Compared to other organic contaminants that commonly trigger remediation actions in water such as TCE and benzene, MTBE has a very high solubility in water. For example, the solubility of the other gasoline hydrocarbons in water is only 120,000 µg/L. As a result of this very high aqueous phase solubility, one gallon of gasoline containing 10-15% MTBE can potentially contaminate 4 million gallons of drinking water.

MTBE that volatilizes into the air can be degraded to CO_2 and water when it absorbs ultraviolet light from the sun. However, if the MTBE comes in contact with precipitation in the atmosphere first, it will dissolve into the water and be stripped from the atmosphere. It will move with the precipitation as it flows over impervious surfaces such as roadways or as it infiltrates into the ground. The runoff from the impervious surfaces will either flow into streams

and rivers or be collected in a storm sewer and ultimately discharged into a local water body, contaminating it with MTBE.

Uncombusted fuel from outboard engines and jet skis is released directly in surface waters and serves as a point source of MTBE. If the water infiltrates into the ground, it will move down through the unsaturated zone of soil until it reaches and mixes with the groundwater, contaminating the aquifer with MTBE.

MTBE from fuel spills will move with the gasoline until it reaches a water body (via runoff) or it will percolate down through the soil until it reaches the groundwater. Because gasoline is relatively insoluble and less dense than water, it will pool on top of the water. The MTBE will then begin to move from the gasoline into the water. This is the mechanism by which MTBE in gasoline contaminates surface water bodies and groundwater.

Unlike many other contaminants in groundwater, MTBE does not readily sorb to soil or rock surfaces, because it is highly soluble in water. A contaminant's mobility in groundwater is expressed as a Retardation Factor (R) where:

$$R = \frac{\text{groundwater velocity}}{\text{compound's velocity}}$$

For MTBE, R is approximately 1, indicating that MTBE will move through the subsurface at the same velocity as the groundwater in which it is dissolved. This contrasts with other gasoline constituents such as the BTEX compounds (benzene, toluene, ethylbenzene, xylenes) that are retarded because they sorb to soil/rock surfaces. The high solubility of MTBE in water, in concert with its low sorption characteristics, mean the MTBE plumes can move on the scale of kilometers away from the source of contamination. BTEX plumes typically move $\leq$ 100 meters from the source. Groundwater velocity, and hence the velocity of MTBE, is dependent upon the permeability and porosity of the formation (which is a function of the type of soil or rock) and the hydraulic gradient. In addition, the pumping of drinking water wells can induce a stress on

the groundwater affecting its velocity. Natural groundwater velocities range from millimeters per year to as much as one meter per day.

Three processes control the fate of MTBE in groundwater: dispersion, dilution and degradation. Dispersion causes the plume of contamination to expand both perpendicular to the direction of groundwater flow and in the direction of flow. It is caused on the microscopic scale by the irregular surface of the soil or rock through which the water is flowing. Microscopic dispersion is particularly important in fractured rock. Macroscopic dispersion is caused by inhomogeneities such as gravel lenses or clay pockets (i.e., layering) in soils.

Dilution occurs when the MTBE plume water is mixed with uncontaminated groundwater. This phenomenon can occur, for example, when a water supply well draws groundwater from a radius around itself. In this case, the plume water constitutes only a part of the water within the well's radius of influence, with clean water comprising the remaining portion of the water drawn into the well.

II. Remediation of MTBE

Dispersion and dilution reduce the concentration of MTBE by mixing the contaminated water with cleaner water, but the total mass of MTBE present *in situ* does not change. Degradation reduces the concentration of MTBE in water by converting it to other compounds. More importantly, degradation reduces the mass of MTBE *in situ*. MTBE in surface and ground water can be treated by pumping the water into an engineered system (*ex situ* treatment) or it can be treated directly in the environment (*in situ* treatment).

A. Ex Situ Remediation

When MTBE is removed from groundwater or surface waters using engineered reactors, the water must be pumped out of the surface water body or aquifer. In the latter case, it is essential to place wells strategically within or near the plume to collect the contamination.

Treated water can be discharged back into the water body or aquifer. There are three major types of engineered remediation processes that are used for MTBE: adsorption systems, air stripping systems, and advanced oxidation processes (AOPs).

The most common adsorbent is Granular Activated Carbon (GAC). This charcoal-like material has a very high surface area and is made from processing wood, bone, or similar products at high temperatures and pressures. GAC has a large capacity for adsorbing organic compounds. As a result, it is commonly used in adsorption systems that treat water containing gasoline compounds. Unfortunately, GAC has a relatively low sorptive capacity for MTBE, in part because the latter is so soluble in water. For example, in the Malley et al. (1993) study, a GAC unit used to treat gasoline-contaminated groundwater worked for only two weeks before it was saturated with MTBE and no more treatment occurred. Once saturated, the GAC must be replaced or regenerated by thermal oxidation or steam cleaning. While GAC can achieve 99% removal of MTBE, the short operational time is problematic in that it results in higher costs because of frequent replacement/regeneration. It is possible to use GAC as a polishing unit after another treatment process (e.g., air stripping). Synthetic sorbents, such as the commercially-fabricated resin Ambersorb®, have been used instead of GAC because they have higher sorptive capacities for MTBE (Malley et al., 1993). However, they have a high capital cost and cannot be easily regenerated, further escalating the total cost.

Air stripping systems exploit the principle that MTBE can be transferred into the gas phase by bubbling air through the water (diffused bubble aeration) or passing it by a thin film of water (packed tower aeration). Air stripping works well for many gasoline compounds that are much more volatile than MTBE when dissolved in water (i.e., they have a higher Henry's Constant). Several types of air stripping devices are used including packed towers and diffused bubble aeration systems. Research conducted in New Hampshire by Malley et al. (1993) indicated that even when very large amounts of air were used (air: water ratio of 150:1), MTBE

removals were only 60%. Some air stripping systems have been reported to have removals of 99%, but lower removals are more typical because of MTBE's high solubility in water. In addition, the MTBE-laden air exiting the air stripping unit must be treated before discharge. This adds expense and complexity to the system and must be accomplished using sorption of the gas phase MTBE onto GAC or by thermal oxidation (combustion of the MTBE). If GAC is used, it must be regenerated after saturation, typically by thermal processing.

AOPs exploit the principle that MTBE can be chemically or physically oxidized to CO_2 and H_2O. The types of oxidants that can be used are: hydrogen peroxide (H_2O_2), ultraviolet (UV) light, and ozone (O_3). Use of AOPs to treat MTBE-contaminated water is promising, with some research indicating 99% removals are possible. As advances are made in AOP technology, its use in MTBE degradation may grow. There is much research ongoing (e.g., the American Water Works Research Foundation is funding an MTBE research project on AOPs in California) that could improve our understanding of AOP application in MTBE removal from water and reduce the high cost of operation.

Perhaps the greatest disadvantage of *ex situ* treatment processes for aquifers is that in order to insure the remediation has met the treatment goal, one must be satisfied that all of the contaminated water is completely captured by the well network. This is often very difficult to accomplish because it is hard to know the location of all of the contaminated water underground, especially because MTBE moves so readily in water. In addition, in the subsurface there is usually significant heterogeneity in the soils/aquifer materials, thereby making it difficult to completely predict where and how the groundwater and MTBE move. In bedrock systems, knowledge of contaminant plumes and movement are further complicated by the very complex pattern of fractures in the rock.

B. In Situ Remediation

Treating MTBE in the environment where it occurs (i.e., *in situ*) eliminates the need to be able to completely remove it from the aquifer. *In situ* remediation is accomplished using microorganisms that live in the environment and can biodegrade MTBE.

In surface and ground waters and soils, most MTBE degradation is a result of microbiological activity. The only other naturally-occurring degradation process – photolysis – is limited because UV light from the sun does not penetrate far into these media. The degradation rate of a contaminant in the environment is often expressed in terms of half-life ($t_{1/2}$). $t_{1/2}$ is the time it takes for ½ of the original compound present to degrade. The $t_{1/2}$ of MTBE in surface waters is greater than 1 day. For example, it will take approximately 6.7 half-lives (7 days) to achieve the two orders of magnitude of degradation needed to reduce a concentration of MTBE of 1000 µg/L to the New Hampshire primary drinking water standard of 13 µg/L. In a river flowing at 1 foot/second, the MTBE plume would have traveled 108 miles in this time. In groundwater, the $t_{1/2}$ is not well known, but is at least 2 years. In this case, assuming a 2-year $t_{1/2}$, it will take approximately 13 years to achieve the two order of magnitude reduction in MTBE. This contrasts with a 2-3 month $t_{1/2}$ for BTEX in groundwater. MTBE is resistant to biodegradation because the tertiary butyl carbons are associated with the ether linkage and the branching off the base molecule is only one carbon long making it hard for microbes to attack the molecule.

The biodegradation pathways of MTBE are not yet fully understood. One generalized pathway is shown in Figure 1. Microorganisms can use the MTBE as a sole carbon and energy source or can degrade it along with another organic carbon source (e.g., pentane). The latter process is called co-metabolism. In the process of using MTBE as an energy source, the microbes remove electrons and hydrogen ions from the molecule and pass them down a chain of

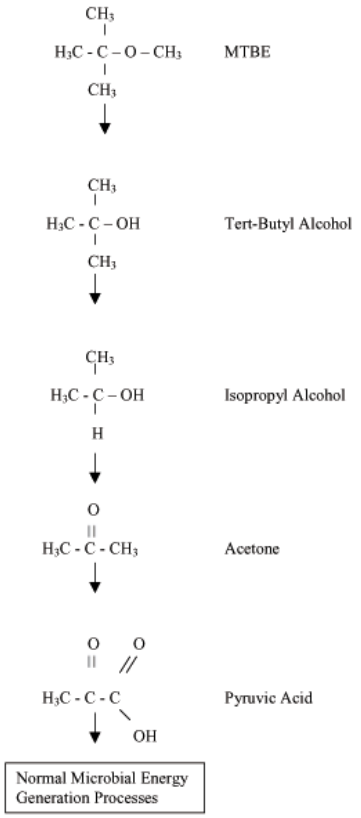


Figure 1. Generalized pathway of MTBE biodegradation based on Church et al. (2000) and Steffan et al. (1997).

oxidation-reduction reactions to a terminal electron acceptor (TEA). When oxygen is present, they will use it as a TEA because it produces the most energy to fuel cell maintenance and growth. Most lab studies on MTBE biodegradation have involved aerobic conditions. A variety of microorganisms, including pure cultures of bacteria and fungi and microbial consortia from waste treatment systems, and contaminated and uncontaminated environments have been found to degrade MTBE aerobically.

However, many contaminated aquifers do not contain significant amounts of oxygen. Some recent studies have shown that microbial consortia can use TEAs other than oxygen (e.g. nitrate, sulfate and carbonate/hydrogen), suggesting that oxygen may not be essential for MTBE biodegradation. However, the rates of some of these anaerobic reactions are slower than those with oxygen.

Some field studies have been conducted to monitor the natural rate of attenuation (degradation) of MTBE in gasoline-contaminated aquifers. Typically, BTEX degradation occurs first followed by MTBE. In some studies, MTBE is not degraded *in situ* at all. In a 1998 report by Hitzig et al., 13 of 70 sites contaminated by MTBE were relying on natural attenuation for remediation. One such site is the Borden Test Site in Ontario, Canada. In the first 16 months after a gasoline release, BTEX concentrations decreased significantly in the aerobic aquifer, but MTBE was hardly affected. Sampling that occurred 7 years later found MTBE concentrations reduced to <200 μg/L from several 1000 μg/L initially. Borden et al. (1997) reported MTBE degradation in a shallow coastal plain aquifer in North Carolina under a mix of aerobic and denitrifying conditions (using nitrate as a TEA). Wilson et al. (2000) conducted laboratory studies using sediment from an anaerobic aquifer contaminated with petroleum hydrocarbons. The rate of attenuation of MTBE under methanogenic conditions (CO_3^{-2}/H_2 as a TEA) was similar to that observed at the field scale. However, degradation rates under these conditions

were so slow that it will take 60 years for the MTBE concentration to be reduced from 1200 µg/L to 30 µg/L.

While naturally-occurring biodegradation offers an attractive alternative for *in situ* remediation of MTBE, it may be limited by the long lag times needed before degradation occurs consistently. In addition, because of the slow growth achieved and perhaps because MTBE is not similar to petroleum hydrocarbons or other organic contaminants, few microbes seem to degrade MTBE. In some cases, MTBE biodegradation has stopped at tert-butyl alcohol (Figure 1), which means it has not been completely degraded to CO_2 and H_2O. Some studies suggest that MTBE will not be degraded at all until other more readily degradable compounds (e.g., BTEX) are eliminated.

It may be possible to speed MTBE biodegradation *in situ* by adding substances to the subsurface. For example, Salanitro et al. (2000) injected oxygen, and oxygen and microorganisms to an MTBE plume in Port Hueneme, CA with favorable results (concentration decreased from 2000 to 2 µg/L). In addition, some bioremediation companies have reported accelerated MTBE degradation with the use of their proprietary products. These studies have been focused on soil-based aquifers and should have independent third party verification. Little to no research work has been performed on MTBE biodegradation in fractured rock.

The challenge of remediating MTBE in groundwater is one of the most difficult subsurface contamination problems facing the nation because of the compound's propensity to dissolve into water at high concentrations and to move with the water with little to no retardation. While *in situ* bioremediation offers the best hope for addressing the extent of MTBE contamination nationwide, natural processes will likely have to be accelerated using innovative engineering approaches, such as injecting TEAs, in order to meet regulatory standards in an acceptable timeframe.

The University of New Hampshire's USEPA-funded Bedrock Bioremediation Center (BBC) will be opening an MTBE/gasoline research site in Fall 2001 in New Hampshire. This site is currently being chosen in coordination with the New Hampshire Department of Environmental Services. The BBC develops and tests technologies to monitor and accelerate *in situ* bioremediation in bedrock. Currently, the BBC has a research site at the Pease International Tradeport (Portsmouth, NH) in a bedrock aquifer contaminated with chlorinated solvents. BBC researchers are developing drilling and monitoring technologies there and conducting evaluations of innovative and emerging bioremediation methods under controlled conditions, so that the true fate and degradation rates of the contaminants are known. It is essential to have such independent verification of monitoring and bioremediation strategies for regulators to accept bioremediation alternatives as viable options for *in situ* remediation. The BBC will be using the same approach at its new MTBE/gasoline site, which will have both bedrock and overburden MTBE contamination. In the future, the BBC may expand its focus to develop and test monitoring and *in situ* bioremediation technologies in the overburden at the test site, if there is interest among the regulatory agencies in this activity.

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STATEMENT OF PATRICIA W. AHO, EXECUTIVE DIRECTOR, MAINE PETROLEUM ASSOCIATION

I appreciate this opportunity to present information pertaining to issues surrounding the use of ethanol in gasoline in New Hampshire and Maine. The Maine Petroleum Association is a division of the American Petroleum Institute, which is a national trade association representing nearly 500 companies engaged in all sectors of the U.S. oil and natural gas industry, including exploration, production, refining, distribution, and marketing. As Executive Director of the Maine office, I also oversee issues of concern to our members in New Hampshire.

BACKGROUND

Federal reformulated gasoline (RFG) is currently required to be used in four southern New Hampshire counties Hillsborough, Strafford, Rockingham, and Merrimack. Conventional gasoline is used in the remainder of New Hampshire. Conventional gasoline is used in Maine except in the summer ozone season when 7.8 RVP conventional gasoline is required in Maine's southern counties. The RFG gasoline which is supplied to New Hampshire uses predominately MTBE as the oxygenate to meet the requirements of Federal law and regulations that require a minimum of 2 percent oxygen by weight. Over the past few years, attention has focused on alternatives that may be used in lieu of MTBE. The focus of many discussions by policymakers and regulators in New Hampshire and Maine has been to determine whether ethanol is a viable alternative.

ETHANOL AVAILABILITY

Last summer, the Coalition of Northeastern Governors hosted a forum on ethanol blending in gasoline in the Northeast and Mid-Atlantic. Because ethanol is not widely available in the Northeast, the forum presented information regarding the economic issues associated with its use in gasoline and the associated development of a regional infrastructure which would be necessary in order to ensure long term production capability. Additionally, the forum discussed issues regarding cellulosic biomass ethanol technology, which is of interest in New Hampshire and Maine because of its potential to be produced from biomass waste, including agricultural, wood and municipal solid waste.

Currently, the Agricultural Products Utilization Commission in Maine has issued a request for proposal to study the feasibility of building and financially sustaining a biomass-ethanol plant in northern Maine. What is important to note from both of these ongoing efforts, is that there is very little, if any, current production capacity for ethanol in either New Hampshire or Maine. API undertook an analysis of the cost and benefits of State-level oxygenate mandates to expand ethanol production in January 1999. This study provides an overview regarding Federal ethanol subsidies, and the market structure of the industry. It indicates that the total capitalization of a 15 million gallon per year ethanol plant is roughly $30 million. Thus the capital necessary for the startup of an ethanol plant would be significant here in northern New England. (I have attached a copy of the study to this statement.)

Recent testimony before this committee's Subcommittee of Clean Air, Wetlands, Private Property and Nuclear Safety by Jason Grumet, Executive Director of the Northeast States for Coordinated Air Use Management (NESCAUM) acknowledged that the Northeast and northern New England do not currently have an available supply of ethanol. He said, " it is possible to ship massive quantities of ethanol to the Northeast by barge, rail and truck. The question remains at what cost." Recently, Comm. Arthur Rocque, Connecticut Department of Environmental Protection has acknowledged that it is not prudent for the State of Connecticut to ban the use of MTBE effective October 2003, and bases his concern on a study evaluating ethanol as an alternative to MTBE which has been conducted by NESCAUM, and the New England Water Pollution Control Commission (NEIWPCC). In fact, Comm. Rocque indicates that to the State of Connecticut, banning MTBE would pose undesirable options to the State including: "the delivery of special or non-complaint (sic) gasoline or an increase in the price of gasoline conservatively estimated in the range of 3–11 cents per gallon." Comm. Rocque has indicated that the Department of Environmental Protection in Connecticut is prepared to recommend changing the date during the next legislative session.

ETHANOL INFRASTRUCTURE

New Hampshire receives its gasoline from marine barge shipments which come into terminals in Portsmouth and Newington, and from trucks which may pick-up products from terminals in Portland, Maine, Boston harbor, Springfield, Massachusetts and even as far away as Albany, New York. Gasoline containing ethanol needs to be transported and stored differently than does gasoline which contains ethers. Ethanol must be transported and stored separately from the gasoline until the point where it is loaded into the truck at the terminal rack, for delivery to retail locations. Terminals which are located in New Hampshire, Massachusetts, or Maine, which would be supplying gasoline with ethanol, would need to build new storage tanks and retrofit terminals with new blending equipment in order to supply the product. Many of our terminals may have difficulties in receiving siting approvals for such additional storage capacity; space constraints may prove to be a significant challenge in expanding existing petroleum terminals.

Exacerbating the separation and segregation requirements, are the number of fuels required in the northern New England area. New Hampshire requires two different fuels, Maine requires two different fuels also. Recently, some proposals have seemed to address only MTBE used in RFG rather than all fuels, which would result in an even greater strain on the gasoline infrastructure. If ethanol were required to be used to comply with the Federal oxygenate mandate in reformulated gasoline, then the terminals servicing New Hampshire marketers would in turn have to carry even more types of gasoline. Our refinery and distribution system is currently stretched to the breaking point. There are over 45 different types of gasoline required nationwide, so any additional requirements for gasoline would pose significant challenges for the industry.

Other infrastructure issues also arise with the consideration of gasoline containing ethanol, including possible changes that might be needed to either underground or aboveground storage tank systems. For example, some fiberglass reinforced plastic tanks may not be compatible with ethanol, and there are questions whether premature failure of leak monitoring systems, and other parts of the fuel dispensing equipment at a gasoline station may occur.

Ethanol is predominately produced in the Midwest and would have to be transported into the Northeast. Until such time as any ethanol is produced in the New England area, the alternative for transporting ethanol from the Midwest include barge, tanker, rail or truck. Infrastructure for this type of transportation will need to be developed prior to any ability to move significant quantities of ethanol to Northeast terminals for blending.

Finally also it is important to note that gasoline containing ethanol cannot be comingled with gasoline containing ethers. Terminals and gasoline stations would not be able to intermingle the two products in its tanks. Thus proposals which attempt to phase-down the use of MTBE or ethers in gasoline, without removing the Federal oxygenate mandate, are not feasible.

CONCLUSION

In conclusion, I appreciate the opportunity to present information to you today; API is committed to working with Congress, the Administration, and State policymakers and regulators to develop appropriate energy policies for our future. Thank you very much.

ATTACHMENT

[From the American Petroleum Institute, January 1999]

THE COSTS AND BENEFITS OF STATE-LEVEL OXYGENATE MANDATES TO EXPAND ETHANOL PRODUCTION

Considerable research has been carried out over the last several decades to address questions relating to the cost and benefits of ethanol programs at the Federal and State levels. Proponents argue that ethanol programs support agricultural production and boost farm income in particular States. In addition, various environmental benefits are attributed to ethanol use, and it is claimed that its use reduces the risk of dependence on foreign oil. New legislation that would significantly increase ethanol demand, e.g., requiring oxygenated motor fuel use statewide, is currently being considered by various State legislatures.[1] On the other hand, opponents to ethanol subsidies argue that the cost to taxpayers and to consumers, e.g., in terms of decreased tax revenue, and increased gasoline and food expenditures, outweigh the benefits to farm producers and processors. The principal purpose of this paper is to assess the likely costs and benefits of additional State level mandates being considered by various State assemblies that, if implemented, would significantly increase ethanol demand and production. Before turning to this issue, a brief description of existing Federal and State ethanol subsidies is provided as well as a characterization of the market structure of the ethanol industry.

Federal Ethanol Subsidies

The rationale for tax exemptions on alternative fuels at the Federal level grew out of energy security concerns associated with the 1973–74 Arab oil embargo. The objective was to displace gasoline by subsidizing renewable fuels. The nation's de-

[1]Minnesota mandated the use of oxygenated fuel year round in both attainment and non-attainment areas in 1997 to be phased in over a number of years. Ethanol is the sole oxygenate in use in Minnesota.

pendence on foreign oil would decline as oil imports dropped, or so it was thought. A Federal exemption of 4 cents per gallon for alcohol fuels was initiated with the enactment of the Energy Tax Act (P.L. 95–618) in 1978, representing the full amount of the Federal gasoline tax. The magnitude of the Federal tax exemption has been changed periodically since that time, most recently with the Omnibus Budget Reconciliation Act of 1990 that established a rate of 5.4 cents per gallon of motor fuel containing 10 percent alcohol by volume.[2] This translates into a 54 cents tax exemption per gallon of ethanol. The act also introduced a tax credit of 10 cents per gallon of ethanol for small ethanol producers (less than 15 million gallons per year). The Energy Policy Act of 1992 extended the tax exemption to gasohol containing less than 10 percent alcohol. Mixtures containing 7.7 percent alcohol receive an exemption of 4.16 cents per gallon, and the exemption for the 5.5 percent mixture is 3.08 cents per gallon.

Magnitude and Types of State Level Ethanol Subsides and Mandates

States have justified ethanol subsidies on grounds ranging from local economic masons to environmental and energy security concerns. The levels and types of subsidies vary by State as seen in Table 1. Common types of programs include production subsidies, tax exemptions on motor fuel taxes, and guaranteed loans at below market rates for new production facilities. For example, Minnesota has provided a 5 cents per gallon blenders' credit, a 20 cents per gallon producers' subsidy, and low interest loans of up to $500,000 per plant through the Ethanol Production Facility Loan Program. More generally, the magnitudes of State level ethanol subsidies of the major producing States range from zero to 40 cents per gallon of ethanol.

Table 1 Ethanol Programs in Selected States[1]

ST	Fed. Mandated Use	State Mandated Use	Producer's Subsidy	Blender's Credit	Subsidized Loans	# Ethanol Plants	State Ethanol Use for Gasohol (% of national)
MN	Ozone–No CO–Yes	Year Round St. Wide OXY. Req.	$.20 / gallon ethanol	$.05 / gallon ethanol	Yes	8	15.1
IL	Ozone–Yes CO–No	Government Vehicles Only	No	No	No	4	15.3
IN	Ozone–Yes CO–No	No	No	No	No	1	5.1
IA	Ozone–No CO–No	Government Vehicles Only	No	$.01 / gallon ethanol	Yes	7	4.7
NE	Ozone–No CO–No	Government Vehicles Only	$.20 / gallon ethanol	No	No	7	1.6
ND	Ozone–No CO–No	No	$.40 / gallon ethanol	No	No	2	0.4
SD	Ozone–No CO–No	Government Vehicles Only	$.20 / gallon ethanol	$.02 / gallon ethanol	No	4	1.3
WI	Ozone–Yes CO–No	Government Vehicles Only	No	No	No	2	5.3

1. State Ethanol Programs in Place as of February 1997. In addition, the Federal motor fuels tax exemption of $0.54 per gallon of ethanol applies across all states. See Appendix for complete use of ethanol by state.

Sources: *Ethanol Programs: A Program Evaluation Report*, Office of the Legislative Auditor, State of MN, Feb. 1997; Federal Highway Administration, *Highway Statistics*, Table MF-33E, 1997.

Statewide year-round use of motor fuel with 2.7 percent oxygen was mandated in Minnesota in October 1997.[3] This will roughly double the amount of ethanol consumption in the State when fully implemented. Such mandates go far beyond the already considerable levels of existing Federal aid State ethanol subsidies, and if en-

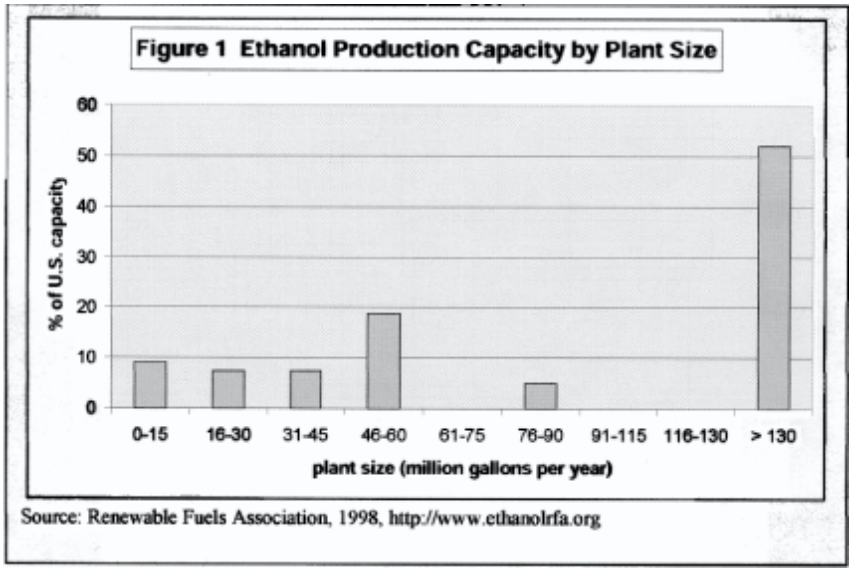
[2]Motor fuel blenders have the alternative of taking an income tax credit of 54 cents per gallon of ethanol.

[3]The 2.7 percent oxygen requirement effectively precludes the use of oxygenates other than ethanol.

acted by a significant fraction of States, will result in soaring levels of ethanol demand and an aggressive expansion in ethanol production.

Market Structure of the Industry

U.S. ethanol production is concentrated in both large and small plants, e.g., large plants exceeding 130 million gallons per year account for over 50 percent of U.S. capacity while plants with capacity of 45 million gallons per year or less account for roughly 23 percent of total capacity as seen in Figure 1.[4] Previous research [see, e.g., USDA, ERS, 1988, USDA, Office of Energy, 1986] shows that unit production costs at larger plants can be up to 45 percent less than those at smaller plants, i.e., increasing returns-to-scale characterizes ethanol production With average[5] ethanol production costs of roughly $1 00 per gallon, this suggests a range of between $85 per gallon and $125 per gallon across large aid small producers under current feedstock prices While the magnitude of these costs would change with changing corn prices, the differential, reflecting production economies, would remain. A natural question to ask is why small and medium size plants are built. Them are several reasons, primary among them are icing constraints and subsidies for small producers.



The total capitalization of a 15 million gallon-per-year ethanol plant is roughly $30 million of which $8 million goes for construction, $10 million toward equipment, $6 million for engineering and design, and $6 million to working capital for startup of operations, The sale of common stock typically provides between 40 and 50 percent of the required capital with bank loans with terms ranging between 7 to 10 years supplying the rest.[6] Given existing producer subsidies and State mandates, bankers do not have to assume that the plant will be profitable, i.e., they provide financing at near zero risk! This follows since the loans are likely to be repaid even if the ethanol plant is an economic failure in States where producer subsidies exist. Assuming a $.20 per gallon producer subsidy, a 15 million gallon plant receives $3 million per year. This provides $30 million over a 10-year period, enough to build the plant (and pay back bank loans) and cover startup costs. State mandates that insure the continuation of local demand for ethanol, and shareholder equity, further reduce the risk of non-recoverable loan default to near zero. Bank financing of larger plants would put more bank capital at risk, and the evidence to date suggests that capital constraints become binding over the 15 million to 30 million gallon per

[4]Plant production by State is given in Table A–2 of the appendix.

[5]This reflects a weighted average across wet and dry ethanol plants at current corn prices. Average wet miller production casts are $ .85 per gallon while these of dry millers are $1.25 per gallon. Wet millers supply roughly 60 percent of the ethanol brought to market, dry millers the remainder.

[6] Some States provide low interest loans of up to $500,000 per plant for small producers.

year plant size. Hence, for the independent producers, capital constraints limit plant size before significant returns-to-scale can be realized. Large companies, e.g., ADM and Cargill, not subject to such capital constraints, build and operate large plants to realize lower unit production costs.

The Costs of State Oxygenate Mandates

A relevant policy question associated with any public expenditure (be it a highway, public park or a subsidy for motor fuel) is whether the societal benefits of the product or service will likely exceed the societal costs? In some cases the answer to this question is relatively straightforward, e.g., even at the time of project commencement the net benefits of the Federal interstate highway system were recognized, while in other cases the optimal amount of government support for a project may be less clear, particularly in its early stages, e.g. the optimal level of public expenditures targeted at global warming.

In the case of public expenditures for ethanol production, the evidence to date strongly suggests that societal costs have significantly exceeded societal benefits. In fact, there is widespread agreement among economists that ethanol production would not take place without the current level of Federal and State subsidies since it cannot compete on a level playing field with readily available substitutes. It follows that State mandates that significantly increase ethanol demand by requiring ethanol use in attainment as well as non-attainment areas, as in Minnesota, lead to further resource misallocation and waste. The cost-benefit analysis of the Minnesota program presented below provides evidence in support of this view.

Motorists Could Pay More For Motor Fuel

At a time when crude oil and hence gasoline prices are at historic lows, motorists could pay more for motor fuel under expanded oxygenate mandates like those in Minnesota (notwithstanding low corn prices and existing ethanol subsidies). This is borne out in the Energy information Administration's most recent weekly retail price data listed in Table 2. The estimates characterize prices of motor fuel sold in attainment areas (conventional), carbon monoxide non-attainment areas (oxygenated) and ozone non-attainment areas (RFG). The average of 5 weekly observations running from 11/9/98 to 12/7/98 reveals that oxygenated fuel in PADD 2 was selling for roughly $.03 per gallon more than conventional fuel. Since Minnesota is the only State in PADD 2 with an oxygenate requirement, oxygenated fuel prices in PADD 2 are Minnesota prices. Furthermore, ethanol is the sole oxygenate in use in Minnesota.

This data squares with a recent report Ethanol Programs: A Program Evaluation Report prepared by the State of Minnesota, Office of the Legislative Auditor in February 1997 that on p.9 states ". . . the retail price of gasohol (in Minnesota) will exceed the price of conventional gasoline by about 2 to 3 cents per gallon over the next several years". [7]

Table 2 Midwest Self-Service Retail Gasoline Prices, All Grades
(dollars per gallon including taxes)

	11/9/98	11/16/98	11/23/98	11/30/98	12/7/98	Average
PADD 2						
Conventional Areas	1.014	0.989	0.980	0.954	0.923	0.972
Oxygenated[1] Areas	1.055	1.024	1.017	0.973	0.942	1.002
RFG Areas	1.086	1.056	1.044	1.022	1.002	1.042

PADD 2 includes Illinois,Indiana,Iowa,Kansas,Kentucky,Michigan,Minnesota,Missouri,Nebraska, N. Dakota,Ohio,Oklahoma,S.Dakota,Tennessee,Wisconsin.

1. Minnesota is the only State in PADD 2 with an oxygenate requirement. Hence oxygenated fuel prices for PADD 2 are Minnesota prices. Furthermore, ethanol is the only oxygenate in use in MN.

Source: DOE, EIA, 12/98. Site Address: ftp://ftp.eia.doe.gov/pub/oil_gas/petroleum/data_publications/weekly_retail_gasoline_.../rtlgas.tx

Before Minnesota imposed its statewide mandate, the use of an oxygenate was required under Federal law in the Twin Cities metropolitan area for one-third of the

[7]It is important to note that this conclusion could change given a significant relative price change between corn and crude oil.

year. Given that roughly one-half of total State vehicle miles traveled fall within the Twin Cities area it follows as a crude approximation that one-third of one-half, or one-sixth, of all gasoline consumed in the State fell under the Federal oxygenate mandate. Hence, the year-round statewide oxygenate mandate is directly attributable to the remaining 5/6 of total State consumption not covered under Federal law.

Given that roughly 2 billion gallons of gasoline are consumed in Minnesota each year, and that gasohol blends currently sell for roughly $.03 per gallon more at the pump than straight gasoline[8] [Table 2 above], it follows that the statewide oxygenate mandate could cost Minnesota and visiting out-of-state motorists $50 million per year (516 x 2 billion gallons x $.03 per gallon) in additional motor fuel costs (upon full program phase-in).

State Taxpayers Will Pay Higher Taxes or Face Reduced Government Services

In addition, the State mandate (to be phased in over time) will eventually increase ethanol demand by roughly 132 million gallons (.077 x 2 billion gallons gasoline x 5/6 x 1.03) per year.[9] This implies a producer subsidy of $26.4 million per year (132 million gallons x $.2 per gallon). According to the Minnesota State Report [1997), ethanol production capacity in Minnesota stood at roughly 92 million gallons per year in 1997, with an additional 37.5 million gallons of capacity (3 plants) under construction, and 105 million gallons of capacity (6 plants) in the planning stage. Total production capacity will be 235 million gallons if and when all 9 plants come on line. Below market rate loans for plant construction for 9 plants will add roughly $.3 million per year to taxpayers bills.[10] The total increase in subsidies due to the oxygenate mandate, to be paid in large part by Minnesota taxpayers, is estimated to be $26.7 million per year.

Federal Taxpayers Subsidize State Ethanol Expansion

Federal tax revenue will decline by $71.3 million per year (132 million gallons x $54 per gallon) due to the Minnesota oxygenate mandate, plus $8.6 million per year (132 million gallons x $.10 per gallon x .65) as a result of the subsidy to small producers. The Federal subsidy for small producers (less than 15 million gallons per year) is $.10 per gallon, and roughly 65 percent of all Minnesota plants that will be in production after the 9 new plants come on line fall under the definition of small producer. The total Federal subsidy for Minnesota's statewide oxygenate mandate is estimated to be $ 79.9 million per year.

In sum, for States actively considering oxygenate mandates such as that recently passed in Minnesota, the timing could not be worse. With no recovery in crude oil prices on the horizon, at least over the near term, additional oxygenate mandates could result in a significant increase in motor fuel outlays for consumers in those States. The total program costs are estimated at $156.6 million per year, as seen in Table 3 on page 9.

THE BENEFITS OF STATE OXYGENATE MANDATES

The Minnesota Agricultural Sector will Benefit from State Oxygenate Mandates

Increased ethanol production will result in an increase in the demand for corn, positively impacting the farm sector. Corn production in Minnesota is roughly 1.1 billion bushels. An increase in demand of 132 million gallons of ethanol due to the State oxygenate mandate translates into a demand increase of 52.8 million bushels of corn assuming a coefficient of .4 bushels of corn per gallon of ethanol, or 4.8 percent of current production. A price increase at the local level of 5.04 to 5.05 per bushel, or 2.3 percent at the current corn price of $2.14 per bushel, could be expected to result from an increase in demand of this magnitude [Personal Communications, Economic Research Service (ERS), 1998].[11] Production margins (gross value of production less variable and fixed costs) for Minnesota corn producers are estimated by ERS to be $79.94 per acre at $2.19 per bushel of corn. This translates into $.64 per bushel given a yield of 124 bushels per acre. Hence, net income to Minnesota corn producers is estimated to increase by $25.8 million (52.8 million bushels

[8]The average PADD 2 conventional fuel price is taken as a proxy for the Minnesota conventional fuel price in this analysis.

[9]The first factor in parenthesis specifies the percent ethanol blend with gasoline required to meet a 2.7 percent oxygen requirement while the last factor takes into account the energy differential between straight gasoline and the ethanol blend.

[10]The current $05 per gallon blender's credit is due to be phased out and therefore not included as a public expenditure.

[11]The change in the national average corn price due to this demand increase would be negligible.

x $.64 per bushel) due to the increase in ethanol demand as a result of the oxygenate mandate. This estimate assumes that demand is filled entirely through Minnesota production. It could be the case that a fraction of the demand is filled through out-of-state production though with Minnesota corn prices significantly lower than those in surrounding States, this fraction is likely to be low. Furthermore, the estimate assumes that demand would be filled entirely through additional production and would not simply be filled by diverting from exports or other uses. To the extent that this is not the case, the benefits reported here are overestimates.

There will also be indirect benefits accruing to the agricultural sector, e.g., the co-products of additional ethanol production will add value to the sector as will the increase in demand for agricultural supplies. The output multiplier associated with feed grains, derived from the U.S. input-output accounts [Survey of Current Business, Vol. 77, No. 11, November 1997], is employed to derive a rough estimate of these indirect benefits. The multiplier (2 in the case of feed grains) indicates the increase in economy-wide output necessary to bring $1 of product (in this case corn) to market. In other words, for every dollar of corn brought to market an additional dollar of economic activity is generated throughout the economy. This implies an additional $115.6 million in production given that $115.6 million ($2.19 per bushel x 52.8 million bushels) in additional corn is produced due to the State oxygenate mandate. Assuming a 10 percent profit margin on this production yields an additional $11.6 million in benefits. Hence, the total benefits to the agricultural and related sectors are estimated to be $37.4 million per year, also given in Table 3.

There Will Be Winners and Losers in the Agricultural Sector

Not all farm producers would benefit from an aggressive ethanol expansion program. As stated above, corn prices would likely increase resulting in increased acreage planted to corn. Higher corn prices result in higher prices of other feed grams and wheat as producers substitute these commodities for corn in their feed rations. The acreage planted to these commodities also increases due to increases in feed demand other than corn. The situation is different for soybean producers as soybean and corn production compete for the same acreage. Given the increase in acreage planted to corn, flower acres are planted to soybeans. The soybean enterprise shrinks and profitability declines with ethanol expansion.[12]

Minimal Environmental and Energy Security Benefits

Given that the State mandate applies to areas already in attainment, environmental benefits will be negligible. Also, 132 million gallons of ethanol per year will displace roughly 102 million gallons of gasoline per year (2.4 million barrels of crude per year). The United States imports roughly 3,285 million barrels of crude and product per year. Hence, the energy security benefit associated with this program is also negligible. It is important to note that given the diversification of U.S. imports of crude by country of origin that has occurred over the last several decades, the energy security value of import reduction (even at levels significantly greater than considered here) has declined.

The result is unambiguous. As seen in Table 3, the societal cost of the State oxygenate mandate is roughly 4 times greater than the societal benefit resulting in an annual net loss of $119 million, This result reflects the significant misallocation of resources associated with ethanol production. It is important to recognize that the statewide oxygenate mandate requires the use of an oxygenate in attainment areas that otherwise could simply have used straight gasoline. Inherent in each gallon of ethanol produced over and above the level required to meet Federal mandates is a resource cost to society equal roughly to the production cost differential between ethanol and straight gasoline. With ethanol production costs at roughly $1.20 per gallon in Minnesota and wholesale gasoline prices at $.30 per gallon, the resource loss (or societal waste) associated with the Minnesota oxygenate mandate is estimated to be $119 million per year (132 million gallons x $.90 per gallon).

[12]In addition, corn oil, a co-product of ethanol production, substitutes for soybean oil further driving down the domestic demand for soybeans.

Table 3 Costs and Benefits of Requiring Statewide Year-Round Oxygenate Use in Minnesota
(millions of dollars per year at full phase in)

Costs	
Increase in Motor Fuel Costs	$50.00
State Subsidies Paid by State Taxpayers	$26.70
Federal Tax Exemptions Paid by U.S. Taxpayers	$79.90
Total Costs	$156.60
Benefits	
Total Benefits (to agricultural and related sectors)	$37.40
Annual Net Loss	($119.20)

Source: API Calculations, 1998

One might presume that such large losses would be unacceptable to the agents bearing them. It should be pointed out, however, that a large part of the program cost is subsidized at the Federal level, resulting in less of a burden to Minnesota taxpayers and consumers. As well, benefits flow to a narrow group of producers (increasing the incentive to lobby) while costs are spread over the entire population (decreasing the incentive to lobby).

Conclusions

There is movement in some State legislatures to adopt statewide oxygenate mandates similar to the program put in place in Minnesota in 1997. The proponents argue that mandates will benefit corn producers directly by increasing the demand for corn, and indirectly in that the corn producers will realize the value-added of additional ethanol production, further boosting their incomes. While proponents are correct in asserting that mandates will benefit corn producers by increasing the demand for corn, this paper has clearly shown that the additional benefits to the agricultural sector do not compensate for the program costs. In particular, the implementation of statewide oxygenate mandates could increase fuel costs to motorists and reduce Federal and State tax revenue. These costs are roughly 4 times as large as the benefits to the agricultural sector. The result is unambiguous. State residents, e.g., in Iowa, would be worse off given the implementation of such a program.

It is important to point out that the claim made by proponents that the value-added of additional ethanol production will be realized by corn producers in the States where the mandates are enacted may or may not be true, depending upon the particular State. While this may in part be true in States like Minnesota, where ownership structures of ethanol plants are predominantly cooperatives (with corn producers as members), it is clearly not true in States like Iowa, where the entire ethanol production in the State can be attributed to two large corporations. In this case the value-added of ethanol production flows not to corn producers in the State, but rather to the shareholders of the two large corporations. Hence, corn producers in Iowa will not realize the value-added of additional ethanol production in the State (unless they own stock in the corporations producing the ethanol).

Were an aggressive national program put in place, household food expenditures would also be likely to rise, adding to total program costs. In addition, transporting the ethanol from producers to distant consumers would be expensive given that ethanol moves by rail or barge rather than through pipelines. The former modes of transportation are inefficient relative to the later.

TABLE A-1 ESTIMATED USE OF GASOHOL, 1997

OCTOBER 1998 (THOUSANDS OF GALLONS) TABLE MF-33E

STATE	TOTAL ETHANOL USED IN GASOHOL	GASOHOL			STATE ETHANOL USE FOR GASOHOL (% OF NATIONAL)
		10-PERCENT GASOHOL	LESS THAN 10-PERCENT GASOHOL	TOTAL	
Alabama	4,421	44,213	0	44,213	0.3
Alaska	7,552	48,407	35,209	83,617	0.6
Arizona	24,398	0	316,855	316,855	1.8
Arkansas	0	0	0	0	0.0
California	94,861	0	1,664,222	1,664,222	7.1
Colorado	67,623	281,648	512,439	794,088	5.1
Connecticut	3,776	36,684	1,398	38,082	0.3
Delaware	0	0	0	0	0.0
Dist. of Co	0	0	0	0	0.0
Florida	1,527	15,271	0	15,271	0.1
Georgia	0	0	0	0	0.0
Hawaii	0	0	0	0	0.0
Idaho	0	0	0	0	0.0
Illinois	202,777	2,027,773	0	2,027,773	15.3
Indiana	67,514	675,137	0	675,137	5.1
Iowa	62,683	626,825	0	626,825	4.7
Kansas	3,021	30,208	0	30,208	0.2
Kentucky	7,084	70,839	0	70,839	0.5
Louisiana	835	8,353	0	8,353	0.1
Maine	0	0	0	0	0.0
Maryland	3,266	13,748	24,565	38,312	0.2
Massachuset	0	0	0	0	0.0
Michigan	29,074	290,744	0	290,744	2.2
Minnesota	201,044	1,055,081	1,240,731	2,295,812	15.1
Mississippi	0	0	0	0	0.0
Missouri	7,419	74,193	0	74,193	0.6
Montana	0	0	0	0	0.0
Nebraska	21,239	212,395	0	212,395	1.6
Nevada	0	0	0	0	0.0
New Hampshi	0	0	0	0	0.0
New Jersey	12,414	10,018	148,212	158,230	0.9
New Mexico	17,723	136,256	53,216	189,472	1.3
New York	23,624	130,687	137,079	267,766	1.8
North Carol	35,447	314,128	52,387	366,516	2.7
North Dakot	5,282	52,823	0	52,823	0.4
Ohio	163,357	1,633,569	0	1,633,569	12.3
Oklahoma	0	0	0	0	0.0
Oregon	0	0	0	0	0.0
Pennsylvani	63,860	472,440	215,799	688,238	4.8
Rhode Islan	0	0	0	0	0.0
South Carol	0	0	0	0	0.0
South Dakot	17,744	177,441	0	177,441	1.3
Tennessee	310	3,097	0	3,097	0.0
Texas	47,509	472,237	3,702	475,939	3.6
Utah	0	0	0	0	0.0
Vermont	0	0	0	0	0.0
Virginia	32,764	251,755	98,546	350,301	2.5
Washington	27,608	131,528	187,736	319,262	2.1
West Virgin	203	2,031	0	2,031	0.0
Wisconsin	70,830	708,297	0	708,297	5.3
Wyoming	145	1,452	0	1,452	0.0
Total	1,328,934	10,009,275	4,692,096	14,701,370	

Table A-2 U.S. Ethanol Production Capacity by Plant[1] and State, 1997

Company	Feedstock	City	Plant Capacity (million gal. / year)
IOWA (subtotal)			350.0
Archer Daniels Midland	corn	Cedar Rapids	150.0
Archer Daniels Midland	corn	Clinton	150.0
Cargill	corn	Eddyville	50.0
MINNESOTA (subtotal)			197.0
Agri-Energy, LLC	corn	Luverne	12.0
Al-Corn	corn	Claremont	15.0
Central Minnesota	corn	Little Falls	15.0
Corn Plus	corn	Winnebago	17.5
CVEC	corn	Benson	17.0
Ethanol2000	corn	Bingham Lake	15.0
Heartland Corn Products	corn	Winthrop	16.0
Kraft, Inc	whey	Melrose	3.0
Minnesota Clean Fuels	waste sucrose	Dundas	1.5
Minnesota Corn Processors	corn	Marshall	55.0
Minnesota Energy	corn	Buffalo Lake	12.0
Morris Ag Energy	corn	Morris	8.0
Pro-Corn	corn	Preston	10.0
ILLINOIS (subtotal)			354.5
Archer Daniels Midland	corn	Decatur	150.0
Archer Daniels Midland	corn	Peoria	150.0
Midwest Grain Products	corn/wheat starch	Pekin	54.0
Vienna Correctional	corn	Vienna	0.5
NORTH DAKOTA (subtotal)			160.5
Alchem	corn	Grafton	10.5
Archer Daniels Midland	corn	Walhalla	150.0
NEBRASKA (subtotal)			333.0
AGP	corn	Hastings	45.0
Cargill	corn	Blair	50.0
Chief Ethanol	corn	Hastings	30.0
High Plaines Corporation	corn	York	23.0
Minnesota Corn Processors	corn	Columbus	55.0
Williams Energy Services	corn	Aurora	130.0
KANSAS (subtotal)			99.1
ESE Alcohol	corn	Leoti	1.1
High Plains Corporation	milo/corn	Colwich	34.0
Midwest Grain Products	corn/wheat starch	Atchison	54.0
Reeve Agri-Energy	corn/milo	Garden City	10.0
VARIOUS STATES (subtotal)			194.6
TOTAL U.S. CAPACITY			1688.7

1.In the case of multiple plants within a firm, e.g., ADM, only aggegate capacity was available. Patitioning was undertaken assuming equal size plants. Hence, totals are accurate but certain plant capacities could be off. As well, a small fraction of listed capacity is under construction.
Source: http://www.ethanolfra.org/prodcap.hltm, Renewable Fuels Association, 1998.

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STATEMENT OF THOMAS L. ADAMS, PRESIDENT, OXYGENATED FUELS ASSOCIATION (OFA)

Mr. Chairman—Our nation continues to face an energy crisis. Additionally, as you are well aware, the overwhelming majority of citizens continue to express a strong desire for cleaner air. One of the tools that is successfully employed in battling both the energy supply and clean air dilemmas is Methyl Tertiary Butyl Ether (MTBE). However, it is being challenged by some who have concerns about its perceived threat to groundwater and surface water. As President of the association representing international and domestic companies engaged in the manufacture and sale of MTBE, we urge you to avoid a rush to judgment that could seriously impact the nation's precarious energy supply and potentially undo the clean air strides that have been made.

A summary of my testimony is as follows:

- MTBE plays a key role in improving air quality.
- MTBE makes up roughly 4 volume percent of the U.S. gasoline pool (11 percent or more in many major metropolitan areas) and with refineries operating at near capacity levels, elimination of this component could have lasting negative impacts on price and supply of gasoline.
- MTBE is not a human health threat. In fact, there are many examples of the significant role played by MTBE in improving the health of all Americans. Despite press accounts, no national or international agency has ever classified MTBE as a carcinogen.
- Where gasoline components have contaminated drinking water sources, the cause of the problem is a release of gasoline due to leaks from underground storage tanks.

I would like to now briefly address the benefits of MTBE, health effects concerns, its impact on water quality and the options that the nation has as alternatives to its use.

The Environmental Benefits of MTBE

It is important to review the accomplishments of the Reformulated Gasoline (RFG) program, and the role that MTBE has played in those accomplishments. The Clean Air Act requires that all RFG must contain 2 percent, by weight, of oxygen. There are two primary oxygenates being used in the RFG gasoline pool today: MTBE and ethanol. MTBE is a product that is made by combining methanol and isobutylene. It is manufactured by refineries and by chemical companies. Congress was wise enough to allow the marketplace to determine the most cost effective or efficient source of oxygen for RFG. For a variety of environmental, commercial, and performance-related reasons, MTBE has become the oxygenate-of-choice for making RFG for those regions outside the Mid-West. MTBE is used in 80–85 percent of all the RFG produced today.

The RFG program consists of two phases: Phase I—the period from 1995 through 1999. Phase II started at the beginning of 2000.

EPA has compiled data for the United States showing that Phase I RFG has surpassed the requirements of the Clean Air Act. An analysis of the Phase I RFG produced by refiners shows that the fuel reduces ozone-forming compounds, such as VOCs, by over 28 percent—that's 44 percent above the 15 percent requirement of the law. Emissions of air toxics are reduced by approximately 30 percent—that's almost twice as much as required by law.

Ambient air monitoring confirms that the RFG program is working. Testing shows that benzene levels have declined by 31 percent between 1994 and 1997; levels of ethyl benzene, another toxic component of gasoline, have declined 52 percent during the same period. RFG areas also showed significant decreases in other vehicle-related VOC concentrations. EPA has testified that the emissions reductions required for Phase I RFG—which have been met and exceeded—and the emissions reductions of Phase II RFG—which are already nearly met—are equivalent to taking more than 16 million vehicles off the road.

As a key component of RFG, MTBE contributes to the environmental benefits of RFG in several ways. First, by adding MTBE to gasoline, refiners dilute or displace gasoline components such as aromatics (benzene, toluene and xylene) which contribute to the formation of ozone and emissions of toxics and PM (particulate matter). These compounds themselves are hazardous air pollutants. EPA has acknowl-

edged that if oxygenates were not used to produce RFG, levels of aromatics may have to be increased to provide the necessary octane.

Second, by adding MTBE to RFG, refiners improve the combustion of the gasoline, resulting in fewer emissions of smog-forming pollutants, such as VOCs and carbon monoxide, as well as Particulate Matter. Use of MTBE reduces harmful exhaust emissions, which due to their highly reactive nature causes a disproportionate amount of smog formation.

Third, MTBE has a lower vapor pressure—the rate at which it evaporates—than the primary competitive product, ethanol, and many other volatile components of gasoline. Lower vapor pressure equates to lower evaporative emissions of VOCs.

Fourth, oxygenates, like MTBE, play a particularly important role in significantly reducing emissions from millions of small engines without catalytic converters. In California, these small, off-road engines used in recreation, gardening and forestry account for a significant level of toxic air emissions from mobile sources.

Health Effects of MTBE

The detections of MTBE in a small percentage of nation's drinking water supplies have prompted questions concerning the health effects of MTBE. Those with a desire to see MTBE removed from the marketplace have gone further to suggest that little is known about the health effects of MTBE. In fact, nothing could be further from the truth.

MTBE's first contribution to the health of Americans was as a replacement for lead in gasoline in the late 1970's. MTBE was added to maintain octane in the fuel. Under the Clean Air Act, the refiners' ability to use MTBE in unleaded fuel was subject to EPA approval. The refiners made the appropriate demonstrations, including providing information on the known health effects of MTBE, and EPA approved the use of MTBE at concentrations of up to 7 percent, by volume. In 1981, EPA approved a blending of MTBE in unleaded gasoline to a maximum of 11 weight percent. In the early 1980's, refiners created an industry study group, managed by the American Petroleum Institute.

The industry group sponsored a toxicology testing program and submitted the results to EPA. In 1986, a Federal Interagency Testing Committee, acting under authority of the Toxic Substances Control Act, recommended additional testing of MTBE based on expected increased production levels, potential exposure as a gasoline component, and the need to complete data sets. The industry agreed to conduct such testing and established a program under EPA oversight and guidelines. From 1988 until 1992, the industry testing group sponsored and/or conducted all of the tests required by EPA. Progress reports on these tests were submitted to EPA for inclusion in the public docket. In 1988, EPA approved the blending of MTBE in unleaded gasoline to a maximum of 15 percent by volume.

In addition to the industry-sponsored tests, toxicologists at EPA's laboratory in Cincinnati, Ohio conducted the first examination of the risks of exposure to MTBE by ingestion. The peer-reviewed study, reported in the Journal of the American College of Toxicology, did not identify any adverse long-term effects associated with exposure to MTBE. Regretfully, MTBE is repeatedly and incorrectly treated as "the skunk at the garden party." The popular media characterize it as a "probable" or "possible" carcinogen.

In 1999, the International Agency for Research on Cancer (IARC), part of the World Health Organization, conducted a review of the existing research on the chronic (long-term) effects of exposure to MTBE. IARC can classify a substance into one of five categories: Group 1 carcinogenic to humans; Group 2A—probably carcinogenic to humans; Group 2B possibly carcinogenic to humans; Group 3—unclassifiable as to carcinogenic risk to humans; and Group 4—probably not carcinogenic to humans. The IARC review put MTBE in Group 3, concluding that there is "inadequate evidence in humans for the carcinogenicity" of MTBE. Such a finding places MTBE in the same category as caffeine, tea, and fluorescent lighting.

As an aside, you might find it interesting to know that MTBE has been used by physicians for years to dissolve gall stones within the human body. Other respected and recognized expert bodies who have recently examined the scientific weight of evidence on MTBE and have also declined to list it as a known, probable, possible or likely human carcinogen include the California Proposition 65 Scientific Advisory Panel Carcinogen Identification Committee and the Federal National Toxicology Program (NTP).

In May 2000, the National Institute for Environmental Health Sciences (NIEHS) released its congressionally mandated report on cancer-causing substances. The report declined to list MTBE as a cancer-causing agent or as an agent likely to cause cancer, but did, however, add ethanol-based beverage alcohol to the list of known carcinogens. As recently as December 20, 2000, the European Union environmental

agency's Classification Labeling Committee announced that it had determined that MTBE was not classifiable as a human carcinogen and that it would not ban MTBE.

In summary, we do not believe there is any credible evidence that indicates MTBE presents a significant risk to human health from either a short-term exposure or over a longer term. Over 80 studies have concluded there is no risk to human health. Ethanol on the other hand has been classified as a known human carcinogen. What is clear is that MTBE has resulted in reduced cancer risk by reducing hazardous air pollutants.

Impact on Water Quality

While MTBE quietly labored as the workhorse of the Clean Air Act since 1992, few in the public took notice until MTBE was detected in a few, isolated sources of drinking water, principally in California. A recent study ("A Screening Level Assessment of Household Exposures to MTBE in California Drinking Water," Williams, P.R., et.al.) in the March 2000 edition of Soil, Sediment & Groundwater indicates that the average MTBE concentrations in California have steadily declined over the 1995–99 time period. The source of MTBE contamination of drinking water supplies in most cases is leaking underground gasoline storage tanks. For example, the South Lake Tahoe area in California is served by seven local gas stations. According to testimony given during the California public hearings on groundwater contamination by MTBE, all of these stations were leaking gasoline into the groundwater; not surprisingly, this gasoline eventually found its way into the water supply for South Lake Tahoe, California. Violations of existing regulations included evidence of disabled dispenser sensors, poor installation, disabled leak detection, and inadequate documentation of annual inspections.

This problem primarily can be attributed to inefficiencies in California's tank program. Some 107 agencies and authorities have jurisdiction over gasoline tanks in California. For primarily this reason, the EPA has not certified California's UST Program. Studies and field experience show that leaking underground tanks of gasoline have been the main source of MTBE in the isolated instances where it has been found in groundwater in the past. Other studies show that spills of gasoline with MTBE on surface soils or water are not a significant threat to drinking water supplies. Like other gasoline components, MTBE will easily volatize into the atmosphere within days. It also easily biodegrades in these surface waters. As a result, any contamination that might occur from a surface spill is generally of short duration.

It is important to have some context in evaluating the frequencies, and levels, of MTBE detections in drinking water supplies. The majority of detections of MTBE in groundwater have been at 2 ppb or less. To put the term ppb (parts per billion) in perspective, 1 ppb equates to a time span of 1 second in 31.7 years. Therefore, 2 ppb equates to a time span of less than 5 seconds in the life of the average person. There is currently no enforceable Federal standard for MTBE in drinking water, although EPA has recently required public water systems to monitor for MTBE in their drinking water supplies and report that information to EPA. The EPA has established an MTBE Drinking Water Guideline based only on aesthetics of 20–40 ppb noting that there "is little likelihood that an MTBE concentration of 20 to 40 ppb in drinking water would cause adverse health effects in humans."

Last, if there is a problem with MTBE in groundwater, the answer is to fix the source of the problem—leaking underground storage tanks. A most recent report by the General Accounting Office (GAO) states that while State compliance with Federal equipment requirements is high, operational and maintenance problems could lead to spills, leaks and health risks.

Alternative Oxygenates

Much has been made of ethanol as a potential substitute for MTBE as a fuel oxygenate. In those areas of the country where reliance on ethanol makes some economic sense, it is already the oxygenate of choice and Federal law itself is, of course, neutral as to which oxygenate may be used. However, greatly expanded use of ethanol makes little sense.

First, expanding ethanol use will come at the expense of air quality. Use of ethanol is not as effective at combating air toxics and even increases levels of certain toxics called aldehydes; and peroxyacyl nitrates (PAN). Ethanol is less effective at controlling criteria air pollutants as well. NESCAUM (the Northeast States for Coordinated Air Use Management) has previously commented that, "Greater emissions of volatile organic compounds (VOCs) would occur during the early and late portions of the [Northeast] region's ozone season since gasoline blended with ethanol is more volatile than similar gasoline without ethanol. " In addition, the higher volatility ethanol-blended gasoline can contribute to an overloading of an automobile's evapo-

rative canister and subsequently lead to higher CO emissions. EPA has acknowledged that the increased use of ethanol will result in increased NOx emissions.

Oxygenates like MTBE go to work in an engine at the point where most pollution is produced: the cold cycle. For the first three to 4 minutes after you start your ignition, your car's engine produces the majority of its emissions. Because oxygenates combust at low temperatures with MTBE combusting at far lower temperatures than ethanol—fuel chemistry clearly demonstrates that MTBE is the most effective component of pollution control when the car is still relatively cold. In addition, to meet the other Federal specifications, RFG without oxygenates would have to increase its ratio of aromatics. The result of this change is two-fold: first, there will be a certain increase in air toxics from automobiles; and second, more ozone precursors from the use of aromatics will be created. In fact, if ethanol is used to replace MTBE, it is more volatile than MTBE and therefore would increase evaporative emissions.

It is not at all clear that greater reliance on ethanol will help resolve any problems with water quality. Gasoline contains a range of aromatics, such as benzene, toluene, and xylene that are among its most toxic components. In subsurface conditions, studies have indicated that ethanol, as part of gasoline, will extend the benzene plumes by 20 percent to 27 percentor more by interfering with the biodegradability of these aromatics, thus creating the potential for a significant source of toxic water contaminants. Given that ethanol can't be blended at the refinery and must be blended at the terminal, this raises a concern about ethanol and it's handling in pure form. Of course, IARC has classified ethanol as a known carcinogen.

Even if expanded ethanol production were a good idea, ethanol cannot be produced in sufficient quantities economically to satisfy America's needs within the RFG program. Indeed, it is unlikely that ethanol can meet its current demands in the Midwest while cost-effectively supplying any new markets on either coast. Just take a look at the cost of ethanol based RFG in the Chicago area. A congressional Research Service Study issued on June 16, 2000 indicates that RFG with ethanol ran roughly 50 cents per gallon higher than MTBE gasoline with 25 cents of that differential attributed to the RFG program with ethanol blending as the oxygenate. This is due to the difficulty in making the non-oyxgenated hydrocarbon portion of the RFG for ethanol known as RBOB. The supplies of gasoline components that can be used with ethanol in RFG are more limited, which contributes to a tighter RFG supply and higher cost. Imagine trying to make an ethanol based RFG that is thousands of miles away from the ethanol supply and which could be further complicated by transportation difficulties and potential summer droughts.

MTBE has extended the nation's supply of gasoline, contributing to the historic low gasoline prices around the country in recent years. Ethanol, due to it's high volatility problem, and the restrictive consequences it places on refiners, has a net impact of reducing the nation's gasoline supply, and thereby increasing the nation's gasoline prices.

Ethanol has logistical problems, including its inability to be carried in gasoline blends through pipelines, the most efficient way to transport fuels. Further, ethanol costs the American taxpayer 53 cents for every gallon consumed. As CBS News described ethanol, it is "probably the most economically inefficient, unwarranted form of corporate welfare in our entire Federal budget." (Eye on America segment, 3/26/96) The American Road and Transportation Builders Association stated in testimony before the U. S. Senate Environment and Public Works Committee that the current ethanol tax subsidy deprived the Federal Highway Trust Fund of approximately $1.1billion/year. In a nutshell, ethanol, in spite of all the State and Federal welfare it receives is not an effective or economically viable alternative.

Conclusion

It is clear that there is no credible evidence that MTBE presents a significant risk to human health, either from short-term exposures or over a longer term. What is clear is that MTBE has resulted in significant reductions in cancer risk by reducing hazardous air pollutants. It has also helped clean the air and we as a nation continue to need to continuously combat the issue of dirty air. The pressure to address the groundwater contamination problems created by leaking underground storage tanks puts several questions in stark relief.

First, is there a need to replace MTBE? The answer is no. Detection data indicates that as underground storage tank compliance improves, detections of MTBE in drinking water supplies decrease. Nationally, measured in the mid 90's when our UST compliance was only 20 percent to 40 percent, less than 1 percent of the community water system detections had concentrations exceeding 20 ppb. Therefore, the

risks to drinking water supplies are decreasing with time, not increasing as some claim.

Second, is there a viable replacement for MTBE? Again, the answer is no. Alternatives to MTBE, including ethanol, are more expensive and more difficult to transport. Industry experts estimate that even under ideal circumstances, replacing MTBE with ethanol will raise prices at the pump a minimum of seven cents or more a gallon. But prices could rise much higher than that if shortages of ethanol and, as a result, of gasoline develop. Currently, refiners use about 286,000 barrels a day of MTBE; total ethanol capacity is far less than half of that today, and most of that ethanol is already committed to supplying octane in other gasolines.

Third, if you restrict or prohibit the use of MTBE, can you be certain that you will not increase the risks of adverse health effects? Some refiners claim that they can make RFG without oxygenates that meets the Federal Phase II requirements, but is there any third-party independent confirmation? EPA has such a question pending before it in the form of request from California, but it seems very reluctant to say yes or no. Possibilities do not always equate to practice. Oxygenates in Phase I RFG allowed for over-achievement. Eliminating oxygenates from Phase II requirements may effectively limit the possibility of similar results.

Finally, what are the other consequences of taking MTBE out of the gasoline supply? As described above, MTBE constitutes a significant percentage of the gasoline pool. If you take away that volume, what are the supply and price ramifications? I think we have seen the answer to that in the spike in gasoline prices across the nation last summer.

President Bush recently stated to the National Energy Policy Development Group, that if we have a price spike in refined product, "It's going to be because we don't have enough capacity, refining capacity—we're not generating enough product."

Our present energy problems will only be compounded by removing this beneficial product from our gasoline supplies. I urge you to avoid a rush to judgment.

I thank you again for the opportunity to offer written comments on this important issue.

SALEM REVISITED: UPDATING THE MTBE CONTROVERSY

(By Richard O. Faulk and John S. Gray)

"I am wronged. IT Is a shameful thing that you should mind these folks that are out of their wits"

What Does "Salem" Have to Do With MTBE?

Martha Carrier, the casualty of those "out of their wits," was hanged as a witch on August 19, 1692 in Salem, Massachusetts. In all, 20 innocent persons were executed in 1692 as a result of hysteria attending the Salem witch trials. After the executions, letters criticizing the trials were sent to the colony's Governor, who then precluded the use of "spectral and intangible evidence" in trials. No prosecution was successful thereafter.

More than 300 years later, Martha Carrier's statement illustrates an almost identical problem that plagues the current controversy surrounding Methyl Tertiary Butyl Ether ("MTBE"), a gasoline additive accused of polluting water supplies and endangering public health when leaked from underground storage tanks ("USTs"). Like the Salem witch trials, UST litigation is presently engulfed in hype—including dire predictions of environmental and health disasters that will flow from MTBE contamination. And like the "spectral and intangible" evidence used in Salem, unreliable evidence is being used to indict MTBE. But as in the witch trials, MTBE will be vindicated if reliable evidence is used to judge the controversy.

A Real Public Health and Environmental Crisis?

Is the MTBE controversy a real public health and environmental crisis? Or is it simply one more example of American regulatory and legal hysteria? Does this controversy mark the beginning of yet another mass tort explosion? Or is it simply another unsubstantiated crusade designed to waste millions of dollars and unnecessarily preoccupy judicial resources? A careful and reflective inquiry suggests that rumors that the class action lawyers have "struck gold" are, at best, premature, and, at worst, utterly false. Although a number of lawsuits regarding MTBE have been filed, their certifiability as class actions is doubtful, and their long-term viability is questionable. The noticeable lack of individual consumer complaints belies the existence of a significant controversy, and the few suits filed by municipal water suppliers already appear to be transparently designed to upgrade previously contami-

nated or deteriorated systems, more than to address real dangers of MTBE contamination.

Unreliable Evidence and Exaggerated Claims

Moreover, at this point, personal injury claims cannot survive judicial scrutiny. Serious health problems, such as cancer, have not been associated with exposure to MTBE and probably will never be linked in a scientifically reliable way. The U.S. government's National Toxicology Program has refused to list MTBE a carcinogen, and the World Health Association has reached the same conclusion. Recently, a major report to the entire European Union determined that MTBE does not present a risk to the health of its citizens or the quality of its water. Empirical studies conclusively show that MTBE levels in California water are minimal and that they are far below levels that could impact human health or compromise water utility. Indeed, the extent of water supplies that are actually compromised appears to be relatively slight. Hence, despite the hyperbolic antics of a few lawyers and public officials, the problem, if any, is primarily localized and focused, instead of national and comprehensive—hardly a compelling script for a mass tort drama.

A Crisis in Containment

Additionally, there is compelling evidence that the alleged MTBE "crisis" did not arise from any problems with MTBE itself, but rather from failures to contain gasoline stored in USTs. These lapses were compounded by ineffective enforcement of UST regulations designed to prevent gasoline leaks into the environment. The U.S. Government, for example, delayed enforcement of its UST regulations for 10 years after they were issued. Recently published research demonstrates major and chronic failures of enforcement by responsible agencies, especially in California, which resulted in massive non-compliance and which unreasonably delayed detection and remediation of gasoline leaks on a statewide basis.

Diminishing Risks and Shrinking Damages

As compliance with UST regulations increases, however, the upgrading of UST systems and the remediation of past leaks not only reduces the risks of future pollution, but also lowers the damages, if any available for past leakage. The number of potentially injured parties is shrinking dramatically, as are the amounts reasonably necessary to compensate them. For example, although plaintiffs are currently seeking "stigma" damages for diminished property values, the law typically precludes such recoveries unless the plaintiffs have suffered a true loss as the result of a diminished sale price, instead of a "paper" loss while still owning the property. Even then, emerging concepts such as Risk-Based Corrective Action ("RBCA") and "Brownfields" initiatives deflate the amount of recoverable damages substantially.

A Valuable Product Unfairly Maligned

This article, published in two parts, discusses and evaluates the current controversy surrounding MTBE. It examines (i) the administrative, legislative and litigation history of MTBE in the context of the Clean Air Act and State environmental statutes, (ii) the importance of applicable UST regulations, (iii) the question of MTBE toxicity for personal injury claims and public health concerns, and (iv) the scope of property damages available to persons who are not physically impacted by MTBE contamination. Certain supporting references are attached, as are excerpts from an updated version of this paper regarding the emerging ethanol controversy and breaking international news. From this evaluation, we conclude that the MTBE controversy is not a real public health or environmental crisis, but rather yet another speculative product of the American legal industry. The facts, as opposed to the allegations, demonstrate that MTBE is a valuable product that is unfairly and outrageously maligned.

STATEMENT OF CLINT NORRIS, CHIEF OPERATING OFFICER, BC INTERNATIONAL

Thank you for the opportunity to provide testimony for consideration by your full committee. I met one of your staffers, Jeff Rose, on April 23, 2001 in Salem, NH, and he fully explained your reasons for postponing the hearing. Unfortunately, I will be unable to attend on the revised hearing date, but am submitting my comments in writing. It is my intent that they will be additive and meaningful—and also brief. Individually, I have worked not only in industry, but also have served as policy and strategy advisor to governments via a role as a periodic consultant to the United Nations. My firm, BC International, has been actively involved biomass ethanol development, not only in New England, but throughout the USA and worldwide since the early 90's. We are currently participating in several U.S. DOE/NREL-supported

projects to locate ethanol plants in the Southern and Western US, using various wastes to make ethanol. We have also been engaged in feasibility work in the Northeast, and have spent some considerable effort looking at viability of forest based feedstocks over the past few years. We are very familiar with the issues and are pleased to discuss them in this forum. We are also engaged in the use of biomass to make other petroleum based products in order to use our own country's renewable resources as the fossil based supplies get more expensive over time.

There are more than environmental reasons for addressing the issue of renewable fuels. There are also strategic issues regarding reducing our foreign-sourced energy dependences; there are economic issues associated with a serious trade deficit and its impact on our nation's capital resources; there are inter-generational issues associated with affordable energy and its future availability; and there are public health issues. Weaving a policy that successfully integrates all the needs will require courage and a rhetoric filter of grand proportions in order to do what is best to address these issues. The following facts may be helpful.

1. Alcohol (Ethanol) has been around for thousands of years. People drink it with their food, at ballgames, in their back yards, etc. They spray it on their bodies via personal care products, use it as an antiseptic to dress wounds, gargle with it in mouthwash, spray it in their hair in hairsprays, etc. It is also used industrially as a solvent. It is generally safe, but it is a chemical and it can be toxic, as all chemicals are. To gage toxicity, as a reference point, Merlot wine generally contains 13 percent ethanol, or 130,000,000 parts per billion. When ethanol breaks down or is burned, it can give off acetaldehyde, but acetaldehyde also breaks down to acetic acid (vinegar), then to carbon dioxide and water.

2. In contrast, MTBE has only been around for a very few years. No one would think of drinking it, spraying it on their bodies, pour it on a wound or gargle with it. If water is contaminated with 0.2 parts per billion, it has a turpentine-like taste, and to gage toxicity of MTBE—it can be toxic at levels below 10 parts per billion. When MTBE is burned it gives off formaldehyde, which also further breaks down, eventually, to carbon dioxide and water.

3. NRC reported that measurements in the countryside to determine MTBE presence from vehicles which used it were relatively easy to make. In contrast, ethanol and acetaldehyde were difficult to detect beyond background levels that are always present, due to the nature of living matter as it undergoes its natural breakdown and return to the earth. Thus, our environment does have a "natural" level of ethanol-based compounds in it.

4. The Health Effects Institute of Cambridge, MA was commissioned to do a study on the effects of oxygenates used in gasoline. It's a 155 page report. On pages 103–6, ethanol is mentioned. The study concludes that reproductive, development, and long term effects of exposure to ethanol from its use in fuel is not expected to cause any effects. The reason is because exposure levels are not expected to increase blood levels significantly—the increase in levels would be much lower than those found endogenously in the blood. As a point of reference, the report states". . . ethanol is a product of many catabolic pathways and is present in blood even in the absence of ingested alcohol."

5. Currently, national ethanol production is located primarily in the Midwest. By utilizing improved technologies that cost effectively make ethanol from biomass wastes and resources, the biomass-rich Northeast also has the potential to become an ethanol production center. I believe that specific measures to support biomass ethanol should be a component of policies to support renewable fuels. This will ensure that the economic and environmental benefits of ethanol production both continue in the Midwest and spread to other regions of the nation, as ethanol markets and production expands.

6. If a national policy is not forthcoming in the short term, and States seek to ban the use of MTBE (such as Gov. Shaheen's recent order), a default mandate will be created for some alternative, most likely ethanol. Other alternatives have some limitations. Alkylates—potentially attractive to refiners—require additives to get fuel octane to necessary levels. The additives are normally "BTX"—benzene, toluene, and xylene. BTX burns with more particulates and toxics, which results in loss of air quality vs levels already achieved. This is called backsliding and the EPA Blue Ribbon Panel specifically recommended against backsliding.

7. A renewable fuels program preserves the original non-environmental policy intent of the oxygenate mandate, and allows accomplishment of other broad policy goals the 2 percent oxygenate mandate originally sought to advance. Some of these policy goals include greater economic development, greater fuel diversity, and increased national security. Consistent with these goals, I support thoughtful policies to develop renewable fuel use nationwide.

8. NESCAUM reported that 1.3 billion gallons per year of MTBE are presently used in gasoline in the Northeast. Assuming a 5.7 percent ethanol blend in gasoline, replacement of a 10 percent MTBE blend with ethanol would require about 750 million gallons per year of ethanol. Abundant biomass resources and a potentially large Northeast market for ethanol provide the region with the opportunity to establish itself as a leader in the nascent biomass-to-ethanol industry supplying the northeast needs. Abundant biomass resources also exist to ensure ample ethanol production to guard against any supply disruptions.

9. Increased use of ethanol will help protect against price spikes by creating an additional supply source for fuel. Gas prices have risen sharply last year in part due to U.S. reliance on imported fuel and a decrease in international petroleum production. Increasing the diversity of domestic fuel sources will improve price stability in the U.S.

10. Nationally, no new petroleum refineries have been built since the 70's. This has put great stress on those refineries trying to meet the nation's needs during the past 3 decades of growth. Chemical plants that run greater than a nominal 85 percent sales to capacity ratio are generally at increased risk of running into supply chain reliability problems. Our nation's refineries are running at levels exceeding 90 percent. The use of ethanol, in addition to being one of the safer alternatives, will provide some relief for these stressed refineries by acting as a fuel extender.

11. The nation's infrastructure is quietly developing in a way that will bring even greater relief to the heavily burdened refining industry. Ford, General Motors and Daimler-Chrysler are all making flexible fuel vehicles (FFV's). An example is the standard Taurus. FFVs can run up to 85 percent ethanol (E–85) in their gas tanks. These growing numbers of vehicles are creating a corresponding growth in demand for E–85, which in turn provides even more relief for the public concern over refinery-dependent price spikes.

With your continued leadership, we can develop a policy solution that facilitates the phase-out of MTBE while also continuing to advance the development of renewable fuels. I firmly believe that a consensus-based legislative outcome can meet the broad range of policy needs, including: fuel security, economic development, cleaner air, the protection of water quality, mitigation of global warming, and reduction of biomass wastes. I look forward to working with you and other stakeholders on this issue. Please do not hesitate to contact me with any questions. Thank you for your leadership and initiative on this issue.

LETTER FROM GAHAGAN & ASSOCIATES SUBMITTED FOR THE RECORD

MTBE & ETHANOL

DEAR SENATOR SMITH: Thank you for the opportunity to provide testimony for consideration by your full committee on April 23, 2001 in Salem, NH. My firm has been actively involved in ethanol and biomass ethanol development in New England for the past 3 years. We are currently participating in a U.S. DOE/NREL-funded feasibility study to locate an ethanol plant in Northern Maine. For the past 2 years, I have been a participant in NESCAUM's MTBE Task Force that covers New England and the Mid-Atlantic States. We are also founders and principals of Northeast Bio-Energy, LLC ("NEB"), an ethanol plant developer.

NEB has been formed in response to the expected phase down of MTBE and the need to replace it with ethanol. Unlike the mid-West which has over the past 25 years developed a corn ethanol industry that now produces in the order of 1.5 billion gallons of ethanol per year as an oxygenate without MTBE, Eastern and Western States each consume in the order of 1.5 billion gallons of MTBE per year. Because corn does not grow well in the East or the West, mid-Western corn producers will be hard-pressed to meet timely demand for an additional 3 billion gallons per year of ethanol.

In response to the opportunity to develop an ethanol industry in the Northeast, NEB has adopted a three-phase approach to developing regional ethanol and biomass ethanol resources and supplies:

Phase One: Start with known and available proven conventional tuber/grain processing technology; import corn and other grains from the mid-west; this is necessary primarily for project finance. Because of existing infrastructure at candidate plant sites, it may be (net) less expensive to bring in grain v. corn ethanol; feasibility for this is being evaluated this Spring.

Phase Two: Add E–10, a dedicated energy crop; this proprietary tuber/cellulose combination has been developed in cooperation with the University of Idaho; we're bringing in seed for trails in Maine this spring; it will take 2–3 seasons to produce

any significant volume; tuber will be processed using Phase One technology; cellulose will be used as a soil additive or animal feed supplement pending Phase Three—conversion to biomass ethanol. E–10 projects 1000 gallons per acre from the tuber; plus an additional 500 gallons per acre from the cellulose stock. This compares very favorably against corn—about 325 gallons per acre. There is no difference between ethanol produced from corn and ethanol produced from biomass.

Phase Three: Add cellulose (biomass wood residue) technology; the incremental cost of adding emerging cellulose technology to a conventional tuber/grain processing plant is expected make the cellulose increment financeable; starting up with Phase Three technology cannot be financed at this time because it is unproven. Significant biomass resources in the Northeast, combined with E–10 and mid-West grain supplements could eventually meet the demand for an estimated 1 + billion gallons per year MTBE replacement in the New England States.

In the context of our support for a national domestic renewable fuels program that includes ethanol from both corn and biomass resources, Northeast legislators and regulators should be aware of the need to support this phase-in approach to ethanol production in the Northeast as MTBE is being phased out.

NEB is pleased to be working with a major regional oil refiner and distributor for ethanol offtake agreements. This company has for many years had a strategic interest in the introduction of new fuel formulations that provide environmental benefits. Their recent introduction of an ultra low sulfur gasoline is a recent example.

The geopolitical, environmental, and economic merits of producing domestic renewable fuels from corn and other emerging energy crops have been well documented by others. Nevertheless, here are a few target points for you to consider:

1. Henry Ford's proposed and preferred choice of fuel for his cars was ethanol. Unfortunately, Mr. Ford didn't have the muscle to take on the Oil Trust. Congress imposed a heavy tax on ethanol; petroleum interests won over agricultural interests.

2. In the 1920's, American engines required more octane. We had a choice to use either ethanol or lead to meet the demand for higher octane. Lead was patented; ethanol was not; commercial considerations won over agricultural interests. Use of lead was the first petroleum strike against U. S. public health.

3. In the 1970's, we had a choice to replace lead with ethanol for U.S. public health reasons. In the name of free market, benzene won. Use of benzene was the second petroleum strike against U. S. public health.

4. In the 1980's, American engines required more oxygen. We had a choice to use either ethanol or MTBE to meet the demand for higher oxygen. In the name of free market and foreign oil interests, MTBE won. Use of MTBE was the third petroleum strike against U.S. public health. Lead, benzene, MTBE—three petroleum strikes and you're out!

5. While I fundamentally believe in the free market, I've come to accept that when it comes to U.S. public health and foreign oil, we should learn from our so-called free market mistakes. We should recognize there's no free market and little if any free choice when we mobilize to protect U.S. petroleum interests in the Middle East.

6. In the name of U.S. public health, we've now mandated lead, benzene and MTBE out. In the name of U.S. public health and domestic renewable fuels, maybe it's (finally) time to remember Henry Ford and mandate ethanol in. After all, we've had at least 6,000 years of experience learning how to manage and control interactions between alcohol (ethanol) and the human body, far longer than we've been trying to control interactions between automobiles and fuel. Wouldn't we rather deal with something as familiar as a .08 Federal alcohol standard, especially when compared to the unknown, unforeseen, unpredictable consequences of whatever is to be the next petroleum-derived lead, benzene or MTBE type solution?

7. Just as it could have been a U.S. public health and domestic renewable fuels winner against lead and benzene, ethanol is still the most cost-effective, environmentally friendly U.S public health alternative to MTBE. There are volumes and volumes of technical information that can be provided by the Renewable Fuels Association (RFA) and many others to support this statement.

8. Ethanol is certainly the least toxic of all alternate options to MTBE. For example, substitution of iso-octanes frequently results in lower octane numbers and the addition of BTX which means higher toxics and a backslide in air quality levels that have already been achieved. On a toxics-weighted basis, ethanol is clearly a safer alternative for a large-scale public use such as transportation fuel.

9. A Renewable Fuel Standard that does not specify ethanol could open the door for unproven and potentially risky alternatives. Ethanol is a fully proven renewable.

10. Ethanol can be transported by pipeline. It is being done in commercial applications today.

11. Use of ethanol in summer months need not be harmful to the environment. All RFG must meet the same VOC performance requirements, whether MTBE or ethanol is used as the oxygenate. Because ethanol slightly increases the volatility of the resulting blend when mixed with gasoline, refiners have to produce a lower volatility blendstock when ethanol RFG is used. Thus, evaporative emissions are the same.

12. Use of ethanol would not (alone) cause consumer costs to increase. Midwest gas prices rose last summer primarily because of an inability to provide just-in-time supply due to a pipeline failure. This caused regional shortages and the resulting supply/demand price response. Prices went up for both RFG and conventional gasoline (where ethanol is not used and no volatility adjustment is made). Midwest ethanol RFG still averaged 5–10 cents below RFG in other areas of the country, including the Northeast.

13. According to energy experts, a primary cause of price volatility is limited U.S. refining capacity—now nearing a "maxed-out" state. With no new refineries added since the 70's, use of ethanol in the fuel supply would be a welcome extender to the limited ability of the industry to respond to summer demand, and in fact could reduce the upward pressure on prices.

14. Oxygenates are required to produce reformulated gasolines that meet the performance requirements of the Clean Air Act. In the absence of oxygenates, refiners could again dramatically increase the use of aromatics, such as benzene, toluene and xylene. This would mean significant backsliding from the toxic benefits currently provided by RFG.

15. If you remove 11 percent of the Northeast's gasoline supply because of the MTBE ban, it would be wise to replace that volume with something other than additional petrochemicals derived from imported crude oil.

16. From a financing perspective, it will be more difficult to finance ethanol projects in the Northeast if there is regulatory uncertainty. A change in the status quo could not only diminish environmental quality; it would not be good for business.

17. The development of a corn ethanol industry in mid-Western States over the past 25 years from 20 million gallons ethanol per year in 1978 to more than 1.6 billion gallons ethanol in 2000 provides tangible, viable evidence for the environmental and economic value of domestic ethanol. New England would be wise to follow the example of mid-Western States and adopt domestic ethanol as a replacement for MTBE. This may require subsidies at the State level similar to those in mid-Western States as shown below:

- Alaska 6–8 cents/gal excise tax exemption (60 to 80 cents/gal ethanol)
- Connecticut—1 cent/gal excise tax exemption (10 cents/gal ethanol)
- Hawaii—4 percent sales tax exemption
- Idaho—2.1 cents/gal excise tax exemption (21 cents/gal ethanol)
- Illinois—2 percent sales tax exemption
- Iowa—1 cents/gal excise tax exemption (10 cents/gal ethanol)
- Minnesota—20 cents/gal producer payment
- Missouri—20 cents/gal producer payment
- Montana—30 cents/gal producer payment
- Nebraska—20 cents/gal producer payment
- Ohio—1 cent per gallon of E10 income tax credit
- South Dakota—20 cents/gal producer payment
- Wyoming—40 cents/gal producer payment.

From a regional as well as a national perspective, encouragement of domestic renewable fuels such as ethanol is in our best interest. At this time, ethanol represents the most market-ready alternative to MTBE. With ethanol as the substitute, there is no need to backslide in either air or water quality.

Respectfully submitted,

HAYES GAHAGAN, *Principal & CEO.*

CLEAN AIR ACT OVERSIGHT ISSUES

WEDNESDAY, MAY 2, 2001

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 9:33 a.m. in room 628, Senate Dirksen Building, Hon. Robert C. Smith (chairman of the committee) presiding.

SCIENCE OF GLOBAL CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS

Present: Senators Smith, Voinovich, Wyden, Chafee, Corzine, Reid, Clinton, Inhofe, Warner, Specter, and Lieberman.

OPENING STATEMENT OF HON. BOB SMITH, U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

Senator SMITH. The hearing will come to order.

Senator Voinovich is going to be chairing the hearing. He will be here shortly, but I thought since the time has gone past 9:30 that I would begin.

Also, I would indicate that I have to leave. I will be in and out of here during the hearing. I apologize for that to the witnesses and to my colleagues.

Just a brief statement before I recognize Senator Wyden: Local climate change is an issue that has generated a lot of discussion across the political spectrum. Unfortunately, I think from my perspective a lot of that discussion has been driven more by politics. When President Bush recently confirmed what everyone in the room already knew, that the Kyoto Protocol was dead, he was loudly jeered. While there are those who will continue to demand the Administration reverse itself, the reality is that if we, the Senate, were to vote on Kyoto today, it would be turned down by a pretty strong bipartisan vote, I believe. I think that was shown in 1997 with a vote of 95 to 0, that this body would not support the provisions of the Kyoto Protocol.

Kyoto may be a lightning rod, but the treaty itself is flawed and I think a false issue. To continue to push forward on this failed treaty is to invite continual bipartisan bickering and, ultimately, in my view delay a productive discussion on climate change.

I applaud the President for taking Kyoto off the table. I know that will invite some controversy, but efforts to paint the President's position as extreme or reckless are not warranted. I think we have proven that again with the bipartisan vote here. The purpose for such charges must be looked at.

I suggest that what we need is not more attacks, but instead let's get beyond Kyoto and focus on collective efforts of a more serious examination of this issue. Our challenge is to look at the issue based on a hard examination of what we know, what we do not know, and what we must do in the name of prudence.

Not to steal the thunder of any witnesses who may be coming here today, but I would like to briefly just boil down the state of the science that I believe is necessary for policymakers to understand.

First, what do we know for certain? Well, I think we know three things. Atmospheric concentrations of greenhouse gases are increasing. Human activities are responsible for a significant portion of that increase, No. 2, and at some point the increased concentrations will cause serious changes in the chemistry of our planet. I think those are facts that are pretty much not disputable.

What don't we know? Pretty much everything else about climate change. All the projections about sea level rises, temperature increases, the future rate of concentration increase, and the cost of emission reductions, all of those things are speculation. They are derived from models or assumptions and predictions, and the uncertainty in the results of this work is tremendous.

So how do we craft policy with that kind of uncertainty? Well, I guess I would have to say cautiously, very cautiously. Many of those who have supported the Kyoto Protocol have argued that, because emissions related to human activities have the potential to lead to adverse climate changes over the course of this new century, we must err on the side of caution by dramatically reducing industrial emissions of CO_2.

To that I say, caution is a good thing, but only when appropriately applied. We should apply the precautionary principle not only to the examination of possible harm from emissions, but also to the possible harm to the economy from overly aggressive emission curves. An appropriate policy should recognize both the economic and the environmental hazards of too little or too much action regarding climate change. How far away is Armageddon, if there is an Armageddon? Is it tomorrow? Is it a hundred years from now, a thousand years from now? We don't know the answer to that question.

If we are too aggressive, we could damage our economy and cripple our ability to address this issue and other environmental matters. If we are too timid, we could invite the environmental peril that could cause economic ruin in parts of the nation.

I believe all of us would like to make a policy decision based on more complete information. We should aggressively seek necessary information, so that we may make intelligent decisions. But also we know that we are not going to have all the information we would like to have. It is not exact science. The steps we eventually do take to address environmental concerns should be consistent with sound economic and energy policies as well.

I want to say, many companies—and I've talked to many of them—are pursuing this type of activity today. Hundreds of American companies are investing in energy efficiencies that make good short-term economic sense and at the same time avoid emissions in significant quantities.

For example, to boast a little bit about New Hampshire, more than 73 companies and public entities are committed to using energy efficient heating, cooling, and lighting fixtures in more than 22 million square feet of office space. This will result in a reduction of 2.5 billion pounds of CO_2, an annual energy savings of $10 million. That is just New Hampshire.

It is not just New Hampshire. Similar efforts in Ohio—the chairman knows where that is [laughter]—will result in the elimination of 45 billion pounds of CO_2 emissions annually. Investments in energy efficient technologies in Oklahoma have prevented the release of 3.8 billion pounds of CO_2. You don't hear too much about these things from some of the critics.

Chevron has invested billions to reduce gas from flaring. Just a single project currently in the planning phase will reduce greenhouse emissions by 100 million metric tons over the 20-year life of the project. This is only one idea that Chevron is working on.

CMS Energy is also working on similar efforts that will result in the reduction of nearly 3 million metric tons of carbon per year.

I ask unanimous consent, Mr. Chairman, that the written testimony be inserted into the record.

Senator VOINOVICH. Without objection.

[The prepared statement of Senator Smith follows:]

STATEMENT OF HON. BOB SMITH, U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

Global climate change is an issue that has generated a great deal of excitement across the political spectrum. Unfortunately, much of that excitement has been driven by politics. For example, when President Bush recently confirmed what everyone in this room already knew—that the Kyoto Protocol was dead—he was loudly jeered.

While there are those who will continue to demand the Administration reverse itself, the reality is that if we, the Senate, were to vote on Kyoto today, it would certainly be defeated by a strong bipartisan vote.

We made it very clear by an overwhelming 1997 vote of 95–0, that this body would *not* support the provisions of the Kyoto Protocol. Kyoto may be a political lighting rod, but the treaty itself is a false issue. To continue to push forward on this failed treaty is to invite continual partisan bickering and ultimately delay a productive discussion on Climate Change.

I, for one, applaud the President for taking Kyoto off of the table.

Efforts to paint the President's position as extreme or reckless are not warranted, and the purpose for such charges must be closely examined. I strongly suggest that what we need is not more attacks but, instead, to get beyond Kyoto and focus our collective efforts on a more serious examination of the issue.

Our challenge is to look at the issue based on a hard examination of what we know, what we do not know, and what we must do in the name of prudence.

Not to steal the thunder of any of our excellent witnesses today, but let me attempt to boil down the state of the science that I believe is necessary for policymakers to understand.

First, what do we know for certain? Just three things:

1. Atmospheric concentrations of greenhouse gasses are increasing.
2. Human activities are responsible for a significant portion of that increase.
3. Like a high school chemistry experiment, at some point the increased concentrations will cause serious changes in the chemistry of our planet.

What don't we know? Pretty much everything else about climate change. All of the projections about sea level rises, temperature increases, the future rate of concentration increase and the cost of emission reductions are speculation; they are derived from models based on assumptions and predictions. The uncertainty in the results of this work is tremendous.

So, how do we craft policy from that much uncertainty? Cautiously. Very cautiously. Many of those who have supported the Kyoto Protocol have argued that because emissions related to human activities have the potential to lead to adverse climate changes over the course of this new century, then we must err to the side

of caution by dramatically reducing industrial emissions of CO_2 and other greenhouse gases.

To that I say, caution is a good thing, but only when appropriately applied. We should apply the precautionary principle not only to the examination of possible harm from emissions, but also to the possible harm to the economy from overly aggressive emission curbs. An appropriate policy should recognize both the economic and environmental hazards of too little or too much action regarding climate change. If we are too aggressive we could damage our economy and cripple our ability to address this and other pending environmental matters. If we are too timid we could invite environmental peril, that could cause economic ruin in parts of the nation.

I believe all of us would like to make a policy decision based on more complete information. We should aggressively seek necessary information so that we may make an intelligent decision, and the steps that we eventually do take to address environmental concerns should be consistent with sound economic and energy policies.

The steps that we consider today should be based on sound science—to buy time. Many companies are pursuing this type of activity today. Hundreds of American companies are investing in energy efficiencies that make good short-term economic sense, and at the same time avoid emissions in significant quantities.

For example in New Hampshire: More than 73 companies and public entities are committed to using energy efficient heating, cooling, and lighting fixtures in more than 22 million square feet of office space. This will result in a reduction of 2.5 billion pounds of CO_2—an annual energy saving of $10 million. Similar efforts in Ohio will result in the elimination of 45 billion pounds of CO_2 emissions annually. Investments in energy efficient technologies in Oklahoma have prevented the release of 3.8 billion pounds of CO_2.

Chevron has invested billions in efforts to reduce gas flaring. In just a single project, currently in the planning phase, will reduce greenhouse emissions by 100 million metric tons over the 20 year life of the project. This is only one of many ideas Chevron is working on.

CMS Energy is also working on similar efforts that will result in a reduction of nearly 3 million metric tons of Carbon per year.

This is the direction our policy should lead. These are actions that make good economic sense, and may even lead to the development of technologies that all the world will buy from us in the future in order to address their own emissions. At the same time, we can begin to make slow our rate of emissions to buy more time for us to understand the problem we face.

One thing is for certain we all care about our children and future generations. We owe it to future generation to leave them a healthy environment and a solid strong economy. The choices we make today will determine that future.

Senator SMITH. This is the direction that our policy should lead. What happens when we export that technology to those nations, to get them to buy it, to those nations who now are saying they either can't or won't adhere to any treaty, Kyoto or otherwise? These are actions that make good economic sense and may even lead to the development of further technologies that the world will be buying from us. At the same time we begin to make slow our rate of emissions, buy more time for us to understand the problem we face.

One thing for certain: I hope we can all agree that we all care about our children and we care about the future. We owe it to the future, all of our children and grandchildren, to leave them a healthy environment and a solid, strong economy. The choices we make today will determine that future. I believe that if we look at the science we know, try to find out the science we don't know, take the technology that we have and export it around the world, and use it here effectively in the United States, we will reduce the emissions, Mr. Chairman, that we are concerned about, including carbon, and we will do it in a way that will enhance our environment and enhance our economy.

Thank you, Mr. Chairman. I will turn the gavel over to you.

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Senator VOINOVICH [assuming the chair.] Thank you very much. I appreciate the fact that you began the hearings this morning.

Today's hearing is on the science of global climate change and the options and obstacles related to reducing net greenhouse gas emissions. It was suggested by Senator Lieberman earlier this year—and I thought it was a good idea—to bring the best and brightest people here before this committee to discuss this issue.

I would like to thank our chairman for allowing me to chair this important full committee hearing.

It has been almost 4 years since this committee had a hearing on climate change science. Since then not only has the issue evolved, but the membership of this committee has changed. There are eight new members of this committee, including myself. Therefore, I thought it would be important to hold this hearing, so that all of the members of this committee would have an update on this very, very important issue.

The state of the science has evolved, and I think it is important for us to hear from the leading scientists as to what we currently understand and what we don't understand regarding climate change. Most of the information the public hears is media summaries, taken from political summaries which summarize the UN's IPCC reports. That's the Intergovernmental Panel on Climate Change. I would like to make it clear that is the United Nations Intergovernmental Panel on Climate Change. That is out of the United Nations. They try to summarize these studies. With all of these summaries, no wonder it is difficult for everyone to understand what is going on.

Today we will see if we shed a little light on the state of the science. We will also take a look at some of the options and obstacles related to reducing net greenhouse gas emissions. Some of the topics I hope we cover include carbon sequestration and energy efficiency. In dealing with reduction issues it is important to understand what can reasonably be accomplished and at what cost. If actions are warranted, we need to make sure we understand the effects of those actions, or perhaps inactions.

First and foremost, we need to understand the science and what it means, where the questions are, and what further research needs to be completed. I am sure most of us remember back in the seventies when the media reported on the coming Ice Age and how the planet would be covered in a sheet of ice, which dramatically changed to predictions of global warming in the late eighties and nineties. We need to make sure we do not get our understanding of the science from Time magazine or summaries by politicians, but instead turn to the scientists conducting the actual research.

There is an article in Science News, November 1969. "'Earth's Cooling Climate." "How long the current cooling trend continues is one of the most important problems of our civilization," says Dr. Mitchell of the Environmental Science Services Administration."

Here's an article in the Science Digest. This is February 1973. "Brace Yourself for an Ice Age." "The idea of another Ice Age is not a new one but recently scientists have been confronted with the possibility that it may be much sooner than anyone thought."

Time magazine, "Another Ice Age?" This is back in June 1974. It warned of expanding arctic saying, "ice and snow covering in the northern hemisphere had suddenly increased by 12 percent in 1971 and the increase has persisted ever since."

Of course, last but not least is the Environmental Magazine, February 1996, and the front cover is "Global Warming."

On Kyoto, I would like to say a few words about the treaty. I know the international press, some countries, and even some here in the United States have criticized President Bush for killing the Kyoto Treaty. The Kyoto Treaty was dead long before President Bush was sworn into office. The treaty was dead when Bill Clinton signed it December 11, 1998. In fact, the treaty was probably dead before the negotiations at Kyoto even began. The treaty that came out of the Kyoto negotiations could not have survived the Byrd-Hagel test as found in the Byrd-Hagel resolution passed in the 105th Congress on July 25, 1997.

It passed in the Senate 95–0. Although I was not a member of the Senate at the time, it is interesting to note that many members of this committee voted for it, including Senators Smith, Warner, Inhofe, Bond, Specter, Campbell, Baucus, Graham, Lieberman, Boxer, and Wyden. I believe Senator Reid is the only member of the committee at that time who didn't cast a vote on that resolution.

Now one could argue that there was never a meeting of the minds between the U.S. negotiators and their European counterparts at Kyoto. When the U.S. negotiators returned from Kyoto in 1997, they announced that the U.S. would get meaningful credits for international trading and carbon sinks. However, last fall at the Hague negotiations broke down when the EU rejected the U.S. trading program and the carbon sink proposal, despite significant concessions by the United States. Apparently, the two sides did not understand each other's position back in 1997.

Cynics would say that many of the countries that are publicly berating the United States are privately relieved that the treaty has been pronounced dead since compliance would have been difficult, if not impossible, for many of them. As the Economist magazine pointed out last month, the only European countries that are likely to meet the Kyoto targets are Britain and Germany. Japan and the rest of Europe are no further along in this issue than the United States of America.

At this point I think it is important not to play partisan games with this issue. We all want to make sure that we do the right thing that protects our environment without causing unnecessary harm to the economy. I would like to have the following questions answered today:

- What is the current state of the science?
- Where do people agree and disagree?
- Where do we need more scientific research?
- If we do, what areas of technology do we need to do more research.
- I would like to know, what is the appropriate role of the Federal Government?

I am sure these questions are just the tip of the iceberg, and I don't expect we will be able to answer all of them today, but we should start to get answers.

We have tried to put together today a balanced hearing, representing all sides of this issue, and I think we have succeeded. Our first panel will discuss the state of the science. Both witnesses have been involved in the research at IPCC. Our second panel will include a mix of technology, science, and business experts. I look forward to their testimony.

I notice that the ranking member of this committee, Senator Reid, is here. Under protocol, Senator, we'll call on you for the next statement.

OPENING STATEMENT OF HON. HARRY REID, U.S. SENATOR FROM THE STATE OF NEVADA

Senator REID. Thank you very much. I appreciate very much your concern about this issue, and I am very happy that we are conducting this hearing.

For every year that goes by without Congress or the President making a serious effort to reduce greenhouse gases, the odds increase that my grandchildren are going to inherit a warmer, more chaotic world. We hear a lot of talk about Senator Byrd's amendment on the Senate floor, but we can only hear from Senator Byrd himself, who just within the past week has stated in a meeting similar to the one in which we are now gathered that he had no intention of his amendment being grounds for wiping out the Kyoto Treaty. He thought his amendment would lead to some discussions, discussions that Third World countries should have more involvement. We could hear more from Senator Byrd, but I only want to say that his amendment and those who voted for it, it was certainly not an effort to—or at least the vast majority of those who voted for it—to somehow "deep six" that treaty.

A recent study by scientists at MIT, the Massachusetts Institute of Technology, calculates there is a one-in-four chance that the world will warm between 5 and 7 degrees Fahrenheit in the next hundred years.

I have this chart up just to take a brief look at it. Mr. Chairman, I am from a State that gambles; I don't gamble myself——

[Laughter.]

Senator REID. [continuing] but I think this chart gives pretty good odds that we have a problem here in the world.

I would hope that we are going to spend more time on this complicated subject than the committee has to date. This is the Environment Committee, and we have spent far too little time on this very important issue.

I applaud the chairman for allowing this hearing to go forward. I appreciate very much, Senator Voinovich, your taking the time to chair this committee.

We need to do more. This committee hasn't looked at this matter directly for more than 2 years. Can you imagine that? The Environment Committee of the Senate on an issue of this importance, we simply have ignored it for 2 years, and that is not good.

Our committee has the responsibility and the jurisdiction to develop legislation that reduces manmade emissions that cause, or

have the potential to cause, harm to the environment and public health. It is far past time for this committee to do its duty and produce some proposals, helping them work together to develop bipartisan legislation to reduce emission of greenhouse gases.

Mr. Chairman, we are on the Senate floor now, and in the next couple of weeks we are going to talk about education, and we should; it's a very important issue. But I would hope that we can spend some time this year debating this issue and coming up with some concrete proposals. We may not be able to do everything that needs to be done, but, hopefully, we can do something.

I understand some of my colleagues have been put in the difficult position by the President's decision to reverse his campaign promise on reductions of carbon dioxide from power plants. We don't need to beat a dead horse, but even his EPA Director gives a speech talking about the United States leading the charge in reducing carbon dioxide. Four days later her legs are literally cut out from under her, the President saying, no, we are not going to reduce carbon dioxide the way that she had talked about.

It is time for leadership and progress. I would say President Bush is a good person. I know he means to do the right thing. I just think he is getting bad advice. I would like to see this committee help to be part of the advice that he gets. I would like this committee to be a laboratory of new bipartisan issues for cutting greenhouse gases. I have no doubt that the Administration is equally interested in such progress.

There has been a lot of talk about voluntary versus mandatory requirements to reduce these gases. My colleagues know that the nation has a Senate-ratified commitment to reduce emissions to 1990 levels. That was to have been accomplished through voluntary measures. Unfortunately, we failed miserably using voluntary means. We are now about 13 percent above our target.

So what we need is a comprehensive approach—excuse me, I have allergies. I hope it is not caused by the global warming, but it is bad.

[Laughter.]

So what we need is a comprehensive approach that achieves real net reductions by a time certain. I don't know any other way to get the ball rolling.

Carbon dioxide and other greenhouse gas emissions must come down. The Senate has already made that policy decision. Scientists at the IPCC and elsewhere can help us help to determine which policy options are most useful and when they should be implemented. But it is time for opponents of that decision to work with us on real world reduction strategies. It is now our job to figure out how to accomplish that goal in the most effective and expeditious way. I am glad that we have some witnesses here on the second panel to tell us about policies we might adopt to move in the right direction.

I would hope also that the Administration's energy policy plan, even though it doesn't sound as though it moves in the right direction for climate purposes or for protecting the environment, really will do that. We need a plan that reduces harmful emissions, not increases them. Press accounts describing the Administration's plan say it would simply result in burning more fossil fuels. That

is really shortsighted and irresponsible and has little or no chance of getting wide bipartisan support. Emphasizing increased and efficient fossil fuel use when we know that carbon concentrations in the atmosphere are higher than they have been for some say 400,000 years is a little bit like handing Nero a fiddle to play while Rome burns.

I believe, Mr. Chairman, a strong and supportable energy plan would first emphasize renewable energy, energy efficiency, and conservation. Then, once all the economically viable energy is wrung out of these resources, we can turn to cleaner and safer uses of coal and other traditional fuels.

Mr. Chairman, we had a hearing 1 day this week in another committee, one of the Appropriations subcommittees, and there it was determined that the States of South Dakota—I'm sorry it leaves me temporarily what the other state would be—could produce enough electricity by windmills to produce all the necessary energy that the whole United States would use. It was also determined there that the State of Nevada in a 100-square-mile plot where the Nevada Test Site now stands could produce enough electricity by solar to power all the United States. Now we know that is not going to happen tomorrow, but I think we need to get on with having proper incentives to get that started. No one can disagree, I don't think, that we should continue burning fossil fuels the way we have. Geothermal, wind, and solar, we need to share these abundances that we have in States with lots of wind and lots of sun with the rest of the country.

Finally, Mr. Chairman, I want to try to be constructive. I want results, but I am not interested in amending the Clean Air Act or any other environmental statutes as part of an energy plan that doesn't make tangible cuts in greenhouse gases.

I would like unanimous consent to include in the hearing record a summary of a recent study showing that reducing carbon emissions can be done cost-effectively.

Thank you for your patience.

Senator VOINOVICH. Without objection, that will be part of the record.

We are going to follow the "early bird" rule, and the next Senator I am going to call upon for a statement is Senator Wyden.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM THE STATE OF OREGON

Senator WYDEN. Thank you, Mr. Chairman. I commend you for holding a very important hearing, and I also want to associate myself with the remarks of the distinguished Democratic Leader.

Mr. Chairman and colleagues, very briefly, I want it understood that I believe there is no plausible scientific deniability about the human contribution to climate change. There has been one objective scientific report after another that has documented the fact. There is no plausible scientific deniability about the human contribution to climate changes. The challenge now, as our colleagues have talked about, is to work in a bipartisan way to deal with the problem. I think Chairman Voinovich put it pretty well; we should not spend our time in partisan bickering.

Toward that end, Senator Larry Craig and I, a Republican who is a senior member on the Natural Resources Committee in Agriculture, he and I today are going to introduce a comprehensive bill to use trees as a key complement of our strategy to fight this problem. This is an approach that will bring together industry and the environmental community to address 25 percent of the problem. We are not going to deal with the entire problem using a tree that absorbs carbon dioxide from the atmosphere, but you can deal with a very significant portion of this problem under the approach that Senator Larry Craig and I will be introducing today.

So I hope our colleagues on both sides of the aisle will join us on this legislation in creating a revolving loan fund for private landowners to plant trees and keep them to sequester carbon. It is easy to administer. It is scientifically sound.

To give you an idea why something like this makes sense, it costs between $2 and $20 per ton to store carbon in trees. Alternative strategies can cost up to $100 per ton.

I think the distinguished Democratic Governor has made a very fine statement. I concur in it entirely. I happen to agree with what Chairman Voinovich has said, that we ought to get away from partisan bickering.

Folks, the scientific evidence is compelling here. Humans are contributing to this problem. Let us get on with forging a bipartisan approach to deal with it, one that makes sense, as Senator Smith said before he left, from the environmental standpoint and from the economic standpoint. Two Senators, Senator Craig and I, introduced legislation to try to advance that goal and look forward to working with our colleagues on a bipartisan basis.

Senator REID. How many trees do you have to plant?

Senator WYDEN. You have got to plant a significant number, Harry, but the point is that the savings relative to the alternative, $100 per ton compared to $2 and $20 per ton, are just staggering. There are approaches that could bring us together, that could allow me to go to Jim Inhofe and say, "Jim, Larry and I can work with you in a way that is going to make sense for industry and make sense from an environmental standpoint, deal with a quarter of the problem." Let's get on with it.

I think that is why Chairman Voinovich said let's get beyond the partisan bickering, and I would say it is time.

Senator VOINOVICH. Well, I would be interested in your legislation because one of the goals I had as Governor of Ohio was that I think we planted 11 million trees a year. Many of the States are involved and it would be interesting to see how that national program would fit in with the legislation that you have and maybe encourage the private sector to do a lot more than what they are now doing.

Senator Chafee?

OPENING STATEMENT OF HON. LINCOLN CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator CHAFEE. Thank you, Mr. Chairman. I also would like to thank you for calling this hearing, the first one in a number of years. Being new here, I am very interested in hearing the testimony. I know there is going to be a great deal of debate just within

this semicircle as well as within the scientific community, and I look forward to that debate.

My own common sense tells me that every once in a while when you read in the newspapers about somebody who pulls into the garage and falls asleep in their car, and the coroner the next day says they died of carbon monoxide poisoning, that we have to do something on this subject. Therefore, I was disappointed in the new Administration backing away from addressing carbon dioxide in a comprehensive, multi-pollutant approach.

I also was disappointed that the new Administration is going to oppose the Kyoto agreement on global warming. This was not because I thought the Kyoto Protocol was a flawless document. The negotiations at Hague demonstrated that future work was necessary to reach a consensus on several aspects of that accord. But, instead, the Kyoto Protocol is a good framework for future negotiations on global climate policy. Without that foundation, the rest is tenuous. I do think it is incumbent on the United States to be a leader on this subject.

So I do look forward to working with my colleagues and also to hearing from the scientists. Six of the seven of the panelists are doctors and other leaders in industry, and I look forward to hearing their testimony.

Thank you, Mr. Chairman.

[The prepared statement of Senator Chafee follows:]

STATEMENT OF HON. LINCOLN CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

I would like to welcome our witnesses and to thank Chairman Smith, subcommittee Chairman Voinovich, and Senators Reid and Lieberman for holding today's full committee hearing on the important and critical issue of global climate change.

The science supports the notion that human activities are disrupting the balance of carbon dioxide, methane and other greenhouse gases in the atmosphere, resulting in global climate alterations. A recent Intergovernmental Panel of Climate Change (IPCC) report estimates that the earth may warm anywhere between 2.5 to 10.4 degrees Fahrenheit over the next century. The world's leading atmospheric scientists are telling us that global warming is already occurring and the hottest 10 years on record have all occurred since 1980, with 1998 recorded as the hottest year ever.

Two decisions by the new Administration have spurred intense discussion in recent weeks: to back away from addressing carbon dioxide in a comprehensive multi-pollutant approach; and second, to oppose the Kyoto agreement on global warming. Like many of my colleagues, I was disappointed with these decisions. This was not because I thought the Kyoto Protocol was a flawless document—the negotiations at the Hague illustrated that future work was necessary to reach a consensus on several aspects of Kyoto accord. Instead, the Kyoto Protocol is a good framework for future negotiations on global climate policy. Without the foundation, the rest is tenuous.

I am interested in learning from our witnesses today where the scientific consensus lies on climate change; what effects humans may have on the change and how quickly it may occur; and what options may exist for stabilizing greenhouse gases in the atmosphere.

I look forward to working with my colleagues on the Committee and in the Senate as we review the science and determine the best course of action for addressing greenhouse gas emissions and global climate change.

Senator VOINOVICH. Thank you, Senator.

Senator Corzine?

OPENING STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator CORZINE. Thank you, Mr. Chairman. I join my other colleagues in complimenting you on having this hearing because this is one of those issues, at least among the community that I represent, people are most concerned about.

It really is as far-reaching an issue that we face today I think as a nation and as a globe. It is complex. We have made progress. There are good ideas that come in a bipartisan way, but we need to deal with the science, economics, and I think the politics of moving forward on this agenda. The pollutants bill was something that I was disappointed to see we were subtracting pieces from. Inattention and inaction I don't think is tolerable or consistent with the science, and the health and viability of our global ecosystems are too vital for us to talk indefinitely. I think we need to move forward.

I will leave the rest of my statement, with your approval, for unanimous consent and submit it. But I think this is terrific that we are having this and I hope we do that to the fullest possible extent, so that we have a real understanding of the issues as we approach deriving solutions and putting them on the table for folks in general.

Thank you.

Senator VOINOVICH. Thank you.

Senator Inhofe?

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Thank you, Mr. Chairman. When you were talking about some of the Time magazine articles and the hysterias of the past, I was reminded that many years ago when I was in high school, they were saying that because of the changes in water levels and climate changes that within 50 years, which would have been the year 2000, the entire State of California would have slid into the Pacific Ocean, which would have solved some of the problems, of course, that they are facing today.

[Laughter.]

In the last few weeks there has been a lot of negative press about President Bush's carbon and Kyoto decisions, but with the allegations of politicized science, a looming recession, and a national energy crisis, I think that President Bush did the right thing.

There are three issues that I want to address today, and I have scratched off some of this, Mr. Chairman, because it would be redundant of some of the things that you have said, but there are a couple of things I am going to say in a different way.

First of all, the science and politics of the United Nations' Intergovernmental Panel on Climate Change, IPCC, keep in mind, as you pointed out, that it is the United Nations. Second, the science and politics of U.S. National Assessment, and, third, the need for more research in a number of areas.

As for the IPCC report, I am very interested in hearing about allegations that—and I will list about five of them here: A portion of the UN's process, the 18-page summary for policymakers, mis-

leads readers and even distorts the underlying scientific conclusions. Second, the scientists did not write this document. Third, allegations that—perhaps the most disturbing—this summary was subsequently and materially altered. Fourth, the IPCC summary is designed to reflect policy decisions rather than the underlying science. Last, one of the most prominent scientists involved, a lead author, and many other scientists do not agree with or approve of the conclusions with which their names are associated. Now these are very serious charges, and if true, the IPCC report should not be the basis of any policymakers' actions, other than possibly investigate and formally object to such actions.

Second, regardless of the IPCC process, the U.S. First National Assessment of Climate Change must be based on sound and objective science, based on the weight of the evidence, so that this assessment can be used to develop our nation's domestic and international strategies on climate change. It is an analysis of the effects of global climate change on the environment, agriculture, water, health, society, biological diversity, and on and on. The report is being prepared by the U.S. Global Change Research Program, a group that includes representatives from different Federal agencies. The total amount of taxpayer spending dedicated to detour assessment-related activities nears an estimated $10 billion, and it would be $1.4 billion for the year 2000.

In fact, Representatives Knollenberg and Emerson and I so strongly believed that it was so important that this assessment be an objective and sound work that we joined a suit against the National Assessment through the VEGA-chartered committee charges that the process, No. 1, violated the United States Global Change Research Act of 1990 by producing a report lacking certain specific issues, areas covered. Second, that same organization was in violation for producing a report including several issue areas not requested by Congress or by the statute, but by political appointee in the White House. Third, that same organization ignored the Emerson amendment to the relevant Fiscal Year 2000 House-passed appropriations bill acceded to in Public Law 106–74 requiring the underlying science be performed prior to producing a report reportedly based on those conclusions.

If we are going to develop effective policies to deal with the issues surrounding climate change, the IPCC and the National Assessment must be of the highest integrity. There has never been a more compelling case to have a policy decision based on the objective weight of scientific evidence.

Last December the Department of Energy's Energy Information Administration released a study on regulating CO_2 emissions from utilities. The study concluded that the mandatory regulation of CO_2 from utilities will cost between $60 and $115 billion per year by the year 2005. The mandatory regulation of CO_2 would make the price and availability of energy a national crisis at a scale our nation has never before experienced.

Well-thought-out, reflecting-consensus environmental regulations can certainly provide benefits to the American people, but as regulatory experts Wendy Gramm and Susan Dudley of the George Mason University's Mercatus Center recently wrote in an article in the Atlantic Journal, "When regulations are rushed into effect

without adequate thought, they are likely to do more harm than good."

If you do not do it in the extreme way that so many of the environmentalist groups want—and we see all the commercials detailing horror stories, while the energy crisis which would be caused by developing policies based on the IPCC report or the National Assessment so far would be a real live horror story. Let's not forget, when the price of energy rises, that means the less fortunate in our society must make the decision between keeping the heat and the lights on or paying for other essential needs. There is a real human cost to implementing policies based on political science rather than sound science.

Last, No. 3, regardless of the state of the science right now, I do fully support public and private research into climatic change science, energy efficiency, and alternative energy sources. Senator Reid talked about the potential of solar and wind energy. That would be great if we could get to that point, and I would very much support that. By doing these things, we will put our nation and the planet in a position to address carbon in our atmosphere, should the science 1 day show a need to do so.

Thank you, Mr. Chairman.

Senator VOINOVICH. Thank you.

Senator Clinton?

OPENING STATEMENT OF HON. HILLARY RODHAM CLINTON, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator CLINTON. Thank you, Mr. Chairman. Obviously, this is an important hearing and there are differing points of view to be considered and reconciled. So I thank you for bringing us here together.

Obviously, this is a hot topic, literally and metaphorically, for all of us. I think it is indisputable that global warming and the impact of human activity on our environment is certainly one of the most pressing problems facing us, and as decisionmakers, we are going to have to confront what it means.

I have a very simple approach to it, and that is, if we look at statistics that are gathered from many different sources, it is apparent to me that a lot of the difficulties that we are confronting because of rising temperatures are likely to get worse. Today, for example, is the Fourth Annual Asthma Awareness Day here on Capital Hill, hosted by the Asthma and Allergy Network and Mothers of Asthmatics. I am proud to be an honorary co-chair along with a number of my colleagues here, including Senators Voinovich, Inhofe, and Corzine.

We know from any mother's perspective that increased temperatures actually worsen conditions for asthma sufferers. Pediatric asthma rates are reaching epidemic proportions in New York and other places in the country, and that is just one element of the kind of challenge that we are facing which has a relationship to what the temperature is and how we deal with the challenges that are posed by rising temperatures.

We know that air quality is still a very big difficulty in many parts of New York and other parts of the country. I am certainly devoted to cleaning up the air, as many of us are, of dealing with

the pollutants that we know are in the atmosphere and causing damage. But I don't think there can be any doubt that there is a link between increasing temperatures and increasing smog in cities like New York and many other places, and that that increased smog can exacerbate respiratory diseases.

Now how are we going to judge the sound science? Obviously, we are going to listen to researchers and scientists. I agree with Senator Wyden that, at least as I review the evidence, the debate is over. It is just a question of what we are going to do in order to address rising temperatures and their impacts.

Another cost that we are paying, in addition to asthma and respiratory disease, and the hospitalization that is often accompanied with pediatric asthma, is the seeming increase in severe weather events. According to rough estimates from FEMA, the Federal Energy Management Agency, disaster relief for severe storms and flood-related events is increasing. Now some could say you shouldn't build on the side of a river, but when you have 100-year floods happening twice in 5 years, it might raise some serious issues as to what exactly is going on.

We are facing this issue today in part because we haven't been willing to really work as hard as we need to in order to come up with some solutions. I was disappointed, like many others, when the Administration reversed itself and the President's campaign promise on CO_2 and declared the Kyoto Protocol dead. Now I have been pleased, however, that since that declaration of death, there does seem to be an effort to breathe some clean air into the life of that corpse in the White House and that they are actively working on the issue and attempting to come up with some response, because the United States must be a leader in addressing global warming.

We know that we are the largest producer of manmade carbon dioxide. I am worried greatly that the Administration's energy proposals will worsen an already very difficult situation. I look at the proposed budget, and I think everyone around this table would agree we do need to invest more in renewables; we do need to do the research to find out whether those wind farms that Senator Reid talked about would be viable. They seem to be. I have talked to a number of utility executives who are beginning to invest in them, but the President's budget has rather significant cutbacks in renewable energy, energy efficiency and conservation, in the Partnership for a New Generation of Vehicles.

There is a lot of things we could be doing right now, but nobody wants to take the political risk of increasing the amount of mileage required from some of our vehicles, trying to work out an incentive program for utilities to even do more to cut emissions. I think this is one of those issues that people will look back on and say, What were they thinking of? Were we so selfish, so self-centered about our needs that we did not work out the best possible realistic solution to what was a looming environmental and energy crisis? I don't think that we really can withstand that kind of scrutiny either now or in the future.

That is why I am pleased to be part of an effort that must be bipartisan, where the Administration not only has to work with Congress, but with people of good faith around the world. We can't

let the perfect be the enemy of the good. We say that a lot in this committee.

There were certainly problems with Kyoto, and if they can be fixed, if we can come up with a set of standards that actually do move us forward, then we should, but let's not forget that, in the wake of Rio, we adopted voluntary standards, and we're worse off today than we were then.

So I think that, just as previous generations came up with the law of the seas and came up with treaties to deal with Antarctica and made some other rather significant steps forward in international cooperation, we ought to be looking to do the same here. So I am very grateful that the chairman would hold this important hearing. I look forward to working with my colleagues on addressing these very important issues.

Senator VOINOVICH. Thank you very much.

We are very fortunate today to have two distinguished witnesses, Dr. Richard S. Lindzen and Dr. Kevin E. Trenberth. Please come to the table.

As you are probably familiar, the rules of the committee are that the statement that you make, your opening statement, should not exceed 5 minutes. I think you are familiar with the light system. The reason for that, to limit the opening statements, is to give the committee an opportunity to ask questions of you. Hopefully, if there are some things that you didn't get out in your opening statement, you can get them out when you respond to the questions being asked by members of the committee.

Our first witness is Dr. Richard S. Lindzen. He is the Alfred P. Sloane Professor of Meteorology at the Massachusetts Institute of Technology. Dr. Lindzen.

STATEMENT OF RICHARD S. LINDZEN, ALFRED P. SLOANE PROFESSOR OF METEOROLOGY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dr. LINDZEN. Thank you, Senator Voinovich, for the opportunity to appear before you. Holding to 5 minutes, I will refer you to my written testimony for some details.

As concerns the science of this issue, despite the statements of some Senators today, I think the public presentation of the issue of global warming over the past 12 years has, by the very nature of the presentation, forced confusion and irrationality to dominate the discussion. On the one hand, the issue is presented as a complex, multifaceted problem involving atmospheric composition, heat transfer, weather, temperature, ocean dynamics, hydrology, sea level, glaciology, ecology, and even epidemiology—all topics that are individually filled with uncertainty. On the other hand, we are assured the science is settled.

What exactly is this settled science? That is rarely explained. I think in some ways Senator Smith came as close as anything I have heard this morning. Then instead of explaining it, the usual procedure is to claim it is supported by thousands of outstanding scientists involved in the UN's IPCC procedure. That, too, has to be considered in some detail.

Finally, it is presumed whatever it is that is settled implies a wide array of catastrophe scenarios endangering the very existence of future generations.

Finally, solutions like those envisioned in the Kyoto Protocol are proposed without making it clear, although it is widely agreed, that adherence to the Kyoto agreement would have almost no impact on climate. Now to question such a situation is to be marginalized as a skeptic while no degree of counterfactual exaggeration is held to be out of the mainstream.

The detailed testimony points out that there are numerous facts that are universally agreed upon in the field that are not—universal, at least widespread agreement—are not supportive of catastrophic scenarios. Also, there is pretty good agreement that the large computer models of the climate, which are the basis not only of the scenario predictions, but also of the chart that was shown from MIT, are broadly unsuccessful and unreliable. Again, I will go into some details on that.

However, the problem we have since the Rio agreement is, as a nation, we have signed onto the precautionary principle. That really takes the scientific pressure off of models to be correct. What we basically require now or claim is that the models represent things that are possible; that is, they cannot be disproven. This is a very difficult situation in order to consider acting upon them. This does not define what "possible" means and generally puts us in the awkward situation of having to act on anything anyone wishes.

The IPCC does deserve some consideration, if not necessarily to criticize it severely, at least understand what the procedures mean. The procedures are in many ways extremely opaque, and certainly the claim of support by thousands of outstanding scientists is more a mantra than a reasonable statement.

That this can lead to policies that are detrimental to the economy and even to the environment has often been noted, but less frequently has it been noted, but perhaps more important, given my provincial outlook, is the fact that the present situation is also detrimental to science and its ability to soundly answer important questions to the benefit of society.

I would maintain that we have, to a very large extent, built into our scientific process a predilection for alarmism. There is no easier way to justify science than alarmism. The very fact that meetings such as this do in general endorse more research will convince the scientists that the way to get more support for research is to promote alarmism. I think one of the main things we can do is figure out how to support science without causing it to have this bias.

Thank you.

Senator VOINOVICH. Thank you.

Dr. Trenberth, who is the Head of the Climate Analysis Section, Climate and Global Dynamics Division, National Center for Atmospheric Research. Thank you for being here.

STATEMENT OF KEVIN E. TRENBERTH, HEAD, CLIMATE ANALYSIS SECTION, CLIMATE AND GLOBAL DYNAMICS DIVISION, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Dr. TRENBERTH. Thank you, Mr. Chairman.

I am also lead author of the Intergovernmental Panel on Climate Change; in fact, on the same chapter as Dr. Lindzen. However, I was also involved in writing the technical summary and the draft of the policymakers' summary, the summary for policymakers. I am happy to answer any questions about that procedure.

I would just emphasize that the IPCC process is a very open process. There are two major reviews, and people from all parts of the political spectrum do take part. The objective of the IPCC is to produce the best statement, along with the uncertainty, that can be made relevant to policy.

The conclusion from the IPCC in the latest round was that there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities. What I thought I would do now is just quickly run through some of the main points of the findings—the scientific findings.

As Senator Smith noted earlier, there are some certainties. The greenhouse gases are increasing in the atmosphere and these are from human activities, especially the burning of fossil fuels. They have long lifetimes. Carbon dioxide has a lifetime of over a century. Therefore, they accumulate in the atmosphere. So even with constant emissions, concentrations in the atmosphere still increase. Carbon dioxide has increased more than 30 percent in the last 200 years, most of that since World War II, and also the other greenhouse gases are increasing. These are greenhouse gases. They produce global warming—that is, global heating.

First, some of that heating increases temperature, and we know that temperatures have increased about 1.2 degrees Fahrenheit in the last 100 years, .7 degrees in the last 30 years. That is a more confident number. The year 1998 is the warmest year and the 1990's is the warmest decade, and we believe that is true in the last thousand years, based upon paleoclimatic evidence.

There is a lot of other evidence to support the reality of this warming. Glaciers are melting around the world. Sea level is rising. Arctic ice is thinning and also retreating, especially in summertime. The temperatures in the ocean clearly show that the oceans are warming, and snow cover is decreasing in general.

There are changes in the atmospheric circulation which complicate matters. This relates to weather events, and in this past winter, temperatures were well below average, in fact, across much of the lower 48 States, but there were record high temperatures in Alaska, 9 degrees Fahrenheit above normal. Similarly, it was very warm throughout Europe.

So this kind of structure to the variability from year to year sometimes complicates perceptions as to what is happening. Global warming doesn't mean it warms everywhere and in a steady fashion.

Over the United States, in particular, it has become wetter. We now understand that this is because of the general warming of the tropical oceans, and the wetness of the United States means that that moderates the temperatures in fact. We also know that more of this rainfall, this wetness, comes from very heavy events. So there is an increased risk of flooding as a consequence.

Now another consequence of global warming, the heating of the planet, is that there is more drying at the surface. In fact, most of

the heat goes into evaporating surface moisture along as there is moisture around. If there is not, then things dry out, we get droughts, and we get heat waves.

A consequence of the increased drying is that there is more moisture in the atmosphere, and there are good observations to show that the humidity in the atmosphere has increased by over 10 percent over the United States in the last 20 years or so. That humidity, that increased moisture in the atmosphere, provides fuel for all of the weather systems. Consequently, it rains harder when it does rain and it even snows harder. As a result, there is an increased risk of flooding, and we are seeing examples of that right now.

Computer models that we use for attributing the causes of the climate change, and also for making future projections, have a number of uncertainties. First, there are uncertainties as to what the projections of carbon dioxide and so on would be in the future. So, instead of making predictions of those, there are various projections or scenarios that are put forward, and they are used for planning purposes, but they should not be confused with true predictions of what is going to happen.

There are better estimates of natural variability from climate models and also from past climate records, and they indicate fairly clearly now that the global mean temperatures are outside the realm of natural variability and have been since about 1980 or so. So we can account for a lot of the structure of the global mean temperature changes.

However, global mean temperatures are more like the canary in the coal mine. They are really an indicator of what is going on. They are not the most important thing. The other changes, in precipitation—for instance, I think water resources—are probably a much bigger issue for society.

The best estimates in the future are that the global mean temperature will increase about 3 to 6 degrees Fahrenheit over the next 100 years or so, and other numbers have been put forward. Some extreme numbers I don't think are very viable. They have often appeared in news reports, but I think some of the reporting of the IPCC results is misleading in that regard.

Let me just close by saying that, while our models are imperfect, to assume that the climate is not changing—which Senator Smith was referring to—that also uses a model which we are certain is wrong. Thank you.

Senator VOINOVICH. Thank you.

I would like to welcome Senator Warner. Senator Warner, before we ask the witnesses questions, would you like to make an opening statement?

Senator WARNER. No, Mr. Chairman. Thank you very much.

Senator VOINOVICH. Thank you, Senator Warner.

Dr. Lindzen, you had an opportunity to hear Dr. Trenberth's statement in regard to the various conclusions that have been made in terms of increase in warming because of fossil fuels, the 30 percent more in greenhouse gases, and so forth, glaciers, sea levels—frightening stuff. The question I have is, Do you agree with the information that has just been presented before this committee by Dr. Trenberth?

Dr. LINDZEN. It is hard to know because, analyzed carefully, I am not altogether sure what he was relating to what. I think, for example, the statement that increasing carbon dioxide is occurring there is universal agreement on. I think the statement that increasing carbon dioxide and other greenhouse gases, we should realize they have already amounted to half the increase we expect by a doubling of CO_2, will more likely cause warming, increase in temperatures, than decrease. I don't think there is any question, moreover, that man, like the butterfly, has an impact on climate.

What I think is important to realize is those statements have no policy implications because, if they are not quantified, if they are not significant, they could just as well be compatible with a negligible impact from CO_2 as a serious impact. So when one draws upon universal agreement, one had better be aware that one is also drawing upon triviality.

The questions then boil down to more serious ones of quantification. Kevin mentioned storminess, but he does not mention that the main source of energy for extra tropical storms is the equator-to-pole temperature difference, and that is predicted to decrease in a warmer world. So we only hear one side rather than the other on that.

He speaks about glaciers retreating, but he doesn't mention that there are quite a few glaciers retreating in regions where the temperature is decreasing rather than increasing, and that, in fact, over Scandinavia the glaciers are advancing again, and there has been very little movement any place since around 1970.

In speaking about increased rain over the United States, this amounts to a few percent, and Tommy Karl presented that, but I know of no hydrologist who thinks we can measure that. So I am not sure how he did it.

As far as ice thinning over the Arctic, that was a report a couple of years ago, but a report came out only a few weeks ago in Geophysical Research Letters that pointed out the errors in that.

Kevin mentioned the thousand-year record, but Wally Broerker just came out with an article in Science pointing out that the methodology of that measurement, which just uses a handful of tree rings to give you accuracy, claimed accuracy of a couple of tenths of degree, is inappropriate.

So there is an evolving area of science. The science where there is agreement and where one speaks of things being settled is not policy-relevant. The policy-relevant parts are highly uncertain and often suggestive of much less impact.

On top of that we have—back to the issue of Kyoto, and that is, if you adhere to Kyoto and you expected, let's say, 6 degrees global warming, Kyoto would knock it down to 5.5. If the Third World participated, it would knock it down to maybe 4, 3.5. There is nothing Kyoto would do that would change the fact that, if you really expect a global warming, you would still have it.

Finally, as far as models go, just to give you a perspective, they are so far incapable of predicting or dealing with or replicating ice ages, warm climates of the past, and so climate dynamics is very poorly handled. There are all sorts of sources of natural variability, and that means internal, nothing forced, that they can't handle.

Yet, all the statements you have heard about man's demonstrated role assume that models correctly produce internal variability.

Senator VOINOVICH. Thank you.

Senator Reid?

Senator REID. Dr. Lindzen, I know you are a scientist, and I am sure you have all kinds of scientific degrees, but common sense to me dictates that all this stuff going into the air which can be quantified over all the many years it has isn't good for the environment. Would you agree with that? If I see all this stuff going into the air, including fossil fuels——

Dr. LINDZEN. It is certainly true of many things, although I would say that Senator Chafee's relating CO to CO_2 is indicative. Remember CO_2 per se is odorless, invisible, nontoxic, essential to life, and a product of breathing. So to refer to that in the same sentence as carbon monoxide, which is poisonous, or soot, which is adversely impacting health in obvious ways, I think confuses the issue. It doesn't help it.

Senator REID. Well, but, Doctor, what I want you to do, rather than try to belittle we Members of the Senate, I think what you should do is answer my question. That is, all this black stuff belching into the air from diesel fuel, power plants, automobiles, is that good for the environment?

Dr. LINDZEN. Of course not.

Senator REID. OK, then, let's take the next point. The next point would be, what we are trying to do here, rather than determine exactly whether a model is right and whether they can replicate the Ice Age, what we want to do—I am speaking for myself—what I want to do is figure out a way to cut down the use of fossil fuel, for a couple of reasons. One is I personally believe, although I am not a scientist, that it is not good for my grandchildren. No. 2, I think anything we can do here in the United States to cut down the use of fossil fuel is good for our economy, because if we can stop importing so much of this foreign oil, it would be better for us in so many ways. Would you agree with that?

Dr. LINDZEN. I am in no position as a scientist to offer any expert agreement or disagreement on those matters.

Senator REID. Well, you would agree as a scientist that we would be better off producing electricity with wind or solar or geothermal than we would be by burning fossil fuel. You would agree with that?

Dr. LINDZEN. Not at all.

Senator REID. Tell me why.

Dr. LINDZEN. Well, because I haven't studied them. I know that wind-generated electricity has its problems.

Senator REID. Tell me what problems.

Dr. LINDZEN. Well, bad for birds, among other things. It also is very space-intensive. It also has the problem that I speak about without expertise that, when you have large-scale wind generation plants, you will impact the wind itself. The wind doesn't exist independently of the devices, and you could very well end up with a wind farm, if it is too large, that kills its own wind. That is a bit wasteful of both terrain, land, and economic resources.

As far as panels go, it is again a space issue, an environmental usage issue, as to whether Nevada wants large parts of Nevada

used to be covered by panels. These things, as you say, can be assessed, but to ask somebody to agree that this is better, I mean that doesn't make sense to me. Maybe it does to you.

It seems to me that with fossil fuels we have available from Australia and elsewhere new forms of coal that are almost chemically indistinguishable from hydrocarbons. Whether those have advantages or not I don't know. There are clean coal technologies. I am no expert on them, but they have to be assessed as well.

Senator REID. Tell me what you are an expert in.

Dr. LINDZEN. Climate dynamics, the physics of climate.

Senator REID. I see. I guess the problem I am having is that, for example, Dr. Trenberth stated that the assumption that warming is not happening also relies on models. Would you tell me what uncertainty is related with those models that he talks about?

Dr. LINDZEN. First, I think you have to distinguish warming meaning a change in temperature and warming meaning man's causing it. There is very little question that warming is going on. There is very little question that it is very hard to know how to attribute it.

When he says that models are also responsible for the possibility that man's activities may not cause much warming, this is a statement that you have at least conceptual models that the feedbacks may not be as positive as they are in existing models.

He showed us that carbon dioxide alone, if it increased, doubled, would not cause more than about 2 degrees Fahrenheit warming, and that is not a huge amount. The claims that it would cause much more are due to the fact that most existing models amplify what carbon dioxide does by having clouds and water vapor come in and make Nature worse.

Senator REID. Dr. Trenberth, would you respond to that?

Dr. TRENBERTH. There are uncertainties in models, indeed, but the models are good enough, we believe, to be able to attribute the climate change to why it is happening now. The real problem is that the models are probably not good enough to make really reliable predictions in the future. In that sense, there is a lot of work to be done.

Professor Lindzen is correct that the warming from carbon dioxide alone, when you double the amount of carbon dioxide in the atmosphere, would be around, I would say, 2.5 degrees Fahrenheit, but the best estimate overall is that about 5 degrees Fahrenheit would be the overall warming that would occur. A lot of that comes from the fact that a lot of the heat goes into evaporating moisture, putting more water vapor in the atmosphere, and water vapor is a powerful greenhouse gas and that provides a positive feedback.

Senator REID. One final thing. I know my time is gone, Mr. Chairman. Both of you have done a lot of work in this field, that's true. I would like to know from what funding sources that you have received your money for these studies. Would you both do that and make it part of the record?

Dr. TRENBERTH. For myself, and many of my colleagues, in fact, my main line of research is not on climate change. I am more an expert originally on El Nino. I find that when we look at El Nino, there are changes going on and we run headlong into the fact that the climate is changing.

My institution is supported by the National Science Foundation and I have grants with NASA and NOAA.

Senator REID. Dr. Lindzen?

Dr. LINDZEN. My funding is also from DOE, NASA, NSF.

Senator REID. Thank you very much. Thanks, Mr. Chairman, for your patience.

Senator VOINOVICH. Thank you.

Senator REID. I would say also that Senator Lieberman, who is the ranking member of the subcommittee, is on his way. He will, along with Senators Corzine and Clinton, who are members of the subcommittee, will be here. I have to go to the Capitol. Excuse me.

Senator VOINOVICH. Thank you.

Senator Chafee?

Senator CHAFEE. Dr. Trenberth, welcome. You said in your opening statement that in the 2001 plenary the IPCC carefully crafted the following: "In the light of new evidence, and taking into account the remaining uncertainties, most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations." Could you just expand on that and your reaction to the relative strength or weakness of that finding?

Dr. TRENBERTH. Perhaps it is worth commenting briefly on the procedures in the IPCC. The scientists are primarily involved in writing the overall document and the technical summary. For the policymakers' summary, a draft is put forward by the scientists, and I was involved in that, but then it goes through an intergovernmental meeting where each word and line is approved and actually modified in an intergovernmental process.

The way that is supposed to work is that the politicians take for themselves how to say things and the scientists defend actually what can be said. There were 42 scientists at that meeting that were defending what could be said. But there was a lot of negotiation over that particular wording, and that wording was actually crafted at the meeting itself. It was a compromise between a lot of different positions that were being put forward at the meeting.

Dr. LINDZEN. Could I mention in my testimony I do have the wording in the draft submitted by the scientists and the wording that emerged, if you wanted to look at the two.

Senator CHAFEE. Very good. Thank you.

I still have some time. I would like to ask Dr. Lindzen to just elaborate on how man and the butterfly impact on climate, in particular.

Dr. LINDZEN. This is the nature of a chaotic system. There is a distinguished professor at MIT, Ed Lorenz, who asked, if you have a system that is unpredictable, as in many respects our weather is, would the fluttering of a butterfly lead to a different evolving path for the weather? And the answer was, yes, it could eventually. It might be negligible. It might be rare. It might be very difficult to specify. But it became a popular theme for people studying chaos to muse on. I was simply saying, if people can muse on the impact of the fluttering of a butterfly's wings, then, of course, man has an impact; we're klutzier than a butterfly.

Senator CHAFEE. Thank you, Mr. Chairman.

Senator VOINOVICH. Senator Inhofe?

Senator INHOFE. Thank you, Mr. Chairman.

Getting back to this process, for both of you, I would like to kind of pursue that a little bit. If one of you wrote a scientific report, which you do with regularity, and there is a process by which both the House and the Senate and the bureaucracy would come together to negotiate what your work actually said, do you really believe that the final congressional summary of the report would accurately reflect the science and the research? Dr. Trenberth?

Dr. TRENBERTH. Well, my response to what came out of the Shanghai meeting in this particular case was that, first, the report actually roughly doubled in length. I certainly preferred the original draft. There is a tendency for some sectors of the United Nations to want to have certain things mentioned, such as the Asian monsoon or in Africa. Statements were carefully inserted. This can change the balance of the document a little bit, but the statements that are in there are actually accurate.

The heaviest lobbying that went on in Shanghai was actually from Saudi Arabia, who was clearly trying to water down and undermine the whole process, I would say.

Senator INHOFE. Dr. Lindzen, you said a minute ago, in response to one of the questions that was asked by Senator Chafee, that in your opening statement, a part you didn't get to in your summary, you had some examples of what was said, of statements that were the scientific statements as opposed to the political statements. Would you give an example or two?

Dr. LINDZEN. Well, let me first give an example of what Kevin mentioned as an alteration. In the original draft, the statement about man's responsibility read, "From the body of evidence since the second assessment, we conclude that there has been a discernible human influence on global climate." I would mention "discernible" doesn't tell you anything, because if it is below a certain value, it means we have no problem.

Studies are beginning to separate the contributions to observe climate change attributable to individual external issuances, both anthropogenic and natural. This work suggests that anthropogenic greenhouse gases are a substantial contributor to the observed warming, especially over the past 30 years, going back to that. However, the accuracy of these estimates continues to be limited by uncertainties in estimates of internal variability, natural and anthropogenic forces, and the climate response to external forces.

I think, by and large, that is a good statement. It was changed to, "In the light of new evidence, and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to an increase in greenhouse gas concentrations." There is a profound difference between these statements, but it was intended.

The same thing, the chapter Kevin and I worked on on physical processes pointed out many difficulties with models that were crucial to their prediction of significant warming, whether they were peripheral—concerning clouds; there were arguments about water vapor. There are all sorts of things in there.

The summary statement was, "Understanding of climate processes and their incorporation in climate models have been proved, including water vapor, sea ice dynamics, and ocean detransport." Not a clue that there were questions.

Senator INHOFE. That is a very good answer, and I don't want you to repeat any other examples, but in your written statement are there other examples? A few?

Dr. LINDZEN. Yes.

Senator INHOFE. All right. There is a statement that you had made, Dr. Lindzen, quoted here. "If we view Kyoto as an insurance policy, it is a policy where the premium appears to exceed the potential damages and where the coverage extends to only a small fraction of the potential damages." Would you like to elaborate on that?

Dr. LINDZEN. Sure. All I am saying is you have estimates of damages to the most likely forming scenario. You have estimates of GDP reduction from implementing Kyoto. At this point they are comparable or perhaps even the GDP looks a bit larger than the savings you incur by preventing the climate damage. Economists can argue over that. But then you come to the stunning fact that Kyoto will not change the climate much. So you are left with both the damages and the cost but no coverage. I don't think that is a reasonable insurance policy.

Senator INHOFE. Thank you very much. Thank you, Mr. Chairman.

Senator VOINOVICH. Senator Corzine?

Senator CORZINE. I guess with respect to that last response, I would love to hear Dr. Trenberth's comments on whether that tradeoff was exactly how other scientists would have assessed that cost-benefit analysis, because I think it is through that peer review and peer challenge that you can actually get to conclusions, if I understand the scientific process. So I would ask if you have any comments on that.

Then I have a whole series of issues that I'm confused when there are views expressed that the quantitative data, aside from the amount, the historic quantitative data, is in place and appears to be under challenge, whether we have had a global mean warming trend, whether you can use ice core delvings to actually draw scientific conclusions. Are there real debates about those issues? My reading—and, again, sometimes it is more popular press than the scientific press—would lead me to believe that there is an overwhelming weight of scientific argumentation with regard to a number of those kinds of statistical bases of historic review.

So those two areas: Why is there a debate today that I read in Dr. Lindzen's commentary on quantitative data from an historical perspective, leaving aside modeling, which always has some probability analysis associated with it? And then his comment on cost-benefit work that follows on from Senator Inhofe's question.

Dr. TRENBERTH. Well, first, looking at Kyoto, there are three options for dealing with this problem. One is to stop it from happening, cut emissions. The second is to adapt to the problem as it goes along, and the third one is to do nothing.

It doesn't seem as though it is possible to stop the problem, and I don't think "doing nothing" is an option, quite frankly. That means we have to adapt to the problem and plan for it.

What Kyoto does is it buys us about 15 years for when preindustrial levels of carbon dioxide would double is another way

of looking at it. It doesn't solve the problem, but it gives us more time to plan and to adapt to the climate change as it is happening.

Senator CORZINE. To study the real impacts of whether it is occurring, to give greater weight to the probability assessments that the models would have because you would have new information, presumably?

Dr. TRENBERTH. Right. The models can get better, and we can actually get into the whole business of really doing climate predictions, presumably, eventually.

With regard to the evidence, there is a lot of evidence and a lot of different variables that we can look at. It is very easy to point to one particular thing and say, oh, this suggests—like this cold winter in the Midwest, in the center of the country this year, global warming can't be happening, but, in fact, if you look around and look at it globally, you can see that this is part of an overall pattern, and Alaska had its warmest winter on record.

So there is a lot of natural variability. There are uncertainties in all of these things that scientists actually like to argue about, but the IPCC statement is an overall assessment, and it takes into account all of the evidence. What we find with some of the naysayers is that their evidence is often very selective. IPCC takes into account all of the evidence.

Senator CORZINE. So you find a state of consensus stronger, significantly stronger, than we are hearing from your colleague?

Dr. TRENBERTH. I would make that statement, yes.

Senator CORZINE. Thank you.

Senator VOINOVICH. Senator Clinton?

Senator CLINTON. Dr. Trenberth, I would like to ask you, what are your policy recommendations? I know that Dr. Lindzen suggests that there is no policy-relevant content to the information that is available at this point in time, but I would like to ask you to respond to that. I would appreciate any recommendations that you think do flow naturally from the understanding of the science as it is viewed today, because I agree with you that we can do nothing; we can adapt; we can try to reverse. What is it that you would recommend that this body take under consideration as policy to flow from the findings that you have put forth?

Dr. TRENBERTH. Essentially, the IPCC has made the statement that global warming is happening in their best assessment. We have attributed the recent climate change over the last, in particular, 30 years to the human influence on climate. There is a direct follow-on from that to say that these climate changes, therefore, are only going to have a greater impact in the future and it is likely to be disruptive. Probably the biggest impact on society is through extremes: the droughts and the floods, in particular.

So there is a cost to climate change. I think when we are considering the economy, we should not just be considering the costs of mitigation, but also the costs of climate change and the fact that they are put off in some other agency, like FEMA or somewhere else, and not considered. It is very hard to point your finger and say, "yes, this particular flood was caused by climate change," but the evidence does suggest often that there is a contributing factor, and that will probably only get worse. So I would encourage the

cost of climate change to be considered in the economic decisions that are being made.

My personal viewpoint is that there should be a very broad portfolio dealing with energy considerations. I find renewable energy sources and conservation measures and incentives to cut down on waste—not leave all the lights on in a building for security measures when it is not needed and then turn the air conditioning on to get rid of the surplus heat. Incentive structures to take that kind of thing away seem to be desirable, and a similar thing for automobiles in terms of gas mileage.

I am from New Zealand, and New Zealand's main source of power is hydroelectric power. I think it is one which is often overlooked. There are certainly environmental costs attached to that, as there are with wind farms or solar farms, so that one has to look at the tradeoffs on these things. I think a broad portfolio on all fronts is needed.

Senator CLINTON. I am also interested in your points about how greenhouse gases stay in the atmosphere and accumulate over a long period of time, and that while we are debating this issue, it is either getting worse or there is no impact. But if you were to go back to Senator Reid's point about being a gambler, it strikes me as a bad bet not to take what would be prudent measures and provide a policy framework to encourage such prudent measures while we continue to try to further plumb what the meaning of a lot of these changes is.

You have in your written testimony written about water and the impact of climate change on our water supplies, and particularly the safety of our drinking water. Could you elaborate what your concerns are about drinking water supplies and the access to water? I know we have seen some rather alarming trends with the Great Lakes having the second year of the lowest level that has been recorded. So the issues of water and temperature are ones that I would like you to briefly address.

Dr. TRENBERTH. Thank you, yes. Global warming produces increased drying, and this means that there is increased evaporation, and plants are apt to wilt somewhat sooner than they otherwise would without global warming.

The moisture in the atmosphere then is lying around. There are increases in moisture, and it gets gathered up by all of the weather systems. For example, a thunderstorm. It reaches out and gathers the water vapor that is available and dumps it down. The evidence suggests that when it rains now, it is raining harder than it was—about 10 percent harder—than it was 20 or 30 years ago.

There are a number of consequences of that. The first one is that more of the water runs off, and therefore, there is a risk of flooding as a result of that. It also means that less of it soaks into the soils and is then subsequently available for agriculture. So that exacerbates the risk of drought when the storms go away.

When there is runoff, a lot of the water runs off across the surface of the earth rather than soaking in through the soils. If it goes through the soils, there is a filtration process which cleans the water. If it runs off across the surface, it picks up all kinds of chemicals. Water is a solvent. It picks up fecal matter from fields, and so on, and water supplies get contaminated. There are many

examples around the United States, and especially in other countries, where there are stomach upsets and health problems often not related to any big picture thing. They are often isolated in small communities, mountain communities, and so on, but they are related to contamination of water supplies in this fashion.

Management of water, consequently, I believe, will be a major issue in the future, first, because when we get it, we are probably getting too much of it. Then, second, when we don't have it, it would be best if we could save it for later use. So I think this will be a big pressure point on society, given the increased demand.

Senator CLINTON. Thank you.

Senator VOINOVICH. Thank you.

Senator Lieberman, the ranking member of the subcommittee, is here. Senator Lieberman, would you like to make a statement?

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. Thanks very much.

Senator VOINOVICH. By the way, I should acknowledge the fact that the two of us met earlier and you suggested that we ought to have this hearing, and my response was I thought it was a great idea because so many of us are in the dark in terms of this whole issue of climate change, global warming. We have had a very lively meeting here this morning.

Senator LIEBERMAN. Thank you, Mr. Chairman. The first thing I wanted to do was to thank you for convening this hearing. In the normal course of life in the Senate, wouldn't you know it, on the morning it is held I am detained in the ongoing negotiations on the education bill that is on the floor. So I apologize to you, my colleagues, and to the witnesses.

I have read the testimony that you have given. I just would say a few words and ask that my full statement be included in the record, if I might.

Senator LIEBERMAN. To me, this is an issue that really will test our political leadership here in this country, all of us, and around the world because it is an issue which I believe, as a layperson following the science, that there is compelling evidence that, in fact, the planet is warming. While we are beginning to see some consequences of it, as Senator Stevens said yesterday at a Commerce Committee hearing, that he was struck by the creeping of the ocean waters into Arctic villages, for instance.

Nonetheless, the great test here is that the worst consequences of this will not happen in the lives of many of us here now. So this calls on us to truly be trustees, stewards of the planet and protectors of those who follow us here. I hope we can rise to that challenge.

The Senate has followed deliberations here, often funding programs to at least begin to deal with the problem. We had that now legendary Byrd-Hagel resolution some period of time ago. I do think the resolution is subject, at least by my understanding, my participation in it, there is some misunderstanding because a number of us who are quite intensely concerned about global warming voted for it for two reasons.

One was we thought the main thrust of it was not to oppose Kyoto, but to say that ultimately this problem was only going to be solved and American leadership was only going to make sense if the developing nations also were part of the solution; they're not standing aside as part of the problem. I think the resolution has been misinterpreted or misunderstood, and understandably so, since then, but I hope that we can come back and rebuild a consensus to do something about this problem.

I was troubled by the Administration's unilateral statement of intention of essentially withdrawal from Kyoto or pull away from it. I am encouraged, on the other hand, by the stories I read that within the Administration there is a group meeting studying global warming, hearing from experts with varying opinions on it, which I appreciate it.

I guess I was troubled a few days ago when Vice President Cheney gave that speech up in Toronto outlining some of the upcoming proposals for a National Energy Policy, and in the entire speech there was not one mention of climate change and the consequences of the investments that he was talking about in coal and other greenhouse gas-emitting energy technologies on our climate. So I think we have a lot of work to do together here. I hope this kind of hearing in which we all learn will be the basis for the Senate to go forward and try to find common ground.

I remember a few years ago, Mr. Chairman, the late Senator Chafee, John Chafee, and I put in a measure which we thought was really a small step forward and would not engender any opposition. We simply said in the proposal that we should create a means to give credit to greenhouse gas-emitting sources, industries particularly, for reducing those greenhouse gas emissions prior to any national scheme for requiring those reductions, but so that they would get credit for their initiative today. John Chafee and I found that we were, I wouldn't say roundly attacked, but at least opposed by people on all sides, one side thinking we were putting the proverbial camel's nose under the tent and the other side feeling that we were not obviously asking as much as was required by the facts here.

So having had that experience, I understand the perils of trying to form a consensus here, but I hope through our leadership on this committee—and I thank you again for convening this hearing—that we can openmindedly assess the facts and finds some ways to move forward.

I remember being at a seminar on global warming several years ago, and there was a Congressman there from the House. It happened to be a Republican. When it was over, he said—they were scientists we were listening to—he said, now if you all are right and we act in response to your advice, we will essentially save the planet as we know it; if you're wrong and we're just hyperventilating, overreacting, we will have taken action to reduce air pollution, to make America more energy-independent. Either way, it is not a bad result, and I agree. So we hope we can find ways to continue to move forward.

Thanks, Mr. Chairman, for allowing me to say a few words today. I look forward to the testimony of the second panel. I thank both of the witnesses.

Senator VOINOVICH. OK, thank you, Senator.

The witnesses would agree that human beings have contributed to warming the atmosphere? Both of you agree to that, that there is a thing called global warming that is occurring and that we contribute to it in some fashion? Do both witnesses agree to that?

Dr. TRENBERTH. I would agree.

Dr. LINDZEN. Sure, as long as you put no numbers on it.

Senator VOINOVICH. OK, all right. I am going to get into a practical situation. If we assume that wind, solar, hydro, and some of these other things that are being talked about cannot currently or in the near future respond to the energy demands of the United States of America, and we take into consideration that we are seeing some astronomic increases in energy costs going on throughout our country—particularly in my own State, the heating bills of people there and the businesses have been just extreme, particularly for businesses.

I believe, for example, that the heating energy cost thing is really contributing substantially to the recession that we are in today in this country. We have to look at more nuclear, and let's say, contrary to what Senator Reid said, moving away from fossils, that we have to take advantage of the 250 years of coal fossil fuel we have available today in this country. There are some who argue that we should have mandatory caps on the amount of CO_2 emissions.

The question is, if we do go forward and we burn coal, and we use the best clean coal technology that is available, what do you think about the issue of having some type of mandatory cap on CO_2 connected with that? Now the President has basically said he is not for that, CO_2 should not be part of that consideration. The issue is, should we mandate a cap on it at a national level or should we rather say that there is no question that there is a problem that man is contributing and that fossil fuel probably is one of the contributors to it, and that we ought to be doing everything to encourage people to reduce CO_2, including sequestration, and so forth, but not make it mandatory, in light of the fact the cost involved in that kind of thing would be very expensive, and therefore, drive up the cost of energy in this country? Do you understand the question?

Dr. TRENBERTH. I think perhaps I can comment somewhat sensibly on it at least. One of the problems with the cap is, how do you trace who exceeded their allotment? This is part of the problem actually also with Kyoto. What would the penalty actually be? I think there are a lot of problems with a cap, and that probably isn't the way you would want to go about doing things.

The whole timeline is a considerable issue. This is true also with Kyoto. On the one hand, there is a need for binding targets, but the timelines that are needed have to take into account the changes in technology that are needed. So if you are dealing with the motorcar, a 10-year timeline is a reasonable timeline. If you are dealing with a coal-fired power station, then the lifetime of the power station is 35 or 40 years, and what you want to do is to make sure that, when that power station has reached its fruitful life, that maybe new technology is used to replace it, if you don't want to write that thing off and have a big economic cost as a result. So the way in which you go about doing these things and multiple timelines seem to me to be a useful thing to do.

Another part of this with regard to caps and related things is that this is a global problem—and this is one of the things we have just been highlighting with Kyoto—is that there are not targets for a number of developing countries. I think that is, indeed, a problem. On the other hand—well, I won't comment further on Kyoto. I think that Kyoto is a useful basis for moving ahead perhaps, but it does require then international negotiations also in order to really deal with this problem, but leadership by the United States in showing how we might go about it could be a big step forward.

Senator VOINOVICH. Dr. Lindzen?

Dr. LINDZEN. Yes, I said to Senator Reid, the we don't pretend expertise on energy policy, but there is one mathematical statement one can make. If one needs to optimize a policy for economical, efficient, and pollution-free energy reduction, one does not generally aid the optimization by putting additional constraints on it. We have to decide our own priorities, and if this is not per se a priority, the others will not be helped by it. You can do a better job without it.

Senator VOINOVICH. Any of the other Senators here want to ask questions of the witnesses?

[No response.]

I want to thank you very much. This has been very helpful to me, and I think I am less confused than I was before.

Dr. Trenberth?

Dr. TRENBERTH. You were citing some magazines before, and I just thought I might add one to your collection. The latest issue of Environment magazine, the May issue, the cover story is on human influence on climate, and, in fact, the cover story is by myself. It is actually a summary and a commentary on the latest IPCC report.

Senator VOINOVICH. Thank you very much. I will get it.

I really appreciate the two of you being here today.

Our next panel—and I appreciate their patience here this morning—is Dr. John R. Christy, Dr. Jae Edmonds, Dr. Rattan Lal, Mr. James E. Rogers, and Dr. Marilyn A. Brown.

I think the witnesses are all familiar with the procedure here. They had a chance to watch it.

Our first witness will be Dr. John R. Christy. Dr. Christy is an Associate Professor, Department of Atmospheric Science, the University of Alabama at Huntsville. Dr. Christy, thank you for being here.

STATEMENT OF JOHN R. CHRISTY, PROFESSOR, DEPARTMENT OF ATMOSPHERIC SCIENCE, UNIVERSITY OF ALABAMA IN HUNTSVILLE

Dr. CHRISTY. Thank you, Mr. Chairman and committee members. Actually, I was promoted 3 or 4 years ago to professor. I am also Alabama State Climatologist and recently served as one of the lead authors of the IPCC. I am glad to be back in front of this committee to testify about climate change again.

I will refer to the figures that are in the back of your written testimony I have submitted.

I want to say first that carbon dioxide, the agent thought to exert the largest part of human-related climate change, is literally the

lifeblood of the planet. The green world you see around you would not be here without it. Carbon dioxide means life, and at several times its current value promoted the development of the plant world we now depend on and enjoy. Carbon dioxide is not a pollutant.

Now will CO_2 affect the climate significantly? The models suggest the answer is yes, though I have serious doubts. A common feature of climate model projections with CO_2 increases——

Senator VOINOVICH. Dr. Christy, I wear hearing aids, and you are speaking very fast, and I am having a hard time understanding. Could you slow down a little bit? I know you want to get what you can in in the 5-minutes, but if you could slow down——

Dr. CHRISTY. Excuse me. A common feature of climate model projections with CO_2 increases is a rise in the global temperature of the atmospheric layer from the surface to 30,000 feet. This temperature rise itself is projected to be significant at surface, with similar or increasing magnitude as one rises through this layer we call the troposphere.

Over the past 22 years, calculations of surface temperature, indeed, show a rise between 0.5 and 0.6 degrees Fahrenheit. This is about half the total rise in the last 100 years. In the troposphere, however, there are estimates which include the satellite data that Dr. Roy Spencer of NASA and I produced, which show there is only a slight warming, 0 to 0.15 degrees Fahrenheit, as shown in figure 1. New evidence, shown in figures 2 and 3, corroborate that many different systems show the same thing: the bulk of the atmosphere has not warmed in the past 22 years.

Now since my last appearance before this committee there has been 1 year above the 20-year average and two below it. Rather than seeing a rise in global temperature that increases with altitude, as climate models project, we see that in the real world since 1979 the warming decreases substantially with altitude.

Am I coming across?

Senator VOINOVICH. Yes, thank you.

Dr. CHRISTY. So the reality of the past 22 years may only indicate that the climate experiences large, natural variations in the vertical temperature structure which climate models have yet to reproduce. However, this means that any attention drawn to the surface temperature rise over the past 20-plus years as evidence of climate change must also acknowledge the fact that the bulk of the atmosphere that was projected to warm has not.

One modeler told me recently that the surface versus troposphere difference was the largest problem they faced. Well, this is a curious phenomenon, but we don't live 30,000 feet in the atmosphere and we don't live in a global average. We live in specific places on the earth.

Making projections for local regional places is virtually impossible. I will show an example from Alabama, figure 4. You will see several climate model runs of temperature showing Alabama's temperature from 1860 to the present and then beyond to 2100. It is clear that the model runs did not do especially well over the time period of observations, and none predicted the cooling that we have actually experienced in the State of Alabama. If in trying to repro-

duce the past we see such errors, we can only expect to see similar errors in the predictions.

I want the committee to be very, very skeptical of media reports in which weather extremes are used as proof of human-induced climate change. Weather extremes occur somewhere all the time. For example, the U.S. temperature for last November/December combined was estimated to be the coldest since records began in 1895. That does not prove that the United States or the globe is cooling or that climate is changing unnaturally. What it demonstrates is that extremes occur all the time.

Other climate data gives similar nonalarmist results, and therefore, are overlooked by the media. As we showed in the IPCC, hurricanes have not increased; thunderstorms, hail, and tornadoes have not increased. Droughts and wet spells, as shown in figure 5, in the United States have not increased or decreased.

I will skip that piece right there; I see the yellow light.

I am decidedly an optimist about this situation. Our country is often criticized for producing 25 percent of the world's anthropogenic CO_2. However, we are rarely recognized and applauded for producing with that CO_2 25 percent of what the world really wants and needs: its food, technology, medical advances, defense, and so on. As figure 7 shows, we in the United States will continue to produce more and more of the world wants with increasing energy efficiency.

In summary, I would say, as someone who actually produces and analyzes climate information, that I find pronouncements today about climate change catastrophes due to increased greenhouse gases to be very overly alarmist. Thank you.

Senator VOINOVICH. Thank you, Dr. Christy.

Dr. Edmonds, who is from the Pacific Northwest National Laboratory. Dr. Edmonds.

STATEMENT OF JAE EDMONDS, PACIFIC NORTHWEST NATIONAL LABORATORY, BATTELLE MEMORIAL INSTITUTE

Dr. EDMONDS. Thank you, Mr. Chairman and members of the committee, for the opportunity to testify here this morning on energy and climate. My presence here today is possible because the U.S. Department of Energy has provided me and my team at the Pacific Northwest National Laboratory long-term research supports, and without that support, much of the knowledge base on which I draw today would not exist. That having been said, I come here today to speak as a researcher, and the views I express are mine alone.

I will focus my remarks on two matters: first, the timing of the global response decline or change needed to stabilize the concentration of greenhouse gases in the atmosphere and, two, the need to expedite the development of technologies to achieve this goal at reasonable cost. My remarks are grounded in a small number of important observations.

The United States is a party to the Framework Convention on Climate Change, which has as its objective the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. This is not the same as stabilizing emissions. Be-

cause emissions accumulate in the atmosphere, the concentration of carbon dioxide will continue to rise indefinitely even if emissions are held at current levels or slightly reduced. Limiting the concentration of CO_2, the most important greenhouse gas, means that the global energy system must be transformed by the end of the 21st century. Given the long life of energy infrastructure, preparations for that transformation must start today.

In 1996, Drs. Wigley, Richels and I published an economics-based analysis of carbon emissions time paths that would stabilize CO_2 concentrations. This work indicates that an energy transition must begin in the very near future.

For example, for a global concentration of 550 parts per million, global CO_2 emissions must begin to break from present trends within the next 10 to 15 years. Given that it takes decades to go from energy research to the practical application of the research within some commercial energy technology, and then perhaps another three to four decades before that technology is widely deployed throughout the global energy market, we will likely have to make this deflection from present trends with technologies that are already developed.

To reduce global emissions even further would require a fundamental transformation in the way we use energy, and that will only be possible if we have an energy technology revolution. That will only come about if we increase our investments in energy R&D.

The global energy system, and not just the United States energy system, must undergo a transition from a one in which emissions continue to grow throughout the century into one in which emissions keep and then begin to decline. Coupled with significant global population and economic growth, this transition represents a daunting task, even if the concentration as high as 750 parts per million is eventually determined to meet the goal of the Framework Convention.

A credible commitment to limit cumulative emissions is also needed to move new energy technologies off the shelf and into widespread adoption in the marketplace. The cost of stabilizing the concentration of greenhouse gases will depend on many factors, including the desired concentration, economic and population growth, and the portfolio of energy technologies that might be made available. Not surprisingly, if the costs are lower, the better and more cost-effective the portfolio of energy technologies that can be developed.

The Global Energy Technology Strategy Program to address climate change is an international public/private sector collaboration advised by an eminent steering group. Analysis conducted during the first phase of that program supports the need for a diverse technology portfolio. No single technology controls the cost of stabilizing CO_2 concentrations under all circumstances. The portfolio of energy technologies that is employed varies across space and time. Regional differences inevitably lead to different technology mixes in different nations, while changes in technology options over time inevitably lead to different technology mixes across time.

Recent trends in public and private spending on energy research and development in the world and in the United States suggests

that the role of technology in addressing climate change may not be fully understood or appreciated. Although public investment in energy R&D has increased slightly in Japan, it has declined somewhat in the United States and dramatically in Europe, where reductions of 70 percent or more since the 1980's are the norm. Moreover, less than 3 percent of this investment is directed at technologies that, although not currently available commercially at an appreciable level, have the potential to lower the cost of stabilization significantly.

Mr. Chairman, thank you for this opportunity to testify. I will be happy to answer your and the committee's questions.

Senator VOINOVICH. Thank you, Dr. Edmonds.

Our next witness is Dr. Rattan Lal, School of Natural Resources at the Ohio State University, which is my alma mater. Dr. Lal, we are very happy to have you here.

STATEMENT OF RATTAN LAL, SCHOOL OF NATURAL RESOURCES, OHIO STATE UNIVERSITY

Dr. LAL. Thank you, Senator. I feel greatly honored to be here to be part of this very important hearing.

In addition to the strong support that I receive from the State of Ohio and Ohio State University, I have also received support from the Natural Resource Conservation Service of the USDA for the last 10 years. We are also developing a program now with three National Laboratories: the Pacific Northwest National Laboratory, the Oak Ridge National Laboratory, and the Los Alamos National Laboratory.

I want to address three issues in this very short time. No. 1, we have heard today that the source of carbon dioxide is primarily fossil fuel combustion. I want to indicate a couple of other sources which are also important. No. 2, what is the impact of laws on the carbon from the other sources on the quantity of those resources? And, No. 3, agriculture is often blamed as the cause of environmental problems, and I would like to state a potential that agriculture can, indeed, be a solution to the problems.

Senator I especially want to come back to the point that you raised that Ohio has been growing 11 million trees, and I want to indicate what those trees might be doing toward potential sink in soil of the carbon.

No. 1 problem: The carbon dioxide concentration has changed from about 600 gigatons in the pre-industrial era to 770 gigatons now. A gigaton is a billion tons. There are two sources from which that problem came. Fossil fuel combustion contributed 270 gigatons. In comparison to that, deforestation, biomass burning, and soil cultivation with respect to plowing contributed 136 gigatons. Out of that 136 gigatons, soil cultivation, plowing, et cetera, contributed somewhere between 60 and 90 gigatons. So soil and deforestation have been in the past a very important source of carbon. The difference is, while fossil fuel carbon we cannot reverse, the carbon in soil and trees that we have lost we can reverse, and that also can have an important impact on the natural resources and the economy.

The No. 2 point which I want to raise is, what impact did have the loss of carbon from soil on the quality of the soil, on the quality

of the water resources? First of all, most of our nation's soils have lost over one-third to one-half of their soil carbon pool since the start of agriculture. That carbon pool amounts to 10 to 20 tons of carbon per acre so far that we have lost in the middle of the United States. This loss of carbon from soil has resulted in decline in soil quality, which means we have put more fertilizers, performed extractive operations, applied other inputs to produce the same yield that we would have if the quality of our soil had not deteriorated.

Because of the loss of soil carbon, the results are increased soil erosion, sedimentation, flooding, leaching of pollutants, and transport of other contaminants into the natural waters. The dangers of nonpoint-source pollution are exacerbated by erosion and reduction in the capacity of soil to bar chemicals. These problems have resulted in considerable environmental issues that need to be addressed.

My third point then is, how can agriculture be a solution to this problem? First of all, there are two things we can do. We can restore the degraded soils. Whether they are degraded by erosion, by mining—we have quite a lot of mineland activities—or by other processes, those soils can be restored and reclaimed. Some of the carbon that we lost, 20 or 30 tons per acre, some of it, maybe 60 percent of it, can be put back through restoration.

Some of the techniques for restoration include CRP, the Conservation Reserve Program; a wetlands reserve program; mineland reclamation, restoring vegetative buffers and strips along riparian zones.

Adopting conservation tillings, we have only about to 30 or 40 percent of the conservation tillings and rotation. I think that is another very important one. Forestation, as you mentioned, is a very important one.

The potential of all these practices is about 270 gigatons of carbon sequestration a year in the United States compared to a total potential, including forest fire models, if you combine soil and forest, about 520 gigatons. This potential is about 70 percent of the commitment the United States would have under the Kyoto Protocol.

This is a truly win/win situation. It improves soil/water quality. It increased agricultural and forest production. It reduces gaseous emissions, and as Senator Lieberman said, you cannot go wrong. Either way, this is the best option.

I thank you, Senator, for giving me the opportunity to be here.

Senator VOINOVICH. Thank you, Dr. Lal.

Our next witness is James E. Rogers. Mr. Rogers is Chairman, President, and CEO of the Cinergy Corporation. Mr. Rogers, thank you for being here today.

Again, thank you all for your patience.

STATEMENT OF JAMES E. ROGERS, CHAIRMAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, CINERGY CORPORATION

Mr. ROGERS. Mr. Chairman and members of the committee, I would like to thank you all very much for giving me the opportunity to share my thoughts on global climate change.

It was my pleasure to testify before this committee last year on the need for a comprehensive environmental emissions reduction

program for coal-fired plants, where you would have a reduction of SOx, NOx, and mercury, and also address the CO_2 issue. My views have not changed since that hearing. With the growing demand for more electric generation, energy producers, now more than ever, need certainty that could come from a comprehensive, longer-term reduction program that this Congress should pass, certainly should consider and pass.

In addition, I believe that Congress must consider at the same time the uncertainties and challenges posed to my industry by the climate change issue. If legislative remedies are intended to build some kind of certainty into our planning process, climate change must be on that environmental roadmap.

Now our company has a lot at stake. We are the largest non-nuclear utility. We are heavily dependent on coal. We burn 30 million tons of coal a year, and we have worked hard to reduce the impact of our coal-fired plants on the environment. We spent $650 million in emission controls and clean coal technology in the last decade. We are spending $700 million to reduce NOx over the next 3 years. We just spent a billion for gas-fired plants that are environmentally more friendly than coal-fired plants with respect to their emissions.

As I sit here and look at the challenges that we have and I think about the issues and I listen to the science this morning and the discussion on this panel, you all have had the opportunity to hear from several very distinguished witnesses regarding the state of the science on the climate issue. Mr. Chairman, you asked a question with respect to the uncertainties, and I thought you got a clear answer, as clear as you can get. But it is clear that there are uncertainties. But, notwithstanding the uncertainties, I believe that it is prudent to start taking measured steps now to begin to address the risks.

I thought it was interesting that Senator Chafee pointed out that six out of seven people on these panels have Ph.D.'s. I happen to be the one who doesn't. I actually find that an advantage.

I come from the business world and, as a lawyer, deal with ambiguities, uncertainties, improbabilities, and that is what this issue really is all about, if you think about it. I would suggest to you that, as policymakers, you need to think about this as we do as business people. You need to view the climate issue as a risk mitigation challenge.

What does that mean? What that means is we need to come up with a very pragmatic, common-sense approach to the issue. We need to focus in the first instance on no-regrets first steps and lay the groundwork for future transformation of the energy production fleet in the United States.

First steps should focus on activities that provide other benefits as well as reduce carbon. We can reduce other harmful emissions. We can decrease fuel consumption. We can lower production costs. We can decrease the need for new generating plants. We can focus on conservation and demand-side management. These are the kinds of first steps that we need to be taking.

We need, to say it in another way, to take first steps that hold the industry roughly where it is today. Let the debate continue. Let the scientific analysis continue. But this is a do no harm strategy.

We are at a tricky point in terms of our understanding of where we are, but what we ought to be doing is looking at ways to flatten out the carbon growth curve, allow technology to develop, and to continue the analysis. To me, those first steps are critical, and we cannot plan to provide energy for the people of this country unless we have certainty with respect not only to SOx, NOx, and mercury, but also with respect to the climate change issue.

Longer term—and this is a long-term issue we need to address—longer term we need to continue to fund R&D programs for new technologies to generate zero emission power. So, as I sit here before you this morning, I am kind of reminded of the fact that for 25 years I had Neil Armstrong on my board of directors. I haven't been around that long, but he has certainly served on that board for that period of time.

As I think about what this country did 40 years ago, when we really as a country stepped up and focused on putting a man on the moon, we need that same kind of commitment and passion in trying to attack the technological puzzle that is wrapped around this whole climate change issue. We need to take first steps, as I suggested, but we also need to make a commitment on a longer-term basis to deal with it, because we have the capability within this country to develop the technology to deal with these issues. We just need to get on about it and recognize that, yes, there are uncertainties; yes, there are ambiguities, but we must take the first step. That is the only way we can provide reliable, affordable energy to people and at the same time achieve our environmental goals in this country.

Thank you.

Senator VOINOVICH. Thank you.

Our next witness is Dr. Marilyn A. Brown. Dr. Brown is the Director of Energy Efficiency and Renewable Energy Program at the Oak Ridge National Laboratory. Thank you, Dr. Brown, for being here and, again, your patience.

STATEMENT OF MARILYN A. BROWN, DIRECTOR, ENERGY EFFICIENCY AND RENEWABLE ENERGY PROGRAM, OAK RIDGE NATIONAL LABORATORY

Dr. BROWN. Thank you, Mr. Chairman and members of the committee, for inviting me to talk with you today. I am also the lead author of a recently published report called "Scenarios for a Clean Energy Future," and I would like to highlight some of its key findings for you.

That report was co-authored by researchers of five Department of Energy national laboratories. It was funded by the Energy Department and the Environmental Protection Agency, but the views I am expressing today are not necessarily those of those two funding agencies.

This study is the most comprehensive assessment to date of technologies and policies that can be deployed to address the nation's energy challenges. It involves the analysis of hundreds of technologies and policies. The focus is the United States and the timeframe is the next 20 years.

The study creates a range of scenarios that characterize how the future might unfold under different sets of policies. First, we have

the business-as-usual scenario, which is really a forecast. If policies continue as they are today, what will happen? The other two major scenarios are defined by policies that assume that the public and political leaders have a greater sense of resolve to address the nation's energy needs and environmental challenges.

So under the business-as-usual forecast, we see a continuing increase in energy consumption in this country, about 10 percent more in each of the next two decades, and there is a concomitant increase in carbon emissions, about proportionate to energy use.

In the moderate scenario, one of these alternative policies scenarios, we define an array of market-based policies that range from a 50 percent increase in energy research to an expanded set of voluntary programs such as those currently in operation at DOE and EPA, and a system of tax credits to promote efficient appliances, vehicles, and non-hydro renewable electricity.

In the advanced scenario we are a bit more aggressive, and we define policies that include, for instance, doubling our current energy R&D budgets and voluntary agreements between industry and the government to reduce the energy content of our industrial products, as well as agreements between government and automakers to achieve various fuel economy goals, renewable portfolio standards, and, finally, a domestic carbon cap and trading system.

So we have these three scenarios. I am going to focus mostly on where we get with the advanced scenario, but just keep in mind we get between a third and a half as far with the moderate set of more market-based policies.

So under this advanced scenario, the United States consumes 20 percent less in the year 2020 than it would under the forecast that assumes today's policies. That savings is enough to meet the energy needs of all the businesses, consumers, and industries in the three largest energy-consuming States of the United States: California, Texas, and Ohio. It will bring us down essentially to where we are today in terms of our energy needs.

By 2020, U.S. carbon emissions would be reduced back to 1990 levels. In addition, NOx, SOx, and mercury emissions would be significantly reduced. We would save consumers money on their energy bills. In particular, $122 billion in reduced energy costs in the year 2020 would be achieved. Some but not all energy prices would rise. Because of the carbon cap and trade system and other policies, the amount of energy required to drive our economy would be so much reduced that the total energy bill would be less in the aggregate than it would be today.

Oil consumption is cut by 5 million barrels per day. This results in a reduction of $23 billion in reduced transfer of wealth from U.S. oil consumers to world oil exporters in the year 2020.

Finally, electricity demand would be cut 22 percent relative to the forecasters' growth rate, just a few percentage more than today's electricity requirements.

What evidence do we have that such technologies are real possibilities and not just wishful thinking? In my testimony, if you will take a look at figure 3, we show the progress that has been made in improving the efficiency of today's appliances, in particular, the household refrigerator. Back in 1970 those units that, hopefully, you no longer have in your basement cooling beer, they consumed

nearly 2,000 kilowatt hours per year. Today's new refrigerator consumes approximately 600 kilowatt hours, and that is the result of a major research effort funded by the Department of Energy, along with Federal standards that regulate the power consumption of appliances.

I have many other technology opportunity examples in my testimony. I will just quickly segue to the conclusions. This Clean Energy Future study identifies a set of policy pathways that could speed the development and introduction of cost-effective, efficient, and clean energy technologies into the marketplace. These technologies are good for business, they are good for the consumers, and they are good for the economy and the environment.

To secure these benefits, the nation needs to move forward on many fronts to develop policies to remove the market barriers, to conduct the research, to accelerate this technological progress, and to conduct programs to facilitate deployment. These, in combination with the political leadership that the world expects of the United States, are all essential ingredients of a clean energy future and of a balanced national energy and environmental policy.

Thank you.

Senator VOINOVICH. Thank you very much.

Mr. Rogers, in your opinion, what would the Kyoto Treaty, if implemented, do to your company, the utility industry, and our nation's economy? You also in your testimony talked about technology incentives. I am a little bit concerned about the Federal Government—and Dr. Brown, you talked about incentives also—I am concerned a little bit about the Federal Government choosing technology winners and losers. How would you structure an incentive program that doesn't preclude technologies which we may not even be aware of today, and then what would the Federal Government's role be in this?

Mr. ROGERS. Let me first address the Kyoto Protocol. Senator Voinovich, it is pretty clear that, given the tremendous growth in our economy in the decade of the nineties, it would be very difficult today during the timeline of the Kyoto Protocol to reduce CO_2 7 percent below the 1990 levels. So, to me, the possibility—there is a very low probability that we could hit the 1990 level. It is just not doable given the growth in the economy today and still at the same time provide affordable, reliable power to fuel the economy of this country.

That was the Kyoto Protocol. That doesn't say that we shouldn't step up and make some commitments with respect to climate change and CO_2 going forward. I think the important point here is, as we debate and as the science continues to evolve, we need to flatten the curve. That is to me a no-regrets way to think about this issue going forward. So it is pretty clear to me the adverse impact it could have on the cost of power and the economy to get back to 1990, but I don't think that in any way takes away from trying to flatten the curve going forward.

With respect to technology, I agree with you, the government shouldn't be in the business of picking winners and losers. The government should also create the right environment for investment. To the extent that we step up and deal from a policy standpoint with SOx, NOx, mercury, and we deal in a clear way with CO_2, and

give some certainty to what the requirements are going to be, it is the giving certainty with respect to future reductions that will drive the development of technology.

There are different kinds of technology. There is technology with respect to reducing emissions. There is no silver bullet answer for CO_2 today, but that is not to say that it might not get developed over the next 5 to 10 years.

At the same time, we will encourage technology with new electric production. We know we have investments in renewables. Our own company is invested in wind. We have invested in fuel cells. We have invested in micro-turbines. So there is a number of new technologies that we in the industry are already investing in as we look down the road. But it is certainly with respect to future environmental requirements that will be the force that drives it. That is the technology.

We, as you know, were successful in the early 1990's with coal gasification. The reality is, to make that commercial and economic, you have to have those first steps. So, again, funding coal gasification is something that happened in the decade of the 1990's. We need to consider to look at it for new state-of-the-art technologies and move it forward.

Senator VOINOVICH. My comment is that we need new technology and we need to go forward, but one of the things I keep hearing here in the Senate from some of my colleagues is it is wind, it is solar, it is water. From a realistic point of view, if you look at the energy needs of this country, these are good things and we need to move forward with them, but the fact is our energy needs are going up, which forces us to look at: What do we currently have and how do we deal with it, and how do we provide the energy to this country and at the same time think about the consumers that are involved? They really haven't been at the table and, frankly, have not been concerned lately because they have been kind of on a honeymoon in terms of energy costs, but now we are starting to see that the chickens have come home to roost.

These prices are starting to go up. They are starting to have an impact on—I had hearings in Cleveland with the Catholic charities and with Lutheran on housing and heating costs and the impact that it is having on the least of our brothers and sisters. How do you reconcile dealing with these environmental needs and the energy needs and also think about the impact that this is going to have on just the ordinary citizen, and beyond that, what impact it is going to have on the economy of the United States of America?

I think somebody made the point earlier that—was it some 25 percent were contributing, but nobody talks about the 25 percent that we are contributing to the economy, providing the goods and services to people that people need. That is the problem that we all have to grapple with in terms of moving forward in this area.

There is no question that the panelists all agree that we need to have more technology and start looking at these things, hoping that as we rachet those things up, the demands for some of these other things will either level off or ultimately come down, which would be good for everyone.

Mr. ROGERS. Senator Voinovich, I thought you made a very good point. I mean, we can't solve it all with renewables. We understand

that. We have got to continue to use coal. Fifty-one percent of the electricity in this country is produced by coal.

I would quickly suggest there are some in the coal industry who think to deal with climate change means the end of coal. I don't believe that. I believe that we can still address the issue and we will still use coal. We're at a delicate point now because you are right, if you look back over the last 10 to 12 years, all across the country new power plants haven't been built, electric rates have generally decreased in real terms dramatically, and even for our own company they have decreased in model terms over the last 10 years as coal prices have come down.

The fact of the matter is that we are in a different part of the cycle than we have been in the last 10 years. We are in a part of the cycle where we have to build new generation to meet the needs. But the question is: What kind of generation? What is the right mix of generation? What are our environmental commitments as we go forward?

I wanted to tell you I cannot—I just bought a $1 billion worth of gas-fired. I am not convinced that I want to build more gas-fired or buy more gas-fired generation, given that the current price of natural gas, which has doubled in the last year.

So then the answer is, well, how do I meet the demands of my customers? I would like to build a state-of-the-art coal plant, but the reality is nobody in this country is going to turn—while there has been a lot proposed, there has been no dirt turned on coal plants. Because the uncertainty with respect to SOx, mercury, and CO_2 is great, it makes it very difficult for anybody to make that bet, given those uncertainties.

Senator VOINOVICH. Senator Lieberman? Thank you.

Senator LIEBERMAN. Thanks, Mr. Chairman.

Mr. Rogers, maybe I will pick right up with you because I appreciate very much what you have said. I take it you believe that, one way or the other, there are going to be CO_2 reductions required of your industry in the future?

Mr. ROGERS. I agree.

Senator LIEBERMAN. I am going to read from the end of your statement because I think it is important. This is the written statement. You said, "My company seeks comprehensive multi-emission power plant legislation because we want long-term clarity and certainty built into our environmental compliance planning process. I think there is general agreement on both sides of the aisle that this approach makes sense.

"For me, this line of reasoning dictates the necessity of including a carbon commitment in the legislation. Without some sense of what our carbon commitment might be over the next 10, 15, or 20 years, how can I or any other utility CEO think we have a complete picture of what major requirements our plants may face."

So I appreciate that statement, and, of course, I agree with you on the first part that, one way or the other, there will be CO_2 reductions required. I take it what you are saying is the obvious, which is that you need a certain picture of the future to make the kinds of enormous investments that are required, and to do it in a rational way.

Mr. ROGERS. I think it is critical that we address today—I mean, again, I don't know if "balance" is the right word between our need for affordable energy in this country to fuel our economy and our environmental goals, because it seems to be a tradeoff. You either get one or you get the other. I don't think that—we ought to be smart enough to solve to get both.

Senator LIEBERMAN. Right.

Mr. ROGERS. So it is my judgment that if we get clarity on the environmental policy from Congress, then we can go to work and invest in the technologies, go to work to hit the deadlines that are set out there. But we also have to be realistic.

The other thing that I did, Senator Lieberman, is list what I thought were the criteria in terms of any kind of legislation on CO_2, including reasonable timelines, recognizing this problem took a long time for us to get to where we are and it is going to take a long time to work our way out of it. But it is my firm belief we have to get started now on the problem.

Quite frankly, from my standpoint, if you guys just kind of put it off for 5 years or for 10 years, and I go build a plant with a 40-year life, I still have to deal with the issue then, but I had to be able to plan my way into it.

Senator LIEBERMAN. I really hope just on the basis of exactly what you are saying we can re-engage the Administration in this question and see if we can find a way to add carbon to the three other pollutants that the Administration is committed to regulating, and what was originally talked about I thought was a pretty creative, non-command-and-control approach to this with market-based trading based on the Clean Air Act. I hope we can find our way to back this.

The final question for you, if I may, just listening to Dr. Edmonds' testimony about timelines and years by which we have to really begin to deal with this, how much time generally is necessary for you to plan for the development of a power plant?

Mr. ROGERS. Once you make the decision that you want to build a power plant, it takes a couple of years to get all the environmental permits that you need to get it done, the lineup, the equipment. It then for coal planning could take you between three and 5 years to build. There are no overnight answers when you are building base-low plants.

We have been able to satisfy ourselves by building these simple cycle gas-fired plants that you could put on the ground pretty quickly, in a year or 18 months, but the requirements just to build a new coal plant, there is a long lead time associated with that.

Senator LIEBERMAN. Thanks.

Dr. Lal, I appreciated your testimony. I was actually at Kyoto when the pact was agreed on, and some of the most intense discussions were over sequestration. As you probably know, last year at the Hague again the battle continued because in some sense I think some of us around the world feel that the United States' focusing on sequestration is in a sense trying to buy our way out without reducing our use. I always feel this is all about the result, and there are various ways to achieve the result. What you are talking about depends on new technologies, and what Dr. Brown has talked about, et cetera, et cetera.

I wonder if you have thought about what Federal programs might be important for implementing the kinds of agricultural and forest measures that you have described in your testimony.

Dr. LAL. Thank you, Senator. Two points: One, yes, I was at the Hague meeting, and I was also disappointed that the sinks were not accepted in the discussion. First of all, the U.S. probably has lost about 3 to 5 gigatons of carbon compared to the world soils having lost 66 to 90 gigatons, historic loss. We think most potential, in fact, even in developing countries, such as in Africa, South Asia, where the natural resources have been tremendously depleted, I am very much surprised often that that part equalized very well. How can we put that carbon back? Restoring degraded land, set aside land programs. CRP, the Conservation Reserve Program, has been a success.

Conservation tilling certainly has a potential, but it has not been followed even in Ohio on a permanent basis. One crop is grown with conservation tilling and the next crop is not. While conservation tillings can lead to carbon sequestration, about 200 to 400 pounds per acre per year, if you plow next year, it goes back up again. So somehow the policy that the farmers are encouraged to adopt conservation tilling on a permanent basis would certainly be a solution.

Reforestation of steep lands, degrading lands, minelands, in eastern Ohio, we worked with AEP on that program over the last 50 years, reclaiming mineland, put in about 35 tons of carbon back into the land over a 50-year period. So any forestation, in addition to sequestering carbon in the biomass, trees, obviously puts carbon back into the soil. I might mention that the residence time of carbon that goes in the soil is much longer than it is in the trees.

So there are certain programs that we could support. Conservation tilling is one of them. Putting in cover crops, perhaps eliminating summer farrow in the western part of the region that is followed, putting any biomass back on the land. We have almost a billion tons of biosolids produced which are now considered as a liability. Ultimately, they could really prove to be an asset if they are put back on the land properly.

Senator LIEBERMAN. Thanks. I appreciate that answer.

So I think all of you here, in one way or another, for the most part testify to the fact that this is a significant problem, but that there are many ways to go at it, including reduction of current emissions, as Mr. Rogers said; new technologies, as Dr. Brown said; sequestration, as Dr. Lal said, and the kind of focus and intensity that other witnesses have talked about because of the timelines involved here.

So, anyway, I thank you very much for your helpful testimony. I hope we can go forward and find common ground and make something happen. Thank you.

Senator VOINOVICH. Senator Chafee?

Senator CHAFEE. Well, thank you, Mr. Chairman, once again, for having the hearing.

Mr. Rogers, welcome and thank you for your patience also.

It is heartening to hear your recognition that something has to be done, and your company's recognition of that. Could you comment on your competitors and how they are facing this issue and

the reality that you have that something has to be done? How are your competitors reacting? How does that affect your company?

Mr. ROGERS. That is a tough question. I will say, let me just speak for the entire utility industry. If you look back to the mid-nineties and you look at how the electric utility industry stepped up on the climate challenge, I remember us sitting around saying, "Can we hit a goal of reducing 40 million tons a year on a voluntary program?" when we stepped up in Vice President Gore's proposal with respect to the climate challenge. We all struggled with ourselves: Can we do it? Well, in 1999 we were able to do 120-plus million through a voluntary program. There has not been another industry in this country that has stepped up and dealt with the CO_2 issue the way the electric utility industry has over the last five to 6 years.

Within my industry there are differing points of view with respect to this, and it is really a function of whether you generate electricity with nuclear or gas or coal. Everybody's position is almost a direct result of what their generation emits happens to be. But I think there are a number of companies in our industry, all of which are competitors of mine, who see the world in a similar way, that we have to deal with this issue; it is the right thing to do because it is a long-term problem, but we have got to get about doing it.

One of the ways we talk about technology—and Senator Voinovich asked the question a few moments ago, how do you do it or pick it? One of the things we could well do as a program is, as part of the doing it now, you get credit to the extent you invest in technologies that could either lead to reductions of emissions of CO_2 or new technologies that allow you to generate electricity in a more environmentally benign way or with less CO_2 emissions than the current technologies.

So there are a lot of ways, short of the government stepping up and investing, to stimulate investment going forward. I thought Dr. Brown, if you read carefully her testimony, there is a whole list of things. I think there are companies in our industry that are all—I mean, I am not the largest investor in wind. Florida Power and Light is the largest investor. If you look at other companies in the industry, we are all slowly but quietly positioning and moving ourselves to deal with this.

Our challenge competitively, I would much rather know the rules because I am so dependent on coal. It is more valuable to me than guys who are dependent on nuclear. So, from my vantage point, the way I see the competition playing out, I need to know that answer for my shareholders and, most importantly, for my customers.

Senator CHAFEE. Thank you, sir.

Senator VOINOVICH. I visited the Gavin plant last week. The Gavin plant is one of the largest producers of electricity in the United States, the coal-fired facility. They put up a $600 million scrub around the facility, and they are just finishing up with a new $200 million investment to deal with the NOx problem. They are going to be reducing NOx by about 90 percent. So there is still a little bit going on.

I posed a question to them about the issue of CO_2, and the reaction was that, first of all, the technology out there in terms of CO_2

and what you do about it is not there. Their concern was that the cost of going the next step and dealing with CO_2 would be very, very prohibitive and drive up the cost of their energy. It gets back to the old issue of, do you put a mandatory cap on what you can put out? The issue is, what is that cap? I think it was one of the witnesses earlier who said that he wasn't certain about a cap because, how do you figure it when you have a lot of people all over the world who are contributing to this problem?

The issue is, if you did NOx, SOx, mercury, and came up with a program that didn't mandatory cap CO_2, what would you recommend in exchange for not having the caps in terms of your industry dealing with this issue of CO_2?

Mr. ROGERS. Senator Voinovich, a way to think about it that goes to your question and gives you specificity with respect to what to do going forward is you could have what I would call a voluntary opt-in program where, once you opt in, you have certain specific requirements. Every company would have to make the judgment with respect to what it did with respect to its competitive position going forward.

The point of the matter is that it allows companies in our position that want to build coal plants, and are prepared to make commitments with respect to CO_2—because the issue, and you said it right, I mean there is no technology today that reduces CO_2 that you could put on the back end of your plant like you can do for SOx or NOx. But you do have the capability—I mean we have invested in co-generation for companies like BP, where we are putting 800 megawatts of co-generation in to buy heat and power that is very efficient in their Texas City plant. We are doing it with GM, our company is. We are doing it with Eastman Kodak in upstate New York, where we go in and operate the facilities and at the same time put in co-generation to buy heat and power that is significant reductions in CO_2.

So my point here is that you might not be able to reduce it for existing plants, but there is a whole set of other things that you can do. Most importantly, you can go after the issue with respect to incremental generation that has to be built in this country. As Vice President Cheney said in his speech in Toronto, he said we have to build one new power plant every week for the next 20 years. Now I am not going to quarrel with whether that is true or not, but if it is anywhere in that direction, we are going to have significant incremental emissions going forward.

What I am suggesting to you, we need to be creative at coming up with an approach, whether it is a voluntary opt-in with a mandatory level or a combination carrot stick in terms of mandatory/voluntary pieces of this, but we need to deal with the incremental emissions. That is really going to be one of our greatest challenges.

Senator VOINOVICH. Dr. Lal, Senator Lieberman talked about Kyoto. Why were the Europeans not willing to give us credit for sequestration?

Dr. LAL. There are two reasons, Senator, that I can think of. When I talked to my colleagues from Norway, from Britain, from Germany, and other scientists and foresters, they were certainly agreed to the principles. The main problem is the land mass available for carbon sequestration in the United States, Canada, and

Australia which does not exist with the countries in the European community. Therefore, that major one piece that is natural to the United States, to us here, is not available there. They do not have the possibility. That is one part.

Second, I think there is clearly quite a lot of lack of information on soil carbon sequestration, on forest carbon sequestration that may be applied to get away from the fossil fuel combustion. I think it is important to make it clear to policymakers across the Atlantic that this is, indeed, a win/win situation for all parties concerned, including natural resources, a good thing to do either way. I think it would be understood.

My suggestion to my colleagues here at USDA and other places was perhaps we need to have a fact sheet which explains what carbon sequestration, what sink means, what could it do for the improvement of natural resources universally, especially in developing countries of Africa, South America, and Asia, which are now the so-called countries in dissent who are so much against it. I think it is a lack of understanding and information. We need to do a bit more public relations.

Senator VOINOVICH. It is interesting listening to Dr. Lal. If you go back in your career, one of the bills that I was responsible for when I was in the State legislature was our reclamation act, which is a model for the rest of the country. Today if you travel to Ohio and go over the former strip mines and see all that land restored, and your testimony today makes me feel even better about the fact that we did it at the time, or our farmland preservation program in the State to try to preserve the farmland and our tree planting program. I must say that at the time that we were doing these things I didn't fully appreciate the impact that it would have on the issue of climate change. So it is a side benefit that we never anticipated.

Senator Lieberman?

Senator LIEBERMAN. Thanks, Mr. Chairman. First of all, I want to tell you that unexpectedly I did spend a lot of time in and over Ohio last fall.

[Laughter.]

I was impressed by the greenery that I saw from land and air, and I thank you for the role you played in it.

Dr. Brown and Dr. Edmonds, you both talked about the role technology, new technologies, can play in helping us deal with this problem. This is, after all, an age of technologies, new technologies, and it seems like that is the place we should look for help in solving this and other problems.

Dr. Edmonds, if I read and heard you correctly, you said that you are concerned about current trends in research and development of new technologies in these areas, greenhouse gas-causing areas particularly. I wonder if you could elucidate on that a bit and what concerns you.

Dr. EDMONDS. Thank you, Senator. One of the things that we learned in this Global Energy Technology Strategy Program—and I would be happy to make the summary report available to the staffs.

It took 3 years of research. It was a public/private collaboration. It included sponsors from both the public sector and the private sector in the United States and around the world.

One of the important findings that came out of that work was that, while a wide array of portfolio was needed to manage the risks that are associated with climate change, that, in fact, over the course of the period of time since the 1980's that in the United States and elsewhere the support for energy R&D in both the public sector and the private sector has declined. It has declined in the United States. If you go to Europe, you will find that it has declined precipitously. Declines of 70 percent or more are commonplace. This is a cause for alarm. So that was the first thing that struck me.

Senator LIEBERMAN. The first response to that would be for us, presumably, to increase investment in research and development through the Department of Energy and to create incentives for the private sector to do the same.

Dr. EDMONDS. Certainly, it would benefit us all to make those investments across the wide portfolio of energy R&D, and it is a wide portfolio. It ranges all the way from the basic sciences, the biological sciences that are going to be needed to undergird the development of a competitive commercial biomass industry, for example, to make the soil carbon not only the option that it is today, but to enhance it. That is going to require research.

Also, the second thing that I think was really striking was that, while we do a pretty good job, I think, in allocating resources to the problem of addressing energy security, and therefore, we have a portfolio that includes solar, wind, geothermal, energy conservation, nuclear, and the performance of fossil fuels, those need to be continued. All the analysis we have done is predicated on the successful performance of those technologies.

In addition, there is a whole suite of technologies which have particular leverage for the climate problem that are attractive candidates. They include the soils. They include captured sequestration of carbon, of fossil fuel use which would allow us to take advantage of this enormously abundant and inexpensive resource that is available to us. I think that is an important element.

Also, the undergirding of research to make a hydrogen economy eventually possible, and that includes investments in material sciences, investments in fuel cell technology, and, finally, the investments in commercial biomass. It could start as tree planting. One of the things that is really interesting, if you take this long-term perspective that we have, is that tree planting always turns into biomass. It turns into biomass because trees grow, mature, and they stop taking up carbon. Eventually, you want to harvest them, turn them into energy, and use that land to grow the trees again.

Senator LIEBERMAN. Thanks. That was an excellent answer.

Dr. Brown, let me ask you to become involved here and generally what the Federal Government can do to stimulate some of the new technologies that your report describes very well, and if you have any response to the question Mr. Rogers has posed in passing which is, what can we do to help them put something on the other end of that plant to reduce carbon emissions?

Dr. BROWN. Well, I guess I would like to underscore that, while we do need to invest in energy R&D, both basic and applied, to be able to continue to grow this portfolio of options, there are a lot of options that are cost-effective today, and every year there are more and more of them. In industrial facilities, for instance, the utilities that are used, the steam, the motors and drive systems, we have shown time and time again that you can go into those plants and you can conduct an audit and recommend that, for modest investments, there are opportunities to save a lot of energy with a one-, at most one-and-a-half, year payback.

So I would like to suggest this: While it does take a long time for us to grow our energy supply options, probably more so for the central power plants, a little less so for the co-generation and distributed power, that it hardly takes us any time to make the energy that we are using go further. So I would just like to reinforce that there is a whole suite of programs in place. They are in the Administration's proposed budget proposed to be significantly cut. I would argue that that is really cutting an energy supply resource because the savings can allow our energy supplies to go further.

So it is not just the R&D program, which I really think is underinvested in. These are public/private partnerships where by sending a signal, a commitment, by the Federal Government, we work with our private companies and work together to develop solutions, there are also important deployment activities where we need to develop the software assessment, tools, the validated performance data to be able to show that opportunities that are cost-effective do exist.

Senator LIEBERMAN. Thanks. That was an excellent and hopeful answer. Thanks to the panel. They are very helpful to us.

Senator VOINOVICH. The challenge I think is that there is a smorgasbord of things that we can give consideration to. We have a major problem in this country with something called New Source Review that came about as a result of a couple of years ago a reinterpretation of regulation under the Air Act that basically said that some of the things that utilities have done over a period of years required permits, and they didn't get them.

One of the things we have to really grapple with now is to clear the air on that because there are just a lot of folks around that are not doing things that could make them more efficient, do a better job, because they are in limbo in terms of what it is that they can or cannot do. Some companies like Mr. Rogers' have paid a fine and agreed to do some things, and so forth. I think that is one area that has to be looked at.

Then the next question is you have "X" number of dollars available and the government is involved; do you provide it in reductions, in credits given to companies to buy energy-efficient machinery? For example, in Cincinnati, Ohio at Cincinnati Milicrom they have two types of injection molding machines. One of them burns an enormous amount of energy. The other one burns very little energy, but it is very, very expensive. They are advocating that we should reward people for buying the machinery that uses the very little amount of energy. So that is one investment you could make.

Another would be some new technology that would help get into a new area of producing energy—biomass or whatever it would be,

fuel cells—and how you allocate these resources in a way that makes the most sense overall. There is no question that we have a real challenge on our hands.

I want to thank the panelists. I thought that you have different points of view, but I think there is a coming together that it is time in this country that we look at our energy needs, our environmental needs, and try to the best of our ability harmonize those so that we come up with some national energy policy that makes sense and takes into consideration the fact that the consumers are also in the room, and for the past number of years they haven't been there. They are real concerned about what we are doing in this area.

I am sure that we will be calling upon some of you to help us grapple with this problem. I believe that if we put each other's shoes on, we can come up with something that is going to really be meaningful for our country. I really believe if we don't come up with this energy policy that is sensible, we are in deep trouble in terms of our competitive position in the world marketplace, and we should be leaders.

Maybe we ought to go back and try to rewrite Kyoto and come back and say this thing started out maybe pie in the sky and wasn't realistic. Let's get real and come back with some stuff that we are willing to do and you are going to have to be willing to do it. It may not be as ambitious as what some would like it to be, but it does move us along in a way that makes sense.

Thank you very much for coming today.

[Whereupon, at 12:28 p.m., the committee was adjourned, to reconvene at the call of the chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. HARRY REID, U.S. SENATOR FROM THE STATE OF NEVADA

I'm glad we're having this hearing, Mr. Chairman. I hope it leads to action soon.

For every year that goes by without Congress or the President making a serious effort to reduce greenhouse gases, the odds increase that my grandchildren are going to inherit a warmer and more chaotic world.

A recent study by scientists at the Massachusetts Institute of Technology calculates that there is a one in four chance that the world will warm between 5 and 7 degrees Fahrenheit in the next 100 years. I don't like those odds at all. Not when we're talking about the future. I hope we're going to spend more time on this complicated subject than the committee has to date. The committee hasn't looked at this matter directly for over 2 years.

Our committee has a responsibility and the jurisdiction to develop legislation that reduces manmade emissions that cause or have the potential to cause harm to the environment and public health. It is far past time for this committee to do its duty and produce some proposals.

I hope we can work together to develop bipartisan legislation to reduce emissions of greenhouse gases. I understand that my colleagues have been put in a difficult position by the President's decision to reverse his campaign promise on reductions of carbon dioxide from power plants.

But, it's time for leadership and progress. I would like this committee to be the laboratory of new bipartisan initiatives for cutting greenhouse gases. We will just have to hope that the Administration is equally interested in such progress.

There has been a lot of talk about voluntary versus mandatory requirements to reduce these gases. My colleagues know that the nation has a Senate-ratified commitment to reduce emissions to 1990 levels. That was to have been accomplished through voluntary measures. Unfortunately, we have failed miserably using voluntary means. We're now about 13 percent above our target.

So, what we need is a comprehensive approach that achieves real net reductions by a time certain. I don't know of any other way to get the ball rolling.

Carbon dioxide and other greenhouse gas emissions must come down. The Senate has already made that policy decision. Scientists at the IPCC (International Panel on Climate Change) and elsewhere can help us how to determine which policy options are most useful and when they should be implemented. But, it's time for opponents of that decision to work with us on real world reduction strategies.

It's now our job to figure out how to accomplish that goal in the most effective and expeditious way. I'm glad we have some witnesses here on the second panel to tell us about policies we might adopt to move in the right direction.

Unfortunately, from what little I've heard about the Administration's energy policy plan, it doesn't sound as if it moves in the right direction for climate purposes or for protecting the environment.

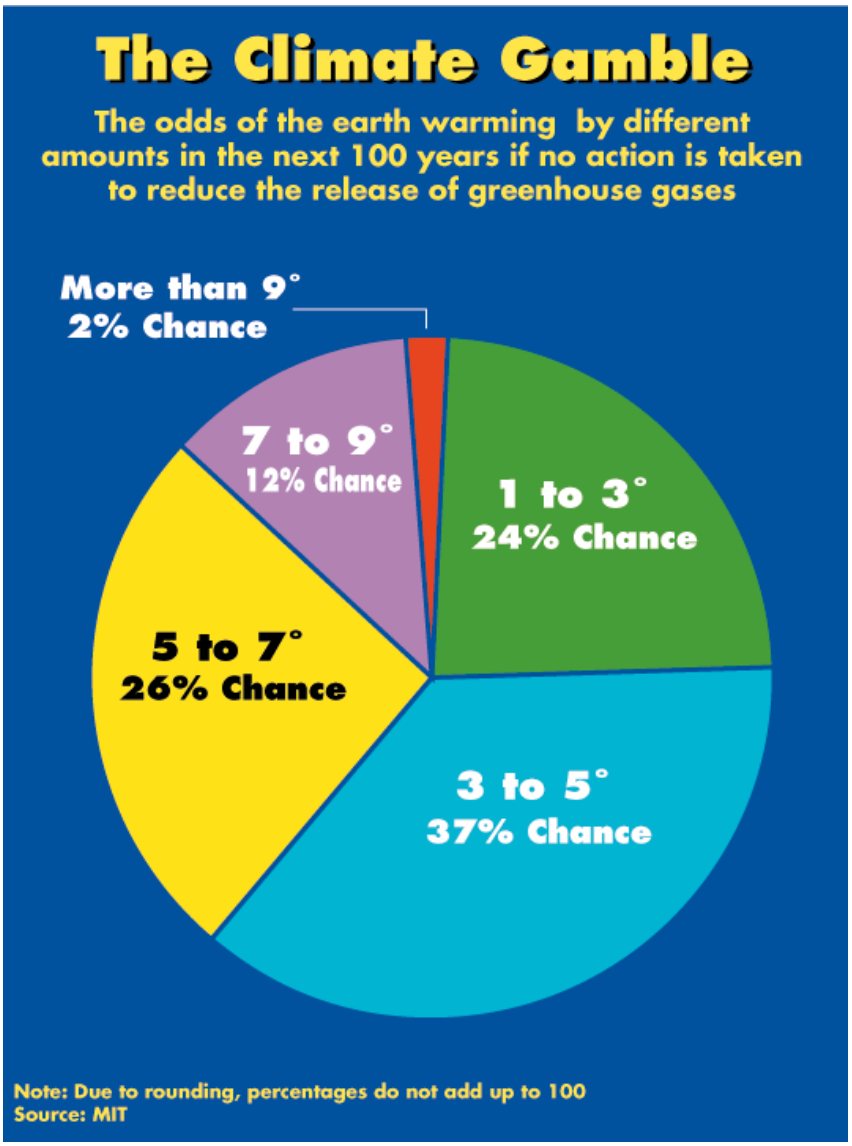
We need a plan that reduces harmful emissions, not increases them. Press accounts describing the Administration plan say it would simply result in burning more fossil fuels. That's short-sighted and irresponsible. It has little or no chance of getting wide, bipartisan support.

Emphasizing increased and inefficient fossil fuel use—when we know that carbon concentrations in the atmosphere are higher than they've been in 400,000 years—is a little bit like handing the Emperor Nero a fiddle to play while Rome burns.

A strong and supportable energy plan would first emphasize renewable energy, energy efficiency and conservation. Then, once all the economically viable energy is wrung out of those resources, we can turn to cleaner and safer uses of coal and other traditional fuels.

As my colleagues may have heard me say before, Nevada has a wealth of clean and climate-friendly renewable resources, particularly geothermal, wind and solar. We are more than willing to share our abundance with the nation. But, I can't support a plan that relegates these sources to obscurity. It wouldn't make economic or environmental sense for my State.

Finally, Mr. Chairman, I want to be constructive and I want results. But, I'm not interested in amending the Clean Air Act or any other environmental statutes as part of an energy plan that doesn't make tangible cuts in greenhouse gases.



STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Thank you, Mr. Chairman, for calling this timely hearing on such an important issue. I would also like to thank our distinguished panel of experts for testifying today.

There was a time when I would have found it hard to believe that humans could do anything that would affect the weather. It was just something we had to learn to live with. But now, I accept the view of most scientists that our everyday activities are slowly changing the world's climate. In fact, there is evidence that a majority of the global warming of the past 50 years is attributable to human activities. While the effects may seem barely perceptible at first, they will grow over time and result in major changes that I have come to believe will alter our children's future.

If left unchecked, many believe the growth in these emissions could have potentially serious effects. Rising global temperatures are expected to raise sea level, change precipitation and other local climate conditions. Changes in regional climates could alter forests, crop yields and water supplies. Such shifting climate patterns and more frequent violent weather, such as floods and droughts, could mean more trouble for Montana's and the nation's farming and ranching families and communities.

I believe that we need to take action to address the consequences of climate change. Kyoto was an important first step. Although most agree that it would have been impossible for the United States and other developed nations to meet the emissions targets contained in the Kyoto Protocol, I don't think that abandoning the entire Protocol was the best approach. We can still work toward implementing some of the market-based mechanisms that were adopted in principle and Kyoto. We can still work to engage the entire world in trying to reach a workable solution. In reality, we have to engage the entire world, including developing nations.

The simple fact is, developing countries, such as China, India and Brazil, emit about 40 percent of the world's greenhouse gases. We can't reach a solution by addressing only 60 percent of the problem. Unless all countries participate, we risk giving our competitors an unfair advantage. The participation of developing countries is absolutely necessary.

Whether we like it or not, the world still looks to the United States to take the lead on this and many other important global issues. We can continue to advance the science of climate change and to pioneer research and development into advanced technologies that improve the efficiency of our power plants, automobiles and other greenhouse gas emitting facilities, technologies that we can export to the rest of the world. The worst thing we could do is abandon the issue entirely.

I look forward to hearing the expert testimony of today's witnesses. I and my colleagues certainly appreciate your insight and knowledge on this issue.

STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Thank you, Mr. Chairman. I want to commend you for holding this hearing on what I believe to be the most important environmental issue that we face—climate change. Mr. Chairman, this issue is enormously complex in every aspect. Scientifically. Economically. Politically.

But complexity is no excuse for inattention or inaction. Because the health and viability of the global ecosystems upon which we all depend are at stake.

I won't dwell here on the range and scope of potential climate change impacts, which are well documented elsewhere. Suffice it to say that no other issue that will come before this committee demands more serious attention. So I look forward to today's testimony on science and mitigation options, and I hope that this hearing is the beginning of a sustained effort. Because the time to act is now.

The Intergovernmental Panel on Climate Change recently released its Third Assessment Report, and the science is increasingly clear and alarming. We know that human activities, primarily fossil fuel combustion, have raised the atmospheric concentration of carbon dioxide to the highest levels in the last 420,000 years. We know that the planet is warming, and that the balance of the scientific evidence suggests that most of the recent warming can be attributed to increased atmospheric greenhouse gas levels. We know that without concerted action by the U.S. and other countries, greenhouse gases will continue to increase. Finally, we know that climate models have improved, and that these models predict warming under all scenarios that have been considered. Even the smallest warming predicted by current models—2.5 degrees Fahrenheit over the next century—would represent the greatest rate of increase in global mean surface temperature in the last 10,000 years.

Mr. Chairman, when I consider these findings, I conclude that we need to begin now to mitigate climate change. We can and should improve the science of climate change. But a call for more research should not obscure or minimize what we already know.

Mr. Chairman, the Senate—and the Environment Committee in particular—needs to provide leadership on this issue. President Bush has pulled back from the Kyoto protocol, leaving a policy vacuum in his wake. He has pledged to craft an alternative to Kyoto, but in the meantime, he will soon issue an energy policy proposal that, by all reports, will not address climate change in a meaningful way. If this is true—and I sincerely hope that it is not—then we can only conclude that President Bush is not serious about addressing climate change.

So the task of dealing with climate change would appear to fall to us. Mr. Chairman, current and future generations are depending on us. To give you one example, the people of New Jersey are depending on me to protect their treasured Atlantic Ocean beaches. Like all coastal areas, these beaches are threatened by projected changes in sea levels due to climate change. I am concerned about this impact. I am concerned about climate change impacts across New Jersey, the country and the globe.

I look forward to hearing from our witnesses. I hope that they can help us to identify sensible mitigation policy options that the committee can continue to work on. Thank you.

STATEMENT OF RICHARD S. LINDZEN, ALFRED P. SLOAN PROFESSOR OF METEOROLOGY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

I wish to thank Senator Voinovich, Senator Smith and the Environment and Public Works Committee for the opportunity to clarify the nature of consensus and skepticism in the Climate Debate. I have been involved in climate and climate related research for over 30 years during which time I have held professorships at the University of Chicago, Harvard University and MIT. I am a member of the National Academy of Sciences, and the author or coauthor of over 200 papers and books. I have also been a participant in the proceedings of the IPCC (the United Nation's Intergovernmental Panel on Climate Change). The questions I wish to address are the following: What can we agree on and what are the implications of this agreement? What are the critical areas of disagreement? What is the origin of popular perceptions? I hope it will become clear that the designation, "skeptic," simply confuses an issue where popular perceptions are based in significant measure on misuse of language as well as misunderstanding of science. Indeed, the identification of some scientists as "skeptics" permits others to appear "mainstream" while denying views held by the so-called "skeptics" even when these views represent the predominant views of the field.

Climate change is a complex issue where simplification tends to lead to confusion, and where understanding requires thought and effort. Judging from treatments of this issue in the press, the public has difficulty dealing with numerical magnitudes and focuses instead on signs (increasing v. decreasing); science places crucial emphasis on both signs and magnitudes. To quote the great 19th Century English scientist, Lord Kelvin, "When you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."

As it turns out, much of what informed scientists agree upon is barely quantitative at all:

- that global mean temperature has probably increased over the past century,
- that CO_2 in the atmosphere has increased over the same period,
- that the added CO_2 is more likely to have caused global mean temperature to increase rather than decrease, and
- that man, like the butterfly, has some impact on climate.

Such statements have little relevance to policy, unless quantification shows significance.

The media and advocacy groups have, however, taken this agreement to mean that the same scientists must also agree that global warming "will lead to rising sea waters, droughts and agriculture disasters in the future if unchecked" (CNN). According to Deb Callahan, president of the League of Conservation Voters, "Science clearly shows that we are experiencing devastating impacts because of carbon dioxide pollution." (Carbon dioxide, as a "pollutant" is rather singular in that it is a natural product of respiration, non-toxic, and essential for life.) The accompanying cartoon suggests implications for severe weather, the ecosystem, and presumably plague, floods and droughts (as well as the profound politicization of the issue). Scientists who do not agree with the catastrophe scenarios are assumed to disagree with the basic statements. This is not only untrue, but absurdly stupid.

Indeed, the whole issue of consensus and skeptics is a bit of a red herring. If, as the news media regularly report, global warming is the increase in temperature caused by man's emissions of CO_2 that will give rise to rising sea levels, floods, droughts, weather extremes of all sorts, plagues, species elimination, and so on, then it is safe to say that global warming consists in so many aspects, that widespread agreement on all of them would be suspect ab initio. If it truly existed, it would be evidence of a thoroughly debased field. In truth, neither the full text of the IPCC documents nor even the summaries claim any such agreement. Those who

insist that the science is settled should be required to state exactly what science they feel is settled. In all likelihood, it will turn out to be something trivial and without policy implications except to those who bizarrely subscribe to the so-called precautionary principle a matter I will return to later. (Ian Bowles, former senior science advisor on environmental issues at the NSC, published such a remark on 22 April in the Boston Globe: "the basic link between carbon emissions, accumulation of greenhouse gases in the atmosphere, and the phenomenon of climate change is not seriously disputed in the scientific community." I think it is fair to say that statements concerning matters of such complexity that are not disputed are also likely to be lacking in policy relevant content. However, some policymakers apparently think otherwise in a cultural split that may be worthy of the late C.P. Snow's attention.)

The thought that there might be a central question, whose resolution would settle matters, is, of course, inviting, and there might, in fact, be some basis for optimism. While determining whether temperature has increased or not is not such a question, the determination of climate sensitivity might be. Rather little serious attention has been given to this matter (though I will mention some in the course of this testimony). However, even ignoring this central question, there actually is much that can be learned simply by sticking to matters where there is widespread agreement. For example, there is widespread agreement:

- that CO_2 levels have increased from about 280ppm to 360ppm over the past century, and, that combined with increases in other greenhouse gases, this brings us about half way to the radiative forcing associated with a doubling of CO_2 without any evidence of enhanced human misery.
- that the increase in global mean temperature over the past century is about 1F which is smaller than the normal interannual variability for smaller regions like North America and Europe, and comparable to the interannual variability for the globe. Which is to say that temperature is always changing, which is why it has proven so difficult to demonstrate human agency.
- that doubling CO_2 alone will only lead to about a 2F increase in global mean temperature. Predictions of greater warming due to doubling CO_2 are based on positive feedbacks from poorly handled water vapor and clouds (the atmosphere's main greenhouse substances) in current computer models. Such positive feedbacks have neither empirical nor theoretical foundations. Their existence, however, suggests a poorly designed earth which responds to perturbations by making things worse.
- that the most important energy source for extratropical storms is the temperature difference between the tropics and the poles which is predicted by computer models to decrease with global warming. This also implies reduced temperature variation associated with weather since such variations result from air moving from one latitude to another. Consistent with this, even the IPCC Policymakers Summary notes that no significant trends have been identified in tropical or extratropical storm intensity and frequency. Nor have trends been found in tornadoes, hail events or thunder days.
- that warming is likely to be concentrated in winters and at night. This is an empirical result based on data from the past century. It represents what is on the whole a beneficial pattern.
- that temperature increases observed thus far are less than what models have suggested should have occurred even if they were totally due to increasing greenhouse emissions. The invocation of very uncertain (and unmeasured) aerosol effects is frequently used to disguise this. Such an invocation makes it impossible to check models. Rather, one is reduced to the claim that it is possible that models are correct.
- that claims that man has contributed any of the observed warming (i.e., attribution) are based on the assumption that models correctly predict natural variability. Such claims, therefore, do not constitute independent verifications of models. Note that natural variability does not require any external forcing natural or anthropogenic.
- that large computer climate models are unable to even simulate major features of past climate such as the 100 thousand year cycles of ice ages that have dominated climate for the past 700 thousand years, and the very warm climates of the Miocene, Eocene, and Cretaceous. Neither do they do well at accounting for shorter period and less dramatic phenomena like El Ninos, quasi-biennial oscillations, or intraseasonal oscillations all of which are well documented in the data.
- that major past climate changes were either uncorrelated with changes in CO_2 or were characterized by temperature changes which preceded changes in CO_2 by 100's to 1000's of years.
- that increases in temperature on the order of 1F are not catastrophic and may be beneficial.

• that Kyoto, fully implemented, will have little detectable impact on climate regardless of what one expects for warming. This is partly due to the fact that Kyoto will apply only to developed nations. However, if one expected large global warming, even the extension of Kyoto to developing nations would still leave one with large warming.

None of the above points to catastrophic consequences from increasing CO_2. Most point toward, and all are consistent with minimal impacts. Moreover, the last item provides a definitive disconnect between Kyoto and science. Should a catastrophic scenario prove correct, Kyoto will not prevent it. If we view Kyoto as an insurance policy, it is a policy where the premium appears to exceed the potential damages, and where the coverage extends to only a small fraction of the potential damages. Does anyone really want this? I suspect not. Given the rejection of the extensive U.S. concessions at the Hague, it would appear that the Europeans do not want the treaty, but would prefer that the United States take the blame for ending the foolishness. As a practical matter, a large part of the response to any climate change, natural or anthropogenic, will be adaptation, and that adaptation is best served by wealth.

Our own research suggests the presence of a major negative feedback involving clouds and water vapor, where models have completely failed to simulate observations (to the point of getting the sign wrong for crucial dependences). If we are right, then models are greatly exaggerating sensitivity to increasing CO_2. Even if we are not right (which is always possible in science; for example, IPCC estimates of warming trends for the past 20 years were almost immediately acknowledged to be wrong so too were claims for arctic ice thinning), the failure of models to simulate observations makes it even less likely that models are a reliable tool for predicting climate.

This brings one to what is probably the major point of disagreement:

Can one trust computer climate models to correctly predict the response to increasing CO_2?

As the accompanying cartoon suggests, our experience with weather forecasts is not particularly encouraging though it may be argued that the prediction of gross climate changes is not as demanding as predicting the detailed weather. Even here, the situation is nuanced. From the perspective of the precautionary principle, it suffices to believe that the existence of a computer prediction of an adverse situation means that such an outcome is possible rather than correct in order to take "action." The burden of proof has shifted to proving that the computer prediction is wrong. Such an approach effectively deprives society of science's capacity to solve problems and answer questions. Unfortunately, the incentive structure in today's scientific enterprise contributes to this impasse. Scientists associate public recognition of the relevance of their subject with support, and relevance has come to be identified with alarming the public. It is only human for scientists to wish for support and recognition, and the broad agreement among scientists that climate change is a serious issue must be viewed from this human perspective. Indeed, public perceptions have significantly influenced the science itself. Meteorologists, oceanographers, hydrologists and others at MIT have all been redesignated climate scientists indicating the degree to which scientists have hitched their futures to this issue.

That said, it has become common to deal with the science by referring to the IPCC "scientific consensus." Claiming the agreement of thousands of scientists is certainly easier than trying to understand the issue or to respond to scientific questions; it also effectively intimidates most citizens. However, the invocation of the IPCC is more a mantra than a proper reflection on that flawed document. The following points should be kept in mind. (Note that almost all reading and coverage of the IPCC is restricted to the highly publicized Summaries for Policymakers which are written by representatives from governments, NGO's and business; the full reports, written by participating scientists, are largely ignored.) In what follows, I will largely restrict myself to the report of Working Group I (on the science). Working Groups II and III dealt with impacts and responses.

• The media reports rarely reflect what is actually in the Summary. The media generally replace the IPCC range of "possible" temperature increases with "as much as" the maximum despite the highly unlikely nature of the maximum. The range, itself, assumes, unjustifiably, that at least some of the computer models must be correct. However, there is evidence that even the bottom of the range is an overestimate. (A recent study at MIT found that the likelihood of actual change being smaller than the IPCC lower bound was 17 times more likely than that the upper range would even be reached, and even this study assumed natural variability to be what computer models predicted, thus exaggerating the role of anthropogenic forcing.) The media report storminess as a consequence despite the admission in the summary of no such observed relation. To be sure, the summary still claims that such

a relation may emerge despite the fact that the underlying physics suggests the opposite. The media's emphasis on increased storminess, rising sea levels, etc. is based not on any science, but rather on the fact that such features have more graphic impact than the rather small increases in temperature. People who have experienced day and night and winter and summer have experienced far greater changes in temperature, and retirement to the sun belt rather than the Northwest Territory represents an overt preference for warmth.

• The summary does not reflect the full document (which still has not been released although it was basically completed last August). For example, I worked on Chapter 7, Physical Processes. This chapter dealt with the nature of the basic processes which determine the response of climate, and found numerous problems with model treatments especially with clouds and water vapor. The chapter was summarized with the following sentence: "Understanding of climate processes and their incorporation in climate models have improved, including water vapor, sea-ice dynamics, and ocean heat transport."

• The vast majority of participants played no role in preparing the summary, and were not asked for agreement.

• The draft of the Policymakers Summary was significantly modified at Shanghai. The IPCC, in response to the fact that the Policymakers Summary was not prepared by participating scientists, claimed that the draft of the Summary was prepared by a (selected) subset of the 14 coordinating lead authors. However, the final version of the summary differed significantly from the draft. For example the draft concluded the following concerning attribution:

From the body of evidence since IPCC (1996), we conclude that there has been a discernible human influence on global climate. Studies are beginning to separate the contributions to observed climate change attributable to individual external influences, both anthropogenic and natural. This work suggests that anthropogenic greenhouse gases are a substantial contributor to the observed warming, especially over the past 30 years. However, the accuracy of these estimates continues to be limited by uncertainties in estimates of internal variability, natural and anthropogenic forcing, and the climate response to external forcing.

The version that emerged from Shanghai concludes instead:

In the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations.

In point of fact, there may not have been any significant warming in the last 60 years. Moreover, such warming as may have occurred was associated with jumps that are inconsistent with greenhouse warming.

• The preparation of the report, itself, was subject to pressure. There were usually several people working on every few pages. Naturally there were disagreements, but these were usually hammered out in a civilized manner. However, throughout the drafting sessions, IPCC "coordinators" would go around insisting that criticism of models be toned down, and that "motherhood" statements be inserted to the effect that models might still be correct despite the cited faults. Refusals were occasionally met with ad hominem attacks. I personally witnessed coauthors forced to assert their "green" credentials in defense of their statements.

None of the above should be surprising. The IPCC was created to support the negotiations concerning CO_2 emission reductions. Although the press frequently refers to the hundreds and even thousands of participants as the world's leading climate scientists, such a claim is misleading on several grounds. First, climate science, itself, has traditionally been a scientific backwater. There is little question that the best science students traditionally went into physics, math and, more recently, computer science. Thus, speaking of "thousands" of the world's leading climate scientists is not especially meaningful. Even within climate science, most of the top researchers (at least in the US) avoid the IPCC because it is extremely time consuming and non-productive. Somewhat ashamedly I must admit to being the only active participant in my department. None of this matters a great deal to the IPCC. As a U.N. activity, it is far more important to have participants from a hundred countries many of which have almost no active efforts in climate research. For most of these participants, involvement with the IPCC gains them prestige beyond what would normally be available, and these, not surprisingly, are likely to be particularly supportive of the IPCC. Finally, judging from the Citation Index, the leaders of the IPCC process like Sir John Houghton, Dr. Robert Watson, and Prof. Bert Bolin have never been major contributors to basic climate research. They are, however, enthusiasts for the negotiating process without which there would be no IPCC, which is to say that the IPCC represents an interest in its own right. Of course, this hardly distinguishes the IPCC from other organizations.

The question of where do we go from here is an obvious and important one. From my provincial perspective, an important priority should be given to figuring out how to support and encourage science (and basic science underlying climate in particular) while removing incentives to promote alarmism. The benefits of leaving future generations a better understanding of nature would far outweigh the benefits (if any) of ill thought out attempts to regulate nature in the absence of such understanding. With respect to any policy, the advice given in the 1992 report of the NRC, Policy Implications of Greenhouse Warming, remains relevant: carry out only those actions which can be justified independently of any putative anthropogenic global warming. Here, I would urge that even such actions not be identified with climate unless they can be shown to significantly impact the radiative forcing of climate. On neither ground independent justification or climatic relevance is Kyoto appropriate.

RESPONSES BY DR. RICHARD S. LINDZEN TO ADDITIONAL QUESTIONS FROM SENATOR REID

Question 1. Have you received funds for climate related research from non-governmental sources? If so, please generally identify those sources.

Response. I already answered this question in the hearing. The answer remains "no." That said, I have no objections in principle to such support. However, private sources have demonstrably favored scientists supportive of global warming.

Question 2. "Broadly unsuccessful and unreliable" are the terms that you used to describe the climate models employed by your colleagues at MIT. Why would they bother using such flawed instruments?

Response. I cannot speak for my colleagues, but several answers are commonly offered:

a. They are using the models, not to make forecasts, but to see what possibilities exist for interactions.

b. The models, themselves, are considered "works in progress."

Question 3. Dr. Trenberth stated that your assertions and assumptions that warming is not happening at the rate generally accepted by a majority of the scientific community also rely on models. Could you respond, including an indication of which models you rely upon and the uncertainty associated with those models?

Response. What I believe Dr. Trenberth was referring to was not any specific model, but rather a model input. I was speaking of the response of models to the known increase in anthropogenic greenhouse gases. ALL current large scale models show much more warming than has been observed. They get around this by putting arbitrary amounts of sulfate aerosol into their models so as to cancel the effect of greenhouse gases. Thus, models with widely varying responses to greenhouse gases can all be made to roughly agree with the surface record of the past century.

Question 4. You quoted from an old National Research Council (1992) and maintain that it remains relevant. Policymakers should". . . carry out only those actions which can be justified independently of any putative anthropogenic global warming." Since you acquire that opinion by association, what would constitute satisfactory independent justification?

Response. I am not sure what you are talking about. All the recommendation was meant to say was that the degree of uncertainty did not warrant actions that were not worth pursuing in their own right. The degree of uncertainty has not changed appreciably since the earlier NRC report.

Question 5. Can the climate system tolerate infinite anthropogenic increases in carbon dioxide and other greenhouse gases without change?

If the answer is no, what and when is the breakpoint that must be avoided to prevent significant harm to private property, the environment and public health?

If your answer is that it is not possible to know that yet, what information would be necessary to determine that anthropogenic emissions should be reduced and, given the residence time of these gases in the atmosphere, how far in advance must we have that information to take policy action to avert significant harm to private property, the environment and public health?

Response. There is no physical possibility of infinite anthropogenic increase in carbon dioxide and other greenhouse gases. As noted in the recent NRC report to the White House, the earth remained thriving during earlier periods with far more carbon dioxide than have been forecast in any current scenario. However, levels about 3–4 times those at present would likely create sufficient changes as to require a measure of adaptation beyond what normal climate changes call for. We have, in my opinion, at least a century to monitor the system in order to see if actions will be needed to preclude such a possibility. This will leave, in my opinion, adequate

time to take suitable measures especially since we can reasonably assume that we will have greater resources at that time to do so. Should I prove wrong, evidence over the next 30 years will show this. A program of measures concentrating on the most short lived substances should then provide mitigation while longer term measures of mitigation and adaptation are prepared. Rushing at present seems likely to incur the very harm to the environment, private property and public health that you wish to avoid. After all, the warming over the past century has been accompanied with great increases in wealth, health, and general well being. It would, therefore, be difficult to justify great expense to avoid that measure of warming, and warming over the next century may, in fact, be even smaller quite apart from any actions we take. Indeed, one matter on which there is widespread scientific agreement, is that the measures agreed to by diplomats at Kyoto would have no discernible impact on climate regardless of what views one may hold on the matter.

STATEMENT OF DR. KEVIN E. TRENBERTH, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Introduction

My name is Kevin Trenberth. I am the Head of the Climate Analysis Section at NCAR, the National Center for Atmospheric Research. I am especially interested in global-scale climate dynamics; the observations, processes and modeling of climate changes from interannual to centennial time scales. I have served on many national and international committees including National Research Council/National Academy of Science committees, panels and/or boards. I served on the National Research Council Panel on Reconciling observations of global temperature change, whose report was published in January 2000. I co-chaired the international CLIVAR Scientific Steering Group of the World Climate Research Programme (WCRP) from 1996 to 1999 and I remain a member of that group as well as the Joint Scientific Committee that oversees the WCRP as a whole. CLIVAR is short for Climate Variability and Predictability and it deals with variability from El Nino to global warming. I have been involved in the global warming debate and I have been extensively involved in the Intergovernmental Panel on Climate Change (IPCC) scientific assessment activity as a lead author of individual chapters, the Technical Summary, and Summary for Policy Makers (SPM) of Working Group (WG) I.

The IPCC is a body of scientists from around the world convened by the United Nations jointly under the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) and initiated in 1988. Its mandate is to provide policymakers with an objective assessment of the scientific and technical information available about climate change, its environmental and socio-economic impacts, and possible response options. The IPCC reports on the science of global climate change and the effects of human activities on climate in particular. Major assessments were made in 1990, 1995 and now 2001. Each new IPCC report reviews all the published literature over the previous 5 years or so, and assesses the state of knowledge, while trying to reconcile disparate claims and resolve discrepancies, and document uncertainties.

WG I deals with how the climate has changed and the possible causes. It considers how the climate system responds to various agents of change and our ability to model the processes involved as well as the performance of the whole system. It further seeks to attribute recent changes to the possible various causes, including the human influences, and thus it goes on to make projections for the future. WG II deals with impacts of climate change and options for adaptation to such changes, and WG III deals with options for mitigating and slowing the climate change, including possible policy options. Each WG is made up of participants from the United Nations countries, and for the 2001 assessment, WG I consisted of 123 lead authors, 516 contributors, 21 review editors, and over 700 reviewers. The IPCC process is very open. Two major reviews were carried out in producing the report, and skeptics can and do participate, some as authors. The strength is that the result is a consensus report. The SPM was approved line by line by governments in a major meeting. The rationale is that the scientists determine what can be said, but the governments determine how it can best be said. Negotiations occur over wording to ensure accuracy, balance, clarity of message, and relevance to understanding and policy. The latest report (IPCC 2001) reaffirms in much stronger language that the climate is changing in ways that cannot be accounted for by natural variability and that "global warming" is happening. A summary and commentary is given in Trenberth (2001).

Observed Climate Change Analyses of observations of surface temperature show that there has been a global mean temperature increase of about 1.2 F over the past

one hundred years. The calendar year 1998 is the warmest on record, exceeding the previous record held by 1997. Preliminary annual global mean temperatures in the latest year, 2000, were about the same as for 1999. The 1990's are the warmest decade on record. Synthesis of information from tree rings, corals, ice cores and historical data further indicates that these years are the warmest in at least the past 1000 years for the Northern Hemisphere, which is as far back as annual-resolution hemispheric estimates of temperatures can be made. The melting of glaciers over most of the world and rising sea levels confirm the reality of the global temperature increases. The warming is observed over land and ocean, and over both hemispheres. It is not an urban heat island effect. Further supporting evidence comes from the substantial retreat and thinning of Arctic sea ice, increased temperatures throughout the upper layers of the global oceans, decreases in Northern Hemisphere snow cover and in the freezing season of lakes and rivers.

There is good evidence for decadal changes in the atmospheric circulation and for ocean changes. These mean that increases in temperature are not uniform or monotonic; some places warm more than the average and some places cool. A good example is the past winter, where it was cold and temperatures were well below average in most of the lower 48 States, but Alaska had its warmest winter on record, averaging 9 F above normal. Similarly it was very warm throughout Europe.

Changes in precipitation and other components of the hydrological cycle vary considerably geographically. It is likely that precipitation has increased by perhaps 1 percent/decade in the 20th Century over most mid and high latitude continents of the Northern Hemisphere. Over the United States, surface temperatures have not risen as much as over Eurasia and instead it has become wetter, with more very heavy events, and this pattern has been shown to be a response to the general warming of the tropical oceans (Hoerling et al. 2001). Changes in climate variability and extremes are beginning to emerge.

One persistent issue has been the discrepancy in trends from the so-called satellite temperature record and that at the surface. The satellite record begins in 1979 and measures microwave radiation from the Earth coming from about the lowest 5 miles of the atmosphere. Consequently it does not measure the same thing as the surface temperature. Climate models run with increasing greenhouse gases suggest that warming in the lower atmosphere should be larger than at the surface whereas the observed record shows much less warming from 1979–1999 and this has been highlighted by skeptics. However, when observed stratospheric ozone depletion is included, the models suggest that the surface and tropospheric temperatures should increase at about the same rate. In fact this is what has happened from about 1960 to the present based on balloon observations that replicate the satellite record after 1979. The shorter satellite record is influenced by El Nino and effects of volcanic eruptions, and thus the Mt. Pinatubo eruption in 1991 leads to a relative downward trend in the lower atmosphere. Other effects, such as from cloudiness changes, have not been quantified but also influence the two records differently. Accordingly, the small trend in the satellite record is not inconsistent with the observed larger trend in surface temperatures (NRC 2000).

Human Influences

The amount of carbon dioxide in the atmosphere has increased by about 31 percent since the beginning of the industrial revolution, from 280 parts per million by volume (ppm) to 367 ppm, owing mainly to combustion of fossil fuels and the removal of forests. In the absence of controls, future projections are that the rate of increase in carbon dioxide amount may accelerate and concentrations could double from pre-industrial values within the next 50 to 100 years. Several other greenhouse gases are also increasing in concentration in the atmosphere from human activities (especially biomass burning, agriculture, animal husbandry, fossil fuel use and industry, and through creation of landfills and rice paddies). These include methane, nitrous oxide, the chlorofluorocarbons (CFCs) and tropospheric ozone, and they tend to reinforce the changes from increased carbon dioxide. However, the observed decreases in lower stratospheric ozone since the 1970's, caused principally by human-introduced CFCs, contribute to a small cooling.

Human activities also affect the tiny airborne particulates in the atmosphere, called aerosols, which influence climate in other ways. Aerosols occur in the atmosphere from natural causes; for instance, they are blown off the surface of deserts or dry regions. The eruption of Mt. Pinatubo in the Philippines in June 1991 added considerable amounts of aerosol to the stratosphere which, for about 2 years, led to a loss of radiation at the surface and a cooling. Human activities contribute to aerosol particle formation mainly through injection of sulfur dioxide into the atmosphere (which contributes to acid rain) particularly from power stations, and through biomass burning. A direct effect of resulting sulfate aerosols, which are seen as the

milky whitish haze from airplane windows, is the reflection of a fraction of solar radiation back to space, which tends to cool the Earth's surface. Other aerosols (like soot) directly absorb solar radiation leading to local heating of the atmosphere, and some absorb and emit infrared radiation. A further influence of aerosols is that many act as nuclei on which cloud droplets condense, affecting the number and size of droplets in a cloud and hence altering the reflection and the absorption of solar radiation by the cloud. Because man-made aerosols are mostly introduced near the Earth's surface where they can be washed out of the atmosphere by rain, they typically remain in the atmosphere for only a few days and they tend to be concentrated near their sources such as industrial regions. They therefore affect climate with a very strong regional pattern and usually produce cooling. In contrast, the greenhouse gases are not washed out. Their long lifetimes ensure a buildup in amounts over time, as is observed to be happening.

The determination of the climatic response to the changes in heating and cooling is complicated by feedbacks. Some of these can amplify the original warming (positive feedback) while others serve to reduce it (negative feedback). If, for instance, the amount of carbon dioxide in the atmosphere were suddenly doubled, but with other things remaining the same, the outgoing long-wave radiation would be reduced and instead trapped in the atmosphere. To restore the radiative balance, the atmosphere must warm up and, in the absence of other changes, the warming at the surface and throughout the troposphere would be about 1.2 C. In reality, many other factors will change, and various feedbacks come into play, so that the best IPCC estimate of the average global warming for doubled carbon dioxide is 2.5 C. In other words, the net effect of the feedbacks is positive and roughly doubles the response otherwise expected. The main positive feedback comes from increases in water vapor with warming.

In 2001, the IPCC gave special attention to this topic. The many issues with water vapor and clouds were addressed at some length in Chapter 7 (of which I was a lead author, along with Professor Richard Lindzen (M.I.T.), and others). Recent possibilities that might nullify global warming (Lindzen 2001) were considered but not accepted because they run counter to the prevailing evidence, and the IPCC (Stocker et al. 2001) concluded that "the balance of evidence favours a positive clear sky water vapor feedback of the magnitude comparable to that found in the simulations."

Increases in greenhouse gases in the atmosphere produce global heating ("global warming") which leads to expectations for increases in global mean temperatures (often mistakenly thought of as global warming), but other changes in weather are also important. In particular, surface heating enhances the evaporation of moisture and thus enhances the hydrological cycle (see Trenberth 1999). Global temperature increases signify that the water-holding capacity of the atmosphere increases and, together with enhanced evaporation, this means that the actual atmospheric moisture should increase, as is observed to be happening in many places. Because water vapor is a powerful greenhouse gas, this provides a positive feedback. It also follows that naturally occurring droughts are likely to be exacerbated by enhanced drying. Thus droughts, such as those set up by El Nino, are likely to set in quicker, plants wilt sooner, and the droughts may become more extensive and last longer with global warming. Once the land is dry then all the solar radiation goes into raising temperature, bringing on sweltering heat waves. Further, globally there must be an increase in precipitation to balance the enhanced evaporation. The presence of increased moisture in the atmosphere implies stronger moisture flow converging into precipitating weather systems. This leads to the expectation of enhanced rainfall and snowfall events, which are also being observed in many areas. In general, it is observed that where an increase in precipitation occurs, more falls as heavy events, increasing risk of flooding.

Modeling and Attribution of Climate Change

The best climate models encapsulate the current understanding of the physical processes involved in the climate system, the interactions, and the performance of the system as a whole. They have been extensively tested and evaluated using observations. They are exceedingly useful tools for carrying out numerical climate experiments, but they are not perfect, and so have to be used carefully (Trenberth 1997). Key issues in global climate change remain those of first detecting whether the recent climate is different than should be expected from natural variability, and second attributing the climate changes to various causes, including the human influences. The latest models have increasingly been able to reproduce the climate of the past century or so. Also their estimates of natural variability are compatible with those from the paleoclimate reconstructions. As a result, they can break down the contributions to the warming into components. Increases in solar luminosity prob-

ably were responsible for some of the warming from about 1910 to 1950 (perhaps as much as 0.3 F), but the warming of about 0.7 F in the past 30 years can only be accounted for by the increases in greenhouse gases in the atmosphere. Consequently, after much debate in the final plenary, the IPCC (2001) carefully crafted the following: "In the light of new evidence, and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations."

In 1995 the IPCC assessment concluded that "the balance of evidence suggests a discernible human influence on global climate" (IPCC 1996). Since then the evidence has become much stronger—from the recent record warmth, the improved paleorecord that provides context, better understanding of the role of stratospheric ozone depletion, improved modeling and simulation of the past climate, and improved statistical analysis. Thus the headline in IPCC (2001) is "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." The best assessment of global warming is that the human climate signal emerged from the noise of background variability in the late 1970's.

Biggest impact is likely to be felt by making the extremes more extreme. For any change in mean climate, there is likely to be an amplified change in extremes. The wide range of natural variability associated with day-to-day weather means that we are unlikely to notice most small climate changes except for the extremes. Extremes are exceedingly important to both natural systems and human systems and infrastructure, as we are adapted to a range of natural weather variations, and it is these extremes that exceed tolerances and cause nonlinear effects: the so-called "straw that breaks the camel's back." For instance, floods that used to have an expected return period of 100 years may now recur in 50 or 30 years. In practice, this effect may be experienced in floods through dams or levees that break, inundating the surrounding countryside and urban areas, resulting in loss of life, water damage, and more subtle effects such as polluted drinking waters.

The attribution of the recent climate change to the increases in greenhouse gases in spite of uncertainties related to aerosols has direct implications for the future. Because of the long lifetime of carbon dioxide and the slow penetration and equilibration of the oceans, there is a substantial future commitment to further global climate change even in the absence of further emissions of greenhouse gases into the atmosphere. Future projections of climate change depend on future emissions. They are given by the IPCC and not detailed here. In spite of differences among models and the many uncertainties that exist, the models produce some consistent results. All show considerable warming. All show larger changes over high northern latitudes and the northern continents, including North America, because land warms up faster than the oceans. Further research is needed to understand why the models respond as they do, and to reduce the uncertainties. While some changes arising from global warming are benign or even beneficial, the rate of changes as projected exceed anything seen in nature in the past 10,000 years and are apt to be disruptive in many ways. The economic effects of the weather extremes are substantial and clearly warrant attention in policy debates. References Hoerling, M. P., J. W. Hurrell, and T. Xu, 2001: Tropical origins for recent North Atlantic climate change. Science, 292, 90–92. IPCC, 1996: Climate Change 1995: The Science of Climate Change. Eds. J. T. Houghton et al., Cambridge University Press, Cambridge, U.K. 572 pp.

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STRONGER EVIDENCE OF HUMAN INFLUENCE ON CLIMATE: THE 2001 IPCC ASSESSMENT

(By Kevin E. Trenberth)

The third assessment from Working Group of the Intergovernmental Panel on Climate Change (IPCC),[1] issued in January 2001, affirmed previous findings but with much stronger language. Its message is clear: The Earth's climate is changing in ways that cannot be accounted for by natural variability—"global warming" is indeed happening. This article provides an outline of the IPCC process, as well as a summary of and commentary on the main findings of Working Group I.

IPCC reports on the evolving science of global climate change, focusing special attention on the ways in which human activities affect the climate. IPCC reviews the evidence for climate change and the possible causes and considers how the climate system responds to various agents of change. Because our climate models are simplified versions of the real world and are still being improved upon, IPCC evaluates the ability of models to describe the processes involved in the climate system and the functioning of the system as a whole. The panel seeks to attribute recent observed changes to possible causes, especially the human influences, and then, using climate models, projects future change from those causes.

Climate changes have occurred in the past naturally for various reasons, over periods ranging from decades to millennia. Fluctuations in the sun's energy output and other factors that influence the amount and fate of the energy that reaches the Earth's surface have caused natural climate change. And now, by greatly changing the composition of the atmosphere, humankind is performing an enormous geophysical experiment.[2] Human actions alter the Earth's environment in ways that cause climate change.[3] Legitimate debates go on about the extent and rate of change and what, if anything, can be done about it, but that the experiment is underway is not in doubt.

Land use (e.g., farming and building cities), storage and use of water (e.g., dams, reservoirs, and irrigation), generation of heat (e.g., furnaces), and the use of fossil fuels are the human-induced environmental changes that most influence the climate. The use of fossil fuels introduces visible particulate pollution (called aerosols) and gases such as carbon dioxide (CO_2) into the atmosphere, both of which alter the balance of radiation on Earth. These gases are relatively transparent to incoming solar radiation, yet they absorb and reemit outgoing infrared radiation. The resulting blanketing effect is known as the greenhouse effect, and the gases involved are called greenhouse gases. Not all greenhouse gases are the result of human activities. There is a large natural greenhouse effect that makes the Earth habitable. The increase in CO_2 levels over the last century or two from human activities, as well as the introduction of other greenhouse gases more recently, mean that more energy stays in the system. Global warming and the associated climate change are the expected results.

Observed Climate Change

Records of surface temperature show that a global mean warming of about 0.7 degrees C has occurred over the past 100 years. IPCC reports this change as 0.6 plus/minus 0.2 degrees C, but this is a linear fit to what is obviously not a linear trend (see Figure 1 below for the instrumental record of global mean temperatures). Temperatures increased most noticeably from the 1920's to the 1940's; they then leveled off from the 1950's to the 1970's and took off again in the late 1970's. The 1990's mark the warmest decade on record, and 1998 is by far the warmest year on record, exceeding the previous record held by 1997. Preliminary annual global mean temperatures in the year 2000 were about the same as for 1999. Synthesis of information from tree rings, corals, ice cores, and historical data further indicates that the 1990's are the warmest decade in at least the past 1,000 years for the Northern

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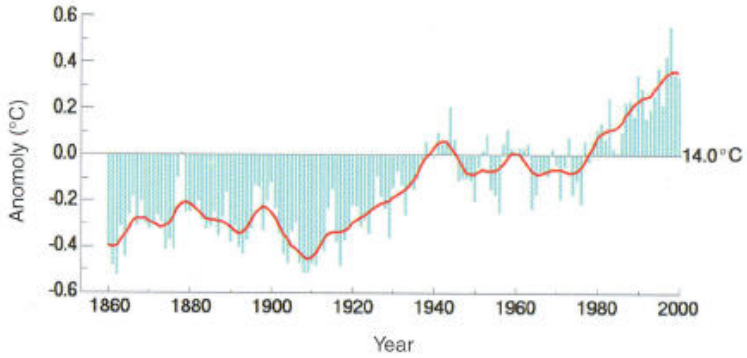
[1]IPCC, Climate Change 2001: The Scientfic Basis, J.T. Houghton et al., eds. (Cambridge U.K.: Cambridge University Press, 2001) (in press).

[2]R. Revelle and H.E. Suess, "Carbon Dioxide Exchange between Atmosphere and Ocean and Question of an Increase of Atmospheric CO_2 during the Past Decades" Tellus 9(1957): 18–27.

[3]F.S. Rowland, "Climate Change and Its Consequences: Issues for the New U.S. Administration:' Environment, March 2001, 28–34.

Hemisphere, which is as far back as annual-resolution hemispheric estimates of temperatures can be made.[4] The melting of glaciers over most of the world and rising sea levels confirm the reality of the global temperature increases.

Figure 1. Departures of global annual mean temperature from 14°C, 1860–2000



NOTE: This figure shows the departures of the global mean temperature from 14°C (the mean from 1961–1990) for the years 1860–2000.

SOURCE: Data provided by Hadley Center, United Kingdom Meteorological Office, and Climate Research Unit, University of East Anglia.

There is good evidence from measurements of sea level pressure, wind, and temperature over the 20th century for decadal changes in the atmospheric circulation and some evidence for similar ocean changes. For instance, these include changes in winds over the North Atlantic and Europe related to the phenomenon known as the North Atlantic Oscillation and changes in El Nino.[5] Such observations signal that increases in temperature are not uniform or monotonic. For example, some places warn more than the average, while other places cool. Changes in precipitation and other components of the hydrological cycle also vary considerably geographically. For instance, it is likely that precipitation has increased by perhaps 1 percent per decade during the 20th century over most mid-and high-latitude continents of the Northern Hemisphere. Changes in climate variability are also being seen and changes in extremes are beginning to emerge. Perhaps of greatest note are the Observed increases in the heat index (which measures humidity and temperature effects on comfort) and the observed trend toward more intense precipitation events.

One persistent controversy in climate change science has been the discrepancy between the trend seen in the so-called satellite temperature record and that seen in the temperature record from the Earth's surface. The controversy stems in part from the fact that the two data sets do not measure the same phenomenon. The satellite record, which begins in 1979, measures microwave radiation from the lowest 8 kilometers of the Earth's atmosphere and thus depicts temperatures in that part of the atmosphere, which are quite different from those at the surface. Climate models

[4]Reconstructions of temperature and rainfall make use of multiple proxy indicators at individual sites around the world but have to be merged, reconciled, and combined to give regional and larger area averages. Sufficient data with annual resolution now exist to do this for the Northern Hemisphere for the past 1,000 years but not for the Southern Hemisphere or for beyond the past millennium. See M.E. Mann, R.S. Bradley, and M.K. Hughes, "Global-scale Temperature Patterns and Climate Forcing over the Past Six Centuries," Nature 392, 23 April 1998, 779–87; and M.E. Mann, R.S. Bradley, and M.K. Hughes, "Northern Hemisphere Temperatures during the Past Millennium: Inferences, Uncertainties, and Limitations," Geophysical Research Letters 26 (1999): 759–62.

[5]J.W. Hurrell, "1995: Decadal Trends in the North Atlantic Oscillation Regional Temperatures and Precipitation," Science 269 (1995): 676–9; K.E. Trenberth and T.J. Hoar, "The 1990–1995 El Nino-Southem Oscillation Event: Longest on Record," Geophysical Research Letters 23 (1996): 57–60; and K.E. Trenberth and T.J. Hoar, "El Nino and Climate Change," Geophysical Research Letters 24 (1997): 3057–60.

that assess the scenario of increasing greenhouse gases suggest that warming in the lower atmosphere should be greater than that at the surface. But here is the point of contention for skeptics: The observed satellite record shows less warming from 1979–1999. Consequently, doubt has been cast on the veracity of both the surface temperature record and the models. However, when the observed stratospheric ozone depletion is included in the models, the models predict that the surface and tropospheric temperatures increase at about the same rate. In fact, this is what has happened from about 1960 to the present based on balloon observations, which replicate the satellite record after 1979. Because the satellite record includes only two decades, the influence of El Nino and the eruption of Mt. Pinatubo in 1991 leads to a disproportionate relative downward trend in temperatures observed in the lower atmosphere. Other effects, such as changes in cloud cover, have not been accounted for by the models and may also affect the two records differently. Accordingly, the different short-term trend in the satellite record is not at odds with the warming in the surface record.

The Climate System and Its Driving Forces

Because we humans live in and breathe the atmosphere, it is natural for us to focus on the atmospheric changes. But the atmosphere is only one element of a greater climate system that involves interactions among various internal components and external forcings. The internal, interactive components include the atmosphere, the oceans, sea ice, the land and its features (including the vegetation, albedo, biomass, and ecosystems), snow cover, land ice, and the hydrology of the land (including rivers, lakes, and surface and subsurface water). The factors that are normally regarded as external to the system include the sun and its output, the Earth's rotation, sun-Earth geometry and the slowly changing orbit, the physical components of the Earth system such as the distribution of land and ocean, the topographic features on the land, the ocean-bottom topography and basin configurations, and the mass and basic composition of the atmosphere and the oceans. These factors determine the mean climate, which may vary from natural causes. Climate variations arise naturally when the atmosphere is influenced by and interacts with other internal components of the system and "external" forcings.

The continual flow of radiation from the sun provides the energy that drives the Earth's climate. About 31 percent of that radiation gets reflected back into space by molecules, tiny airborne particles (aerosols), clouds, or by the Earth's surface and thus plays no part in the climate. The sun's massive energy input leads to warming. To maintain a balance, the Earth radiates back into space, in the form of "long-wave" or infrared radiation, roughly the same amount of energy that it receives. The amount of radiation lost from the top of the atmosphere to space corresponds to a global mean surface temperature of about -19 degrees C, much colder than the annual average global mean temperature of about 14 degrees C. The higher mean temperature of the Earth, given the amount of energy radiated from its surface, can be explained by the existence of the atmosphere. The Earth's atmosphere intercepts the bulk of energy emitted at the surface and, in turn, reemits energy both toward space and back to the Earth. The energy that escapes into space is emitted from the tops of clouds at various atmospheric levels (which are almost always colder than the surface) or by atmospheric gases that absorb and emit infrared radiation. These greenhouse gases, notably water vapor and CO_2, produce a blanketing effect known as the natural greenhouse effect. Water vapor gives rise to about 60 percent of the current greenhouse effect and CO_2 accounts for about 26 percent.[6] Clouds also absorb and emit infrared radiation and have a blanketing effect similar to that of the greenhouse gases. But because clouds also reflect solar radiation, they act to cool the surface. Though on average the two opposing effects offset one another to a large degree, the net global effect of clouds in our current climate, as. determined by space-based measurements, is a small cooling of the surface.

Human Influences

The amount of CO_2 in the atmosphere has increased by about 31 percent since the beginning of the Industrial Revolution, from 280 parts per million (ppm) by volume to 367 ppm. This increase is due mainly to combustion of fossil fuels and the removal of forests. Projections of future CO_2 concentrations suggest that, in the absence of controls, the rate of increase may accelerate and thus double the concentrations of CO_2 from pre-industrial levels within the next 50 to 100 years. Human activities (especially biomass burning; agriculture; animal husbandry; fossil fuel extraction, distillation, and use; and the creation of landfills and rice paddies) have

[6]J.T. Kiehl and K.E. Trenberth, "Earth's Annual Global Mean Energy Budget," Bulletin of the American Meteorological Society 78 (1997): 197–208.

increased the atmospheric concentrations of several other greenhouse gases (methane, nitrous oxide, chlorofluorocarbons (CFCs)) and tropospheric ozone. These other greenhouse gases tend to reinforce the changes caused by increased CO_2 levels. However, the observed decreases in lower stratospheric ozone since the 1970's, caused principally by human-introduced CFCs and halocarbons, contribute a small cooling effect.

Aerosols enter the atmosphere naturally when they are blown off the surface of deserts or dry regions, blasted into the atmosphere during volcanic eruptions, or released during forest fires. They impact climate in various ways. For instance, the aerosols introduced into the atmosphere during the eruption of Mt. Pinatubo in the Philippines in June 1991 blocked enough radiation for 2 years to cause observable cooling. Human activities contribute to aerosol particle formation mainly through emissions of sulfur dioxide (SO_2) (a major source of acid rain), particularly from coal-burning power stations and through biomass burning. Sulfate aerosols, visible as a milky, whitish haze from airplane windows, reflect a fraction of solar radiation back to space and hence work to cool the Earth's surface. Some aerosols, like soot, absorb solar radiation and lead to local warming of the atmosphere. Other aerosols absorb and reemit infrared radiation. Aerosols play still another role. By acting as the nuclei on which cloud droplets condense, they affect the number and size of droplets in a cloud and thereby alter the reflective and absorptive properties of clouds.[7] Aerosols from human activities are mostly introduced near the Earth's surface and are often washed out of the atmosphere by rain. They typically remain aloft for only a few days near their sources. Aerosols therefore have a very strong regional affect on the climate, usually producing cooling.

The determination of the climatic response to the changes in heating and cooling is complicated by feedbacks. Some of these feedbacks amplify the original warming (positive feedback) and others serve to reduce warming (negative feedback). If, for instance, the amount of CO_2 in the atmosphere were suddenly doubled while all other factors remained constant, the amount of energy absorbed by the atmosphere would increase. With additional energy trapped in the system, a new balance would have to be reached. To accomplish this balance the atmosphere would have to warm up. In the absence of other changes, the warming at the surface and throughout the troposphere would be about 1.2 degrees C.[8] In reality, many other factors could change as a result of doubled CO. concentrations, and various feedbacks would come into play. When the positive and negative feedbacks are considered, the best IPCC estimate of the average global warming for doubled CO_2 is 2.5 degrees C. The net effect of the feedbacks is positive and, in fact, roughly doubles the global mean temperature increase otherwise expected. Increases in water vapor that accompany warming contribute the strongest positive feedback.

Modeling of Climate Change

To quantify the response of the climate system to changes in forcing, the complex interactions and feedbacks among the components must be accounted for (see Figure 2). Numerical models of the climate system based upon sound, well-established physical principles are the tools used to estimate climate change. Experiments can be run with climate models in which concentrations of greenhouse gases or other influences, like aerosols, are varied. The best models capture the current understanding of the physical processes involved in the climate system, the interactions among the processes, and the performance of the system as a whole. The predictive powers of a model can be tested by running the model with known forcings from the past through it and then comparing the results to actual climate records. Though models are exceedingly useful tools for carrying out numerical climate experiments, they do have limitations and must be used carefully.[9] The latest models have been able to reproduce the climate of the past century or so with increasing accuracy (see Figure 3 on page 15). Thus the global mean temperature record is well replicated within limits imposed by natural fluctuations merely by specifying the changes in atmospheric composition and changes in the sun.

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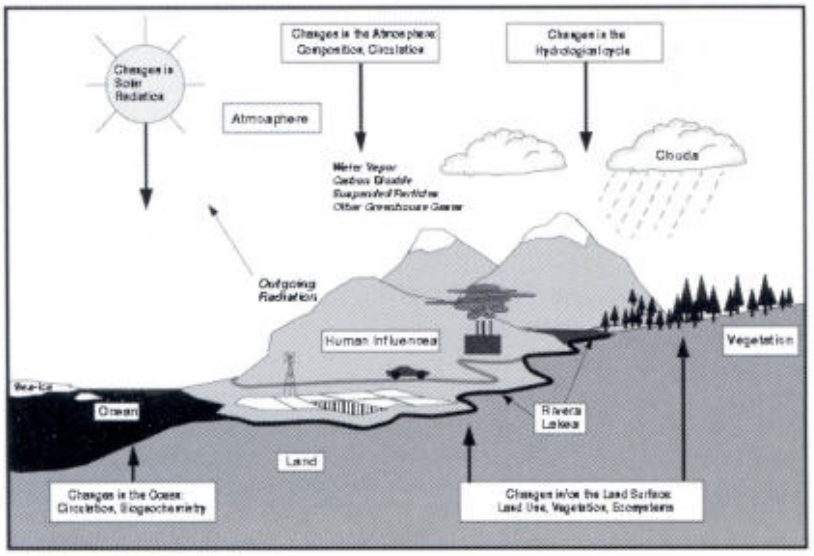
[7]Recent evidence highlights the possible importance of this effect, although the magnitude is very uncertain, See J.M. Hansen, M. Sato, A. Lacis, and R. Ruedy, 'The Missing Climate Forcing," Philosophical Transactions of the Royal Society of London 352 (1997): 231–40.

[8]K.E. Trenberth, J.T. Houghton, and L.G. Meira Filho, "The Climate System: An Overview:' in J.T. Houghton et al., eds., Climate Change 1995: The Science of Climate Change (Cambridge, U.K.: Cambridge University Press, 1996), 51–64.

[9]K.E. Trenberth, "The Use and Abuse of Climate Models in Climate Change Research:' Nature 386, 13 March 1997, 131–33.

Figure 2. The climate system and its driving forces



SOURCE: K. Trenberth.

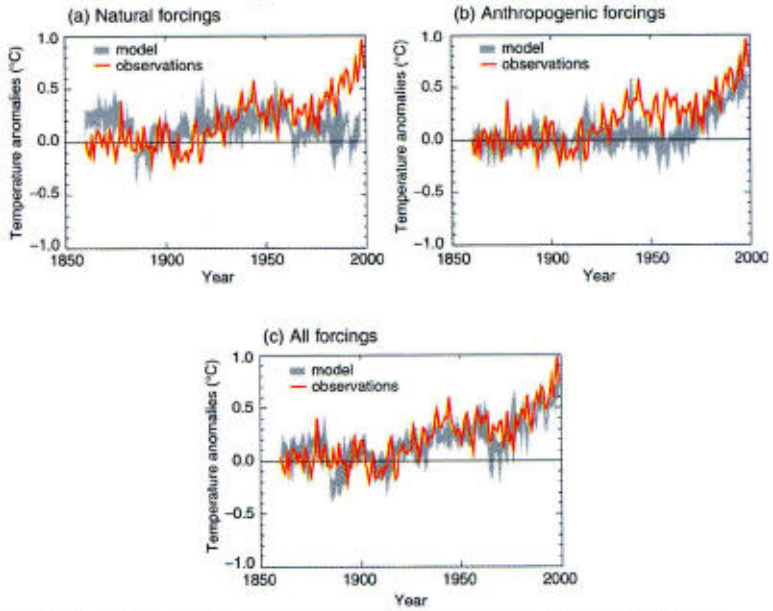
Detection and Attribution

Two main issues that must be settled before politicians are likely to take action: First, it must be discerned whether the recent climate has changed more than expected from natural variability; second, observed climate changes must be attributed to various causes, including human influences. Several key points that emerged from the recent IPCC assessment address these issues:

- The magnitude and rate of change of mean surface temperature globally, or at least in the Northern Hemisphere, over the past few decades is outside the range of anything deduced from paleo-climate records of the last 1,000 years. Data are inadequate before that.
- Estimates of internal climate variability (how much climate can vary from natural causes not including changes in the sun) derived from models are reasonably consistent with the preindustrial variability deduced from paleo-climate data. Together, the estimates from model and paleo-climate observations provide more reliable estimates of the natural variability.
- Consequently, given the better sense of natural climate variability, detection of climate change is much clearer now than it was 5 years ago. Hence, it is very unlikely that recent climate change is natural in origin.
- The natural forcing agents (e.g., solar and volcanoes) over the last two to four decades are likely to have had a net cooling effect and, thus, cannot be a cause of the recent increase in temperature.
- A combination of internal climate variability, natural forcing, and perhaps small anthropogenic forcing can account for the increases in the observed globally averaged surface temperature up until about 1970. Increases in solar radiation may account, in part (perhaps 0.15 to 0.2 degrees C), for the warming between about 1920 and 1940, even though solar changes are poorly known before 1979 when satellite observations began (see Figure 3). However, it is also probable that a natural component related to changes in North Atlantic Ocean circulation may have played a role.
- The rate and magnitude of the warming over the last few decades cannot be explained unless the net human influence is one of warming over the last 30 years. Uncertainties in cooling by aerosol forcing (especially the effects on clouds) are therefore constrained.
- The nearer the "balance" or the offset between positive anthropogenic greenhouse gas forcing and negative anthropogenic aerosol forcing over the last 50 years, the larger the climate responsiveness needs to be to explain warming over recent

decades. For instance, if the net warming is small, the climate system must be quite sensitive to that warming to produce the observed temperature change. But if the warming is larger, the climate system must be less sensitive to produce the same temperature change. This has implications for future predictions.

Figure 3. Simulation of temperature change under three forcing mechanisms



NOTE: Climate models can be used to simulate the temperature changes that result from natural and anthropogenic causes. The simulations represented in Figure 3a were done with only natural forcings: solar variation and volcanic activity. Figure 3b represents simulations with only anthropogenic forcings: greenhouse gases and aerosols. Figure 3c represents simulations with both natural and anthropogenic forcings. Notice that when human and natural forcings are included, the simulations most closely match the observed temperature changes. Such comparisons suggest that anthropogenic forcings provide a plausible explanation for a substantial part of the observed temperature change over the past century.

SOURCE: IPCC, *Climate Change 2001: The Scientific Basis,* J. T. Houghton et al., eds. (Cambridge U.K.: Cambridge University Press, 2001) (in press). Based on P. A. Stott et al., "External Control Of Twentieth-century Temperature Variations by Natural and Anthropogenic Forcings," *Science* 281, 15 December 2000, 2133-37.

The line of argument shown by these points is open to the criticism that there is some circular reasoning involved. The objective of attributing climate change to specific causes is to account for the change in temperature, but the temperature change itself is invoked as part of the argument. Ideally, only the knowledge of forcings and responsiveness of the system, as given by models, are used to replicate the observed temperature. Neither the forcings nor the true sensitivity of the systems are known well enough to proceed in this manner. Climate modelers attempt to avoid such a trap by basing their models on sound physical principles. However, many parameters have to be chosen when developing models. Although the choices are based on knowledge of the processes, and the parameters are physically based,

there is ample scope for unintentional tuning. For example, the brightness of clouds depends on the size and number of cloud droplets but varies from cloud to cloud and is not known well. Choice of a particular value for the model clouds may compensate for shortcomings in the amount of clouds in the model. Inevitably, running a model with two different sets of parameters yields different results, and the set that brings the model into best agreement with observations is chosen for further use in the model. It is important, therefore, to recognize that the procedure is not as objective as it might appear and that uncertainties remain.

The most contentious section in the Summary for Policy Makers proved to be the concluding paragraph on attribution. After much debate, a carefully. crafted statement was agreed upon: "In the light of new evidence, and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations," Moreover, although not highlighted by IPCC, increasing evidence suggests that the signal of human influence on climate emerged from the noise of natural variability in about 1980 and will only get larger.

The implications of these findings may be felt in the near future. The models predict that global temperature increases of 0.1 to 0.2 degrees C over the next decade are likely unless volcanic eruptions interfere.[10] Time will tell whether the assessment is correct, perhaps within a decade.

Prediction of Climate Change

Climate models have been used to project the effects of future global warming to the year 2100. Because human activities are not predictable in any deterministic sense, "predictions" based on human influences necessarily contain a "what if" emissions scenario. IPCC presumes that these predictions will be used for plan-fling purposes, including actions to prevent undesirable outcomes, consistent with the Framework Convention on Climate Change. Such actions, which are a consequence of the prediction, may change the outcome and thus make the prediction wrong. Accordingly, they are not truly predictions but rather projections that are tied to particular emissions scenarios. This is art important point, because some skeptics have ignored the distinction and misused it to challenge findings. For example, in 1990, only scenarios with increasing greenhouse gases were used. Then, in 1995, the first primitive scenarios with aerosols were included, which produced a cooling. Some skeptics, pointing to this difference, claimed that the models had changed and were therefore suspect, when, in fact, it was the scenarios that had changed, not the models. In addition, for a given scenario, the rate of temperature increase depends on the model used and how, for instance, the model depicts features such as clouds. It is for this reason that a range of possible outcomes exists. About half of the spread in range of values at 2100 is due to uncertainties in models. The spread in values is unrelated to the scenarios and should not be considered as representative of anything real. The rest of the spread in range can accounted for by the different scenarios.

In 2001, the future emissions scenarios were set up by the Special Report on Emissions Scenarios (SRES)[11] (see the box on this page) and included 35 scenarios. The projections for six "illustrative" CO_2 emission scenarios are given in Figure 4a. For each emissions scenario, IPCC calculates expected concentrations of CO_2. In the year 2100, the projected values range from about 550 ppm to almost 1,000 ppm, compared with 367 ppm at present. Projections of temperature change and sea-level rise for these same scenarios are shown in Figures 4b and 4c on page 18. When the range of uncertainties is factored in and the projections for 2100 across all 35 scenarios are analyzed, there is an increase in the global mean temperature from 1.4 degrees C to 5.8 degrees C (see Figure 4b). Most increases fall between 2 degrees C to 4 degrees C. These numbers exceed those in the 1995 IPCC report, which showed temperature changes ranging from about 1 degree C to 3.5 degrees C.[12] The increase is higher mainly because the new emissions scenarios include lower sulfur emissions (which are likely to be reduced for air quality reasons). The 35 scenarios also expand the range of possibilities from the last report and contribute to the range in temperature projected in 2100. Modifications in carbon cycle models that

[10]IPCC, note 1 above.

[11]IPCC, Special Report on Emissions Scenarios, Summary for Policy Makers (2000).

[12]IPCC, Climate Change 1995: The Science of Climate Change, J.T. Houghton et al., eds., (Cambridge, U.K.: Cambridge University Press, 1996). For a review of the second IPCC assessment, see Climate Change 1995: The Science of Climate Change, reviewed by W.C. Clark and J. Jager, Environment, November 1997, 23–8; Climate Change 1995: Impacts, Adaptations, and Mitigation, reviewed by R.W. Kates, Environment, November 1997, 29–33; and Climate Change 1995: Economic and Social Dimensions, reviewed by T. O'Riordan, Environment, November 1997, 34–39.

convert emissions to concentrations and in climate models account for less than 20 percent of the deviation between the 1995 IPCC report and this year's report and thus do not account for much change in the range.

Figure 4c also shows the corresponding sea-level rise. Because heat penetrates slowly into the voluminous oceans, sea-level rise is expected to be manifested over a longer period of time than temperature change. Because the heat inputs that have already occurred will only work their way through the system slowly, even in the unlikely scenario of a massive reduction in greenhouse gas emissions, sea-level rise will continue unabated. Note again that though these projections include crude estimates of the effects of sulfate aerosol, they deliberately omit other possible human influences, such as changes in land use.[13] A major concern is that the projected rates of climate change in Figures 4b and 4c exceed anything seen in nature in the past 10,000 years.

An increase in global mean temperature logically follows increased heating. But temperature increase, often thought of as the sole indicator of "global warming," is not the only possible outcome. For example, rising concentrations of greenhouse gases enhance the hydrological cycle by furnishing additional energy for the evaporation of surface moisture. Because the water-holding capacity of the atmosphere is greater at higher temperatures, increased atmospheric moisture should accompany global temperature increases. Because water vapor is also a powerful greenhouse gas, it contributes a strong positive feedback, amplifying global warming. Naturally occurring droughts are also liable to be exacerbated by enhanced drying. Thus droughts, such as those set up by El Nino, are likely to take hold more quickly, wilt plants sooner, and become more extensive and longer-lasting with global warming. When the land is dry, the energy that would ordinarily drive the hydrological cycle goes into raising temperatures, bringing on sweltering heat waves. Further, globally there will have to be an increase in precipitation to balance the enhanced evaporation. More moisture in the atmosphere implies stronger moisture 'flow converging into all precipitating weather systems-such as thunderstorms or extratropical rain or snow storms-and rain or snow events of greater intensity.[14]

For any change in mean climate, there, is likely to be an amplified change in extremes. Because of the wide range of natural variability associated with day-to-day weather, most small climate changes will probably go unnoticed: the extremes, however, will be easily detected. Extremes play an exceedingly important role for natural and human systems and infrastructure, All living organisms are adapted to a range of natural weather variations, New extremes could he devastating to ecosystems. Extremes that exceed tolerances of a system can cause nonlinear effects: the so-called "straw that breaks the camel's back," For instance, floods that historically have had an expected return period of 100 years may now recur in 50 or 30 years.[15] More frequent extreme floods may overstress dams and levees, causing breaks and the consequent damage to infrastructure, loss of human life, and contamination of drinking water.

The changes in extremes of weather and climate observed to date have only recently been compared to the changes projected by models. many of which agree with recent observed trends. Models project that higher maximum temperatures, more hot days. and more heat waves are all likely. The largest temperature increases are expected mainly in areas where soil moisture decreases arc apt to occur. Increases of daily minimum temperatures are projected to occur over most land areas and are generally larger where snow and ice retreat. A decreased number of frost days and cold waves is likely. Changes in surface air temperature and surface humidity will mean increases in the heat index and increased discomfort. Increases in surface air temperature will lead to a greater number of days during which cooling (such as from air conditioning) might be considered desirable for comfort and fewer days during which space heating is required for comfort. Precipitation extremes are expected to increase more than the mean, as will the frequency of extreme precipitation events. A general drying is projected for the mid-continental areas during summer, as a result of higher temperatures and increased drying not offset by increased precipitation in these regions. Theoretical and modeling studies project increases in the upper limit of intensity of tropical cyclones in addition to appreciable increases in

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[13]It is estimated that conversion from forests to agriculture in the United States makes the surface much brighter, especially in the late summer and fall after crops are harvested. This means more solar radiation is reflected, which results in cooling.

[14]K.E. Trenberth, "Atmospheric Moisture Residence Times and Cycling: Implications for Rainfall Rates with Climate Change," Climatic Change 39 (1998): 667–94.

[15]K.E. Trenberth, "The Extreme Weather Events of 1997 and 1998:' Consequences 5 (1999): 2–15.

their average and peak precipitation intensities. Changes in El Nino are also likely, but their nature is quite uncertain.[16]

Humans Are Changing the Climate

In 1995, the IPCC assessment concluded that "the balance of evidence suggests a discernible human influence on global climate."[17] Since then the evidence has become much stronger-the recent record warmth of the 1990's, the historical context provided by the improved paleo-record, improved modeling and simulation of the past climate, and improved statistical analysis. Thus the headline in the new IPCC report states, "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."[18] The best assessment of global warming is that the human contribution to climate change first emerged from the noise of background variability in the late 1970's. Hence, climate change is expected continue into the future. The amplification of extremes is likely to cause the greatest impact. Although some change arising from global warming may be benign or even beneficial, the economic effects of more extreme weather will be substantial and clearly warrant attention in policy debates.

Because of the long lifetime of CO_2 in the atmosphere and the slow heat penetration and equilibration of the oceans, there is already a substantial commitment to further global climate change, even in the absence of further emissions of greenhouse gases. IPCC considered implications for stabilizing CO_2 and greenhouse gases at various concentrations up to four times pre-industrial levels and concluded that substantial reductions in emissions, well below current levels, would be required sooner or later in all cases. Even full implementation of the Kyoto Protocol would merely slow the time of doubling of CO_2 concentrations from pre-industrial values by perhaps 15 years (for instance from 2060 to 2075).[19] Moreover, these projections emphasize that even stabilizing concentrations would not stop climate change because of the slow response of the system; for this reason, temperature increases and especially sea-level rise would continue for many decades thereafter. As we begin to understand that our geophysical experiment might turn out badly, we are also discovering that it cannot be turned off abruptly.

The IPCC report provides the evidence that global warming is happening and now the question arises, What, if anything, should be done about these findings? The options include: do nothing, mitigate or stop the problem, adapt to the changes as they happen, or find some combination of these options. Different value systems come, into play in deciding how to proceed. Considerations include those of population growth, equity among developed and developing countries, intergenerational equity, stewardship of the planet, and the precautionary principle ("better to be safe than sorry"). Those with vested interests in the current situation frequently favor the first option, extreme environmentalists favor the second, and those who have a belief that technology can solve all problems might favor the third. In rationally discussing options, it is helpful to recognize the legitimacy of these different points of view. This problem is truly a global one because the atmosphere is a global commons. These immense problems cannot be solved by one Nation acting alone. Unfortunately, to date, international progress toward mitigating and preparing for the possible outcomes of global warming is inadequate.

The evidence presented by the IPCC report suggests that there is a strong case for slowing down the projected rates of climate change caused by human influences. Any climate change scenario is fraught with uncertainties. But a slowing in the warming process would allow researchers to improve projections of climate change and its impacts. Actions taken to slow down climate change would provide time to better prepare for and adapt to the changes as they appear. Natural systems and human systems, many of which have long amortization lifetimes (e.g., power stations, dams, and buildings), are then less likely' to be dislocated or become obsolete quickly. Therefore, we must plan ahead. Greater energy efficiency and expanding

[16]The 1997–1998 El Nino is the biggest recorded event by several measures. The last two decades have been marked by unusual El Nino activity. See Trenberth and Hoar, 1996 and 1997, note 5 above. A key question is how is global warming influencing El Nino? Because El Nino is involved with movement of heat in the tropical Pacific Ocean, it is conceptually easy to see how increased heating from the buildup of greenhouse gases might interfere. Climate models certainly show changes with global warming, but none simulate El Nino with sufficient fidelity to have confidence in the results. So the question of how El Nino may change with global warming is a current research topic.

[17]Trenberth, note 14 above.

[18]IPCC, note 1 above.

[19]T.M.L. Wigley, "The Kyoto Protocol: CO_2, CH_4 and Climate Implications," Geophysical Research Letters 25 (1998): 2285–8.

use of renewable resources, such as solar power, are clearly key steps toward slowing the rate of climate change.

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RESPONSES OF DR. KEVIN E. TRENBERTH TO ADDITIONAL QUESTIONS FROM SENATOR CORZINE

Question 1. Dr. Lindzen's testimony describes the state of scientific consensus about climate change as "lacking in policy relevant content." Do you agree with this assessment and, if so, why?

Response. I do not agree that the scientific consensus about climate change is "lacking in policy relevant content." Some relevant points follow. The assessment has determined:

1) The climate is changing.

2) The global change is significant and outside of the realm of natural variability.

3) The change in the last 50 years is mostly caused by human activities.

4) The biggest contributor is the observed increases in carbon dioxide in the atmosphere which arise mostly from emissions from fossil fuel burning. However, there are several other factors (e.g. methane) and activities (such as deforestation) that also contribute.

5) The slow response of the climate system, especially the oceans, means that we have not yet seen the full change already mandated by our activities.

6) The prospects are that changes will continue and will grow in magnitude, but not in a straightforward way.

7) Changes are likely to occur at a rate that is much greater than anything seen historically (in the last 10,000 years).

8) Change itself is thus likely to be disruptive—unless we can plan for and adjust to the expected changes beforehand. Some changes might be beneficial, but prospects are for more extremes (like floods and droughts) which are not.

9) Our current observing, modeling and prediction capabilities limit our ability to plan very reliably. However, projections scope out the magnitude of the anticipated changes.

10) The long lifetime of carbon dioxide means that we cannot stop the problem, at best we can slow it down. But that would buy time for better planning and adaptation.

11) The atmosphere is global, contributions from all countries count.

12) Effects will be uneven, across countries, across societies, and across rich and poor, although the latter are more vulnerable. They will affect everyone, regardless of their contributions to the problem. There will be winners and losers.

Even what seems to be a benign change can be disruptive. For instance, I recently had a call from a scientist from Greece who had been working in Crete. The winters there have become drier, the rainy season has shifted more into the spring and is now more intense when it occurs. The change in rainfall has meant that the primary crop of olives has insufficient moisture when developing, and the quality and quantity have gone down. The new climate is less suitable for olives. These changes are believed to be related to global warming.

Accordingly I believe that the above findings have direct relevance to policies on:

- The need to reduce emissions of greenhouse gases into the atmosphere to slow the rates of change
- To improve observations of how the climate is changing
- To increase research that will lead to better predictions of how the climate will change
- To make plans to deal with the effects of climate change, and perhaps compensate victims of climate-related disasters
- The need for the U.S. to play a leadership role internationally on this whole issue

Question 2. Can you please offer your assessment of the integrity of the IPCC Assessment Report process? Do you believe the IPCC takes into account the best scientific literature available, and produces credible scientific documents?

Response. Yes.

The IPCC process involves scientists from many nations. A deliberate attempt is made to involve scientists from developing countries—although they may not contribute a lot to the report, they contribute to the understanding and acceptance of the report. Scientists from all political and ideological persuasions are included and are encouraged to be involved. The process is very open. Well known skeptics are involved as lead authors, contributors and as reviewers (including Dr. Lindzen). For the Third Assessment IPCC report, Working Group I consisted of 123 lead authors, 516 contributors, 21 review editors, and over 700 reviewers. Two major reviews were carried out: the first by scientists, the second with comments by anyone, including governments and NGO's. All comments are taken into account and all are addressed, with a file of the answers kept by IPCC Technical Support Unit and overseen by independent editors, two per chapter. A key point is that the assessment is performed by scientists who have as their objective to produce the best statement about the state of the science.

Each new IPCC report reviews all the published literature over the previous 5 years or so, and assesses the state of knowledge, while trying to reconcile disparate claims and resolve discrepancies, and highlight uncertainties. The report cannot be selective in what it deals with. It is the most credible document imaginable. The result is very much a consensus document. It has all of the advantages implied by that but also the disadvantages: It is not necessarily the latest or greatest, it is too long for readability, but because it does sort out what can be reliably stated, and it is a useful reference. The greatest weakness is that all chapters are written in parallel, and also the working groups operate in parallel. Several plenary sessions of all authors help to cut down on conflicts, gaps, and duplication, but that some of those problems remain is almost inevitable. The summaries provide more digestible material for most readers.

Only in the Summary for Policy Makers do governmental officials get involved in a word by word approval process, in which how things are said is determined by governments, but what is said is vigorously defended by the scientists that are present.

Question 3. Dr. Lindzen expresses dissatisfaction in his testimony that certain positive feedbacks are poorly accounted for in current models. In your testimony, you note that the likely net effect of all feedbacks is positive. Can you elaborate on the significance of this for interpreting the outputs of climate models?

Response. There are shortcomings of our understanding of the processes involved and how they are depicted in models. These arise from inadequate observations and theoretical underpinnings associated with the incredible complexity of dealing with scales from molecules and cloud droplets to the planetary-scale atmospheric circulation, as well as computational limitations. Several steps are done:

1) Individual processes are dealt with as best possible given the understanding and computational limitations.

2) The processes are assembled in models and then the model components are tested with strong constraints. The components include modules of the atmosphere, the oceans, the land and sea ice, and the land surface. For instance the atmosphere can be simulated with specified ocean (sea surface temperature) conditions, etc.

3) The climate system model as a whole is then tested against observations when it is run in an unconstrained mode.

One strong test is to simulate the annual cycle of seasonal variations. Another is to simulate measured variability from year to year. Yet another is to simulate past climates (paleoclimate), based on reconstructions of conditions thousands or millions of years ago using tree rings, ice cores etc.

All models have some shortcomings, and some are better than others. Note that feedbacks are not explicitly inserted, they arise from the above process. However, it is not possible to pass all of these tests without inferring aspects related to the feedbacks.

In particular, with no feedbacks, a doubling of carbon dioxide concentration in the atmosphere is estimated to produce a global mean temperature increase of 1.2 degrees C. The best estimate with all feedbacks is 2.5 degrees C. The dominant feedback is from water vapor. Increased heating produces increases in evaporation and atmospheric moisture content and, as water vapor is a greenhouse gas, it has a positive feedback. Professor Lindzen believes this feedback may be overestimated but the evidence does not support his views, as outlined in my testimony. It has been shown that without positive water vapor feedbacks, it is not possible to get close to passing these tests.

Question 4. I represent a coastal State, New Jersey. I am therefore particularly concerned about a projected rise in sea level from three to 35 inches by 2100. Can

you elaborate on the projected Atlantic coast impacts of climate change over that time period?

Response. Rising sea level is a major problem for small island States and coastal regions. The central estimate for 2100 is about 20 inches increase. But sea level will continue to rise much more further into the future.

Sea level varies naturally with tides and with storms. Therefore there is some resiliency to its effects. However, the effects can be catastrophic if all three are combined: higher sea level at high tide and a storm surge. An example is that during a major El Nino, sea level rises by 6 to 12 inches along the coast of California. In early 1998 the rise was 8 inches. When storms and high tides combined with this, it led to tremendous coastal erosion and a number of examples of houses along the coast toppling into the sea.

There are many other effects and these are all nicely summarized in a two-page spread of National Geographic, February 2001, called Earth Pulse, about 8 pages from the front of that issue (unfortunately with no page numbers). Effects include infiltration of fresh water systems in the water table by salt water, loss of coastal wetlands, and beach erosion. Protective dikes and powerful pumps are used in some places to keep the sea out (e.g. New Orleans area, where the problem is exacerbated by subsiding land).

Other risks on the Atlantic coast are enhanced versions of things seen in recent years. More prolonged droughts, but also more risk of inundations from decaying tropical storms. Hurricane Floyd in 1999 on the heals of a drought might be a case in point.

Question 5. The recently published National Assessment on climate change, coordinated by the USGCRP, stated that climate change would affect the Northeast's ecosystems, such as bays and estuaries. Can you give us an example of an ecosystem or species that would be adversely impacted by minimal changes in temperature?

Response. I am not an expert in ecosystems and I cannot answer the specific question. However, Northeast bays and estuaries would be affected not only by temperature changes, but also changes in precipitation, runoff, salinity, and storminess. Water quality would likely change. Seasonal changes in snow cover and melt, and ice on rivers and streams would likely increase runoff in winter or early spring instead of late spring. Algal blooms are projected as likely to increase, limiting other aquatic vegetation. However, details of what would happen in this area are quite uncertain and also depend on water-borne pollutants. While change is likely, its detailed nature and impact on specific species is not so clear.

Question 6. What further studies can be done to understand how oceans play an important part in climate change and the reduction of greenhouse gases? What other climate components or processes would you recommend that Federal research be focused on?

Response. We do not have a global observing system for the oceans. Nor are many other observation systems for climate adequate. The foremost need, in my view, is to develop an observing system for the oceans that is global. Up till now this has not been practical, but new technology now makes it possible and plans have been developed. The observing system has space-based components, including altimeters to measure sea level, passive radiometers to measure sea surface temperature, ocean color, and precipitation, and active sensors (including radars) to measure surface winds (or wind stress) and precipitation. However, satellite borne instruments cannot see below the surface, and an in situ observing system is also vital. Implementing the plans for the "ARGO" array of profiling floats is essential to provide measurements of temperature and salinity so that we can begin to track the ocean state. This is vital 1) to know how the oceans are changing, 2) to provide observations that can be used to improve and validate models, and eventually 3) to provide initial states of the oceans for climate predictions. The latter have now begun for El Nino in the equatorial Pacific but the need is global.

I would also recommend complementary improvements in atmospheric and land surface observations, so that they can be used for climate purposes. Many observations taken now are used for weather prediction and insufficient care is taken to enable the smaller climate signals to be reliably tracked. Infrastructure is needed to merely keep track of how well the observing system we now have is performing and to nip problems in the bud.

I also recommend that increased funding for research programs such as CLIVAR, which is short for "Climate variability and predictability." It is an international program under the World Climate Research Programme (WCRP), but with a strong U.S. component and a project office in Washington, DC. under the U.S. Global Change Research Program (i.e. it is a multi-agency program). Many process studies

are planned under CLIVAR and these are targeted at improving understanding and modeling capabilities to predict El Nino and natural climate variability, as well as make climate change projections more reliable. A new set of implementation plans has just been developed for U.S.CLIVAR. Sister international programs under the WCRP include those devoted to the Global Energy and Water Cycle (GEWEX), The Climate and the Cryosphere (CLIC), and the Stratospheric Processes And their Role in Climate (SPARC). Climate modeling is the integrating thread that pulls all of these together, and substantial further research and computational resources are needed, as documented in a recent NRC report.

RESPONSE BY DR. KEVIN TRENBERTH TO ADDITIONAL QUESTION FROM SENATOR REID

Question. Have you received funding for climate related research from non-governmental sources? If so, please generally identify those sources.

Response. No, I have not received any funding from non-governmental sources for climate related research, although I did receive some funds from the Electric Power Research Institute to help publish my book "Climate System Modeling", Cambridge University Press, 1992, 788 pp.

STATEMENT OF JOHN R. CHRISTY, UNIVERSITY OF ALABAMA IN HUNTSVILLE

Mr. Chairman and committee members, I am pleased to accept your invitation to speak to you again about climate change. I am John Christy, Professor of Atmospheric Science and Director of the Earth System Science Center at the University of Alabama in Huntsville. I am also Alabama's State Climatologist and recently served as one of the Lead Authors of the IPCC.

Carbon Dioxide

The concentration of carbon dioxide (CO_2) is increasing in the atmosphere due primarily to the combustion of fossil fuels. Fortunately (because we produce so much of it) CO_2 is not a pollutant. In simple terms, CO_2 is the lifeblood of the biosphere. The green world we see around us would disappear if not for atmospheric CO_2. These plants largely evolved at a time when the atmospheric CO_2 concentration was many times what it is today. Indeed, numerous studies indicate the present biosphere is being invigorated by the human-induced rise of CO_2. In and of itself, therefore, the increasing concentration of CO_2 does not pose a toxic risk to the planet. It is the secondary impact of CO_2 that may present challenges to human life in the future. It has been proposed that CO_2 increases could cause climate change of a magnitude beyond what naturally occurs that would force costly adaptation or significant ecological stress. For example, enhanced sea level rise and/or reduced rainfall would be two possible effects likely to be costly to those regions so affected. Data from the past and projections from climate models are employed to provide insight on these concerns.

Climate Models

Climate models attempt to describe the ocean/atmospheric system with equations which approximate the processes of nature. No model is perfect because the system is incredibly complex. One modest goal of model simulations is to describe and predict the evolution of the ocean/atmospheric system in a way that is useful to discover possible environmental hazards which lie ahead. The goal is not to achieve a perfect forecast for every type of weather in every unique geographic region, but to provide information on changes in large-scale features. If in testing models for current large-scale features one finds conflict with observations, this suggests that at least some fundamental process, for example heat transfer, are not adequately described in the models.

Global Averages

A common feature of climate model projections of global average temperature changes due to enhanced greenhouse gasses is a rise in the temperature of the atmosphere from the surface to 30,000 feet the true bulk of the atmosphere. This temperature rise itself is projected to be significant at the surface, with increasing magnitude as one rises through this layer called the troposphere. Most people use the term Global Warming to describe this possible human-induced temperature rise.

Over the past 22-years various calculations of surface temperature do indeed show a rise between +0.52 and +0.63 F (0.29 and 0.35 C depending on which estimate is used.) This represents about half of the total surface warming since the 19th century. In the troposphere, however, the values, which include the satellite data Dr.

Roy Spencer of NASA and I produce, show only a very slight warming between +0.00 and +0.15 F (+0.00 and +0.08 C) a rate less than a third that observed at the surface (Fig. 1). New evidence shown in Figs. 2 and 3 continues to show the remarkable consistency between independent measurements of these upper air temperatures.

Since the last time I testified before this committee, 1998 was above the long term average, but 1999 and 2000 were below. So, rather than seeing a warming over time that increases with altitude as climate models project, we see that in the real world the warming decrease substantially with altitude.

It is critically important in my view to correctly model tropospheric temperature changes because this is where much of the global atmospheric heat is stored, moved about and eventually expelled to space. This layer also has a strong influence on surface temperature through radiation processes. It is conceivable that a model which retains too much heat in the troposphere, may also retain too much at the surface when integrated over long time periods.

It is certainly possible that the inability of the present generation of climate models to reproduce the reality of the past 22+ years may only reflect the fact that the climate experiences large natural variations in the vertical temperature structure over such time periods. By recognizing this however, any attention drawn to the surface temperature rise over the past two decades must also acknowledge the fact that the bulk of the atmospheric mass has not similarly warmed.

Regional Averages

This disparity between observations and model results is a curious and unexplained issue regarding the global average vertical temperature structure. But we do not live 30,000 feet in the atmosphere, and we do not live in a global average surface temperature. We live in specific places. Local and regional projections of surface climate are very difficult and challenging. An example from Alabama's past is useful here only to illustrate the difficulty of providing local predictions with a high level of confidence.

In Fig. 4 you will see several climate model runs which attempt to reproduce Alabama's temperature from 1860 to the present, and one that attempts to predict its temperature out to 2100. These complex models incorporate solar changes, increasing CO_2, aerosol cooling (a highly uncertain hypothesis) and so on. It is clear that the model runs did not do especially well over the time period of observations, with none predicting the actual cooling we have seen in Alabama over the last century. If in trying to reproduce the past we see such errors, one must assume that predicting the future of regional climate will be at least as difficult.

The models may have done fairly well in the global average, and may have done acceptably well in many geographic locations, but these results do not give me the confidence to understand how the weather will be different in the coming century. (Please note that every century is different from its predecessor because of natural variations.) If in trying to reproduce the past we see such model errors, one must assume that predicting the future would produce similar opportunities for errors on a regional basis.

Weather Extremes and Climate Change

I want to encourage the committee to be suspicious of media reports in which weather extremes are given as proof of human-induced climate change. Weather extremes occur somewhere all the time. For example, in the 48 conterminous States, the U.S. experienced the coldest combined November and December in 106 years, yet that does not prove U.S. or global cooling.

Has hot weather occurred before in the US? In my region of Alabama, the 19 hottest summers of the past 108 years occurred prior to 1955. In the midwest, of the 10 worst heatwaves, only two have occurred since 1970, and they placed seventh and eighth. Hot weather has happened before and will happen again.

Similar findings appear from an examination of destructive weather events. The intensity and frequency of hurricanes have not increased. The intensity and frequency of tornadoes have not increased. The same is true for thunderstorms and hail. (Let me quickly add that we now have more people and much more wealth in the paths of these destructive events so that the losses have certainly risen, but that is not due to climate change.) Droughts and wet spells have not statistically increased or decreased (Fig.5). Last summer's drought in Texas was not the worst that State has seen. In fact, temperature trends for summers in Texas are actually slightly downward.

One century is a relatively short time in climate scales. When looking at proxy records of the last 2000 years for drought in the Southwest, the record suggests the worst droughts occurred prior to 1600 (Fig. 6). The dust bowl of the 1930's appears

as a minor event on such a time scale. This should be a warning that with or without any human influence on climate we should be prepared for a significant, multi-year drought. (Low cost energy would help mitigate the costs of transporting water to the stricken areas.)

When considering information such as indicated above, one finds it difficult to conclude the climate change is occurring in the United States and that it is exceedingly difficult to conclude that part of that change might have been caused by human factors.

In the past 150 years, sea level has risen at a rate of 6 4 in. (15 cm 10 cm) per century and is apparently not accelerating. Sea level also rose in the 17th and 18th centuries, obviously due to natural causes, but not as much. Sea level has been rising naturally for thousands of years (about 2 in. per century in the past 6,000 years). If we look at ice volumes of past interglacial periods and realize how slow ice responds to climate, we know that in the current interglacial period (which began about 11,000 years ago) there is still more land ice available for melting, implying continued sea level rise.

One of my duties in the office of the State Climatologist is to inform developers and industries of the potential climate risks and rewards in Alabama. I am very frank in pointing out the dangers of beach front property along the Gulf Coast. A sea level rise of 6 in. over 100 years, or even 50 years is minuscule compared with the storm surge of a powerful hurricane like Frederick or Camille. Coastal areas threatened today will be threatened in the future. The sea level rise, which will continue, will be very slow and thus give decades of opportunity for adaptation, if one is able to survive the storms.

Summary

Regional climate change, including that part that might be human related, is essentially impossible to predict at this point. Will there be an increase in 3-year droughts or a decrease? No one knows. I can say with a high degree of certainty that some regions will see an increase and some a decrease, because the climate is always changing.

I am decidedly an optimist. As Fig. 7 shows we in the U.S. will continue to produce more and more of what the world wants (its food, products, technology, defense, medical advances, and so on) with less and less energy. I remember as a college student at the first Earth Day being told it was a certainty that by the year 2000, the world would be starving and out of energy. Such doomsday prophesies grabbed headlines, but have proven to be completely false. Similar pronouncements today about catastrophes due to human-induced climate change sound all too familiar and all too exaggerated to me as someone who actually produces and analyzes climate information.

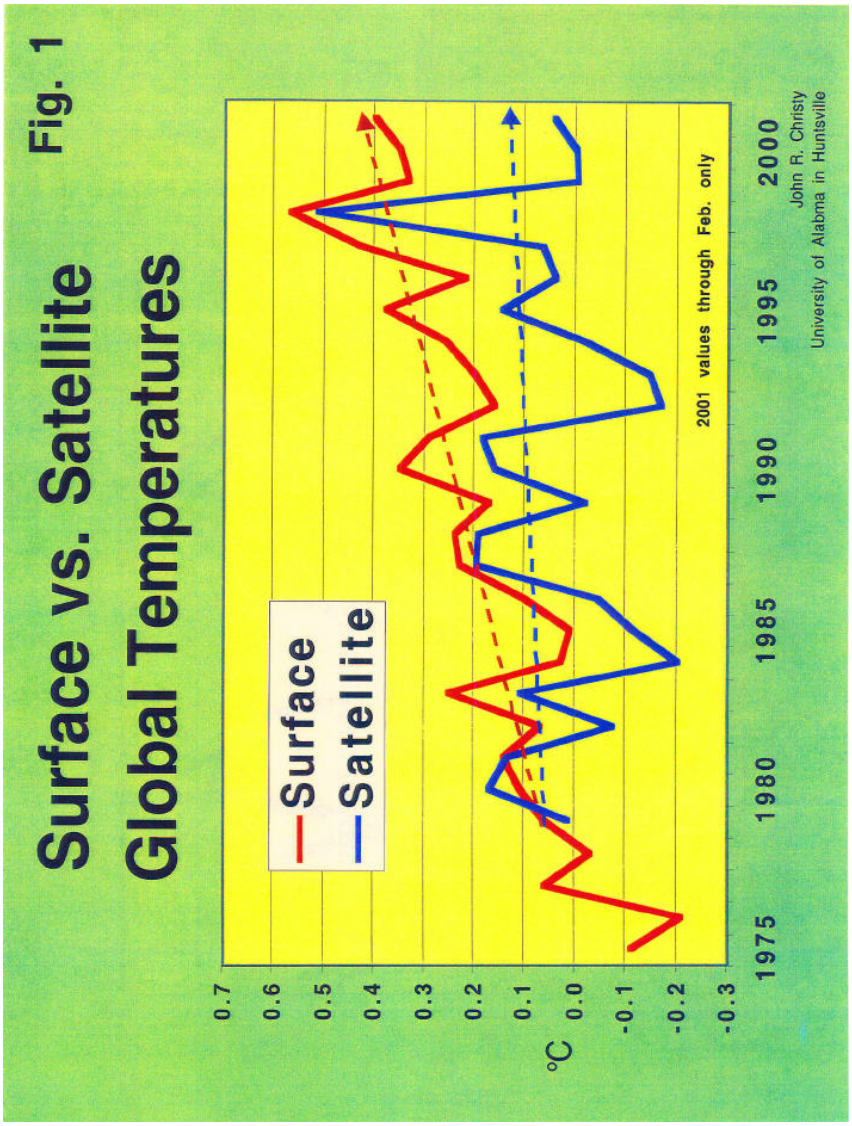


Fig. 1
Surface vs. Satellite
Global Temperatures
Surface
Satellite
°C
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1975
1980
1985
1990
1995
2000
2001 values through Feb. only
John R. Christy
University of Alabma in Huntsville

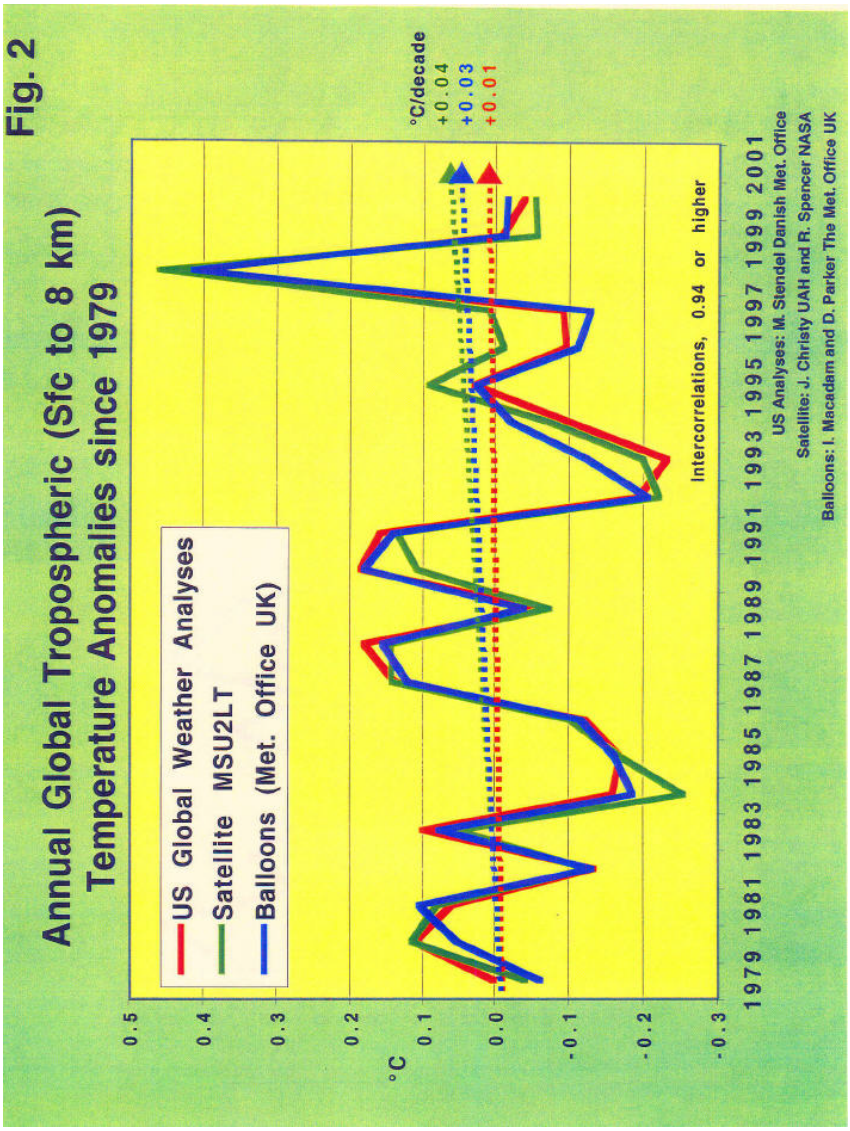
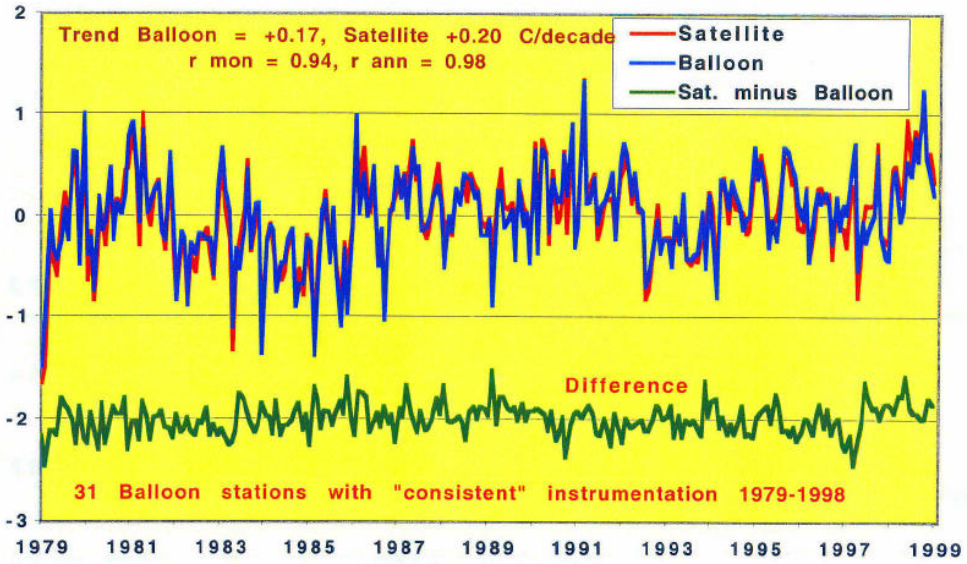


Fig. 2
Annual Global Tropospheric (Sfc to 8 km)
Temperature Anomalies since 1979
US Global Weather Analyses
Satellite MSU2LT
Balloons (Met. Office UK)
°C
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001
°C/decade
+0.04
+0.03
+0.01
Intercorrelations, 0.94 or higher
US Analyses: M. Stendel Danish Met. Office
Satellite: J. Christy UAH and R. Spencer NASA
Balloons: I. Macadam and D. Parker The Met. Office UK

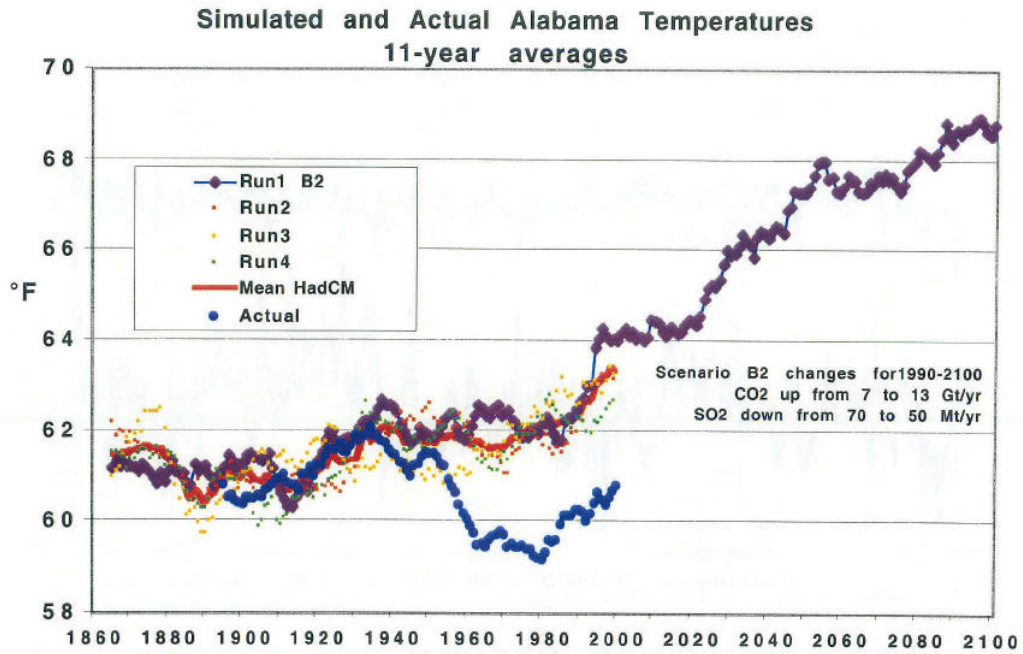
Fig. 3

Satellite and Balloon Comparison 2LT



John R. Christy
University of Alabama in Huntsville

Fig. 4



HadCMB2: Peter Stott, Hadley Centre for Climate Prediction and Analysis
Actual: National Climatic Data Center/NOAA

Fig. 5

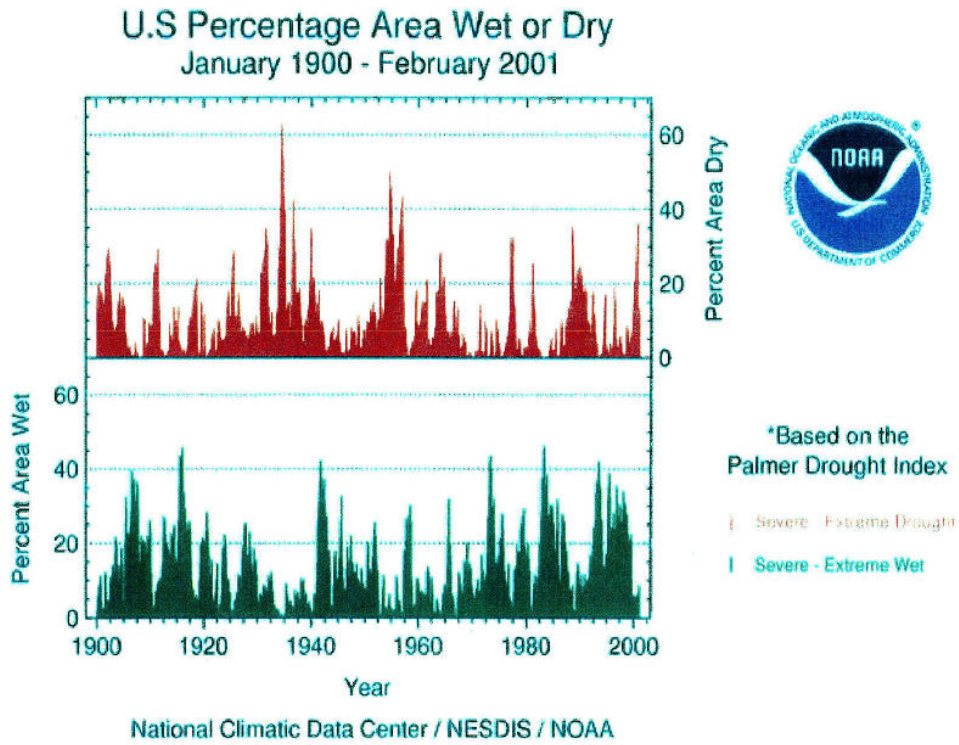
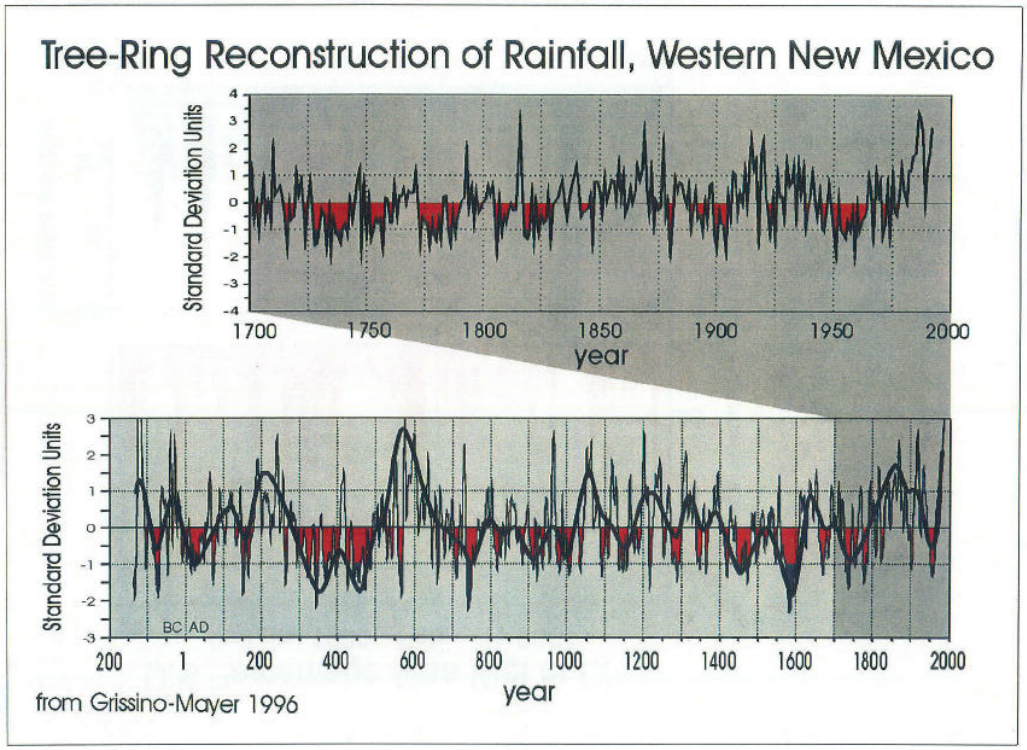
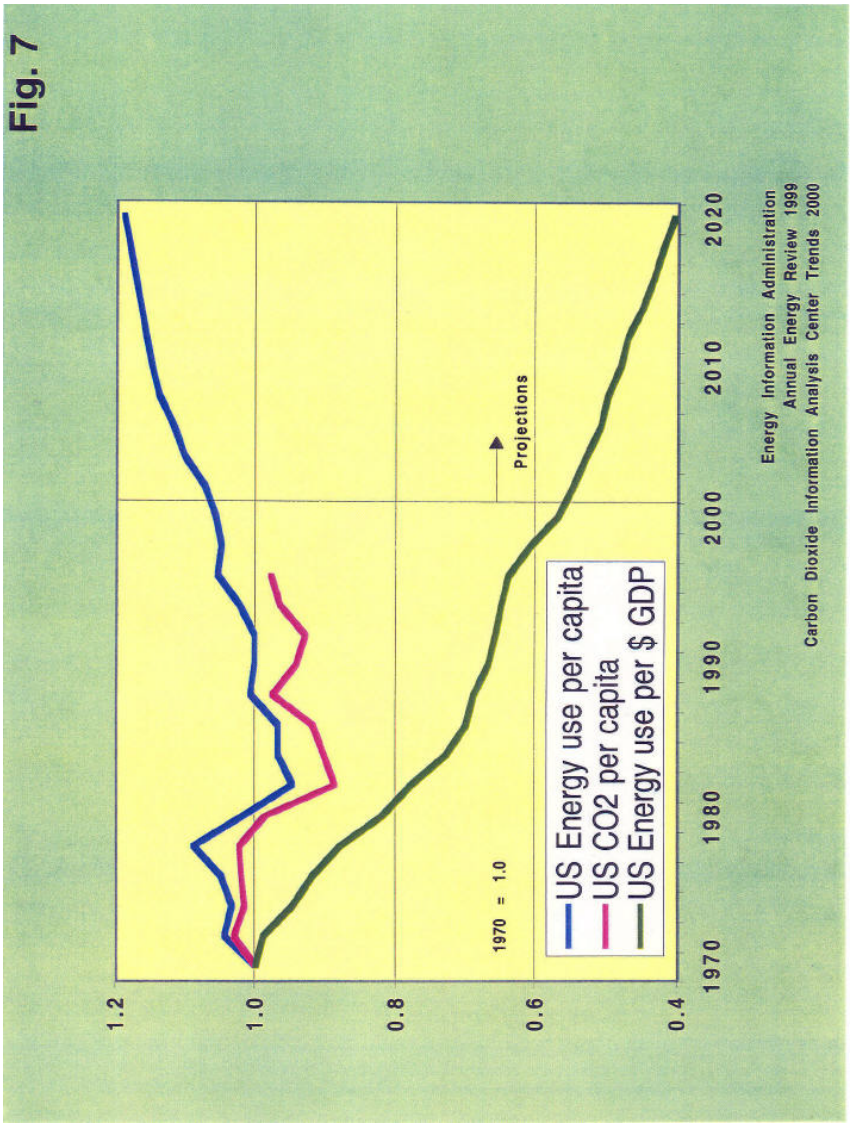

U.S Percentage Area Wet or Dry
January 1900 - February 2001
Percent Area Dry
Percent Area Wet
0
20
40
60
1900
1920
1940
1960
1980
2000
Year
*Based on the
Palmer Drought Index
Severe - Extreme Drought
Severe - Extreme Wet
National Climatic Data Center / NESDIS / NOAA

Fig. 6


Tree-Ring Reconstruction of Rainfall, Western New Mexico
Standard Deviation Units
4
3
2
1
0
-1
-2
-3
-4
1700
1750
1800
1850
1900
1950
2000
year
Standard Deviation Units
3
2
1
0
-1
-2
-3
BC AD
200
1
200
400
600
800
1000
1200
1400
1600
1800
2000
year
from Grissino-Mayer 1996



STATEMENT OF JAE EDMONDS, PACIFIC NORTHWEST NATIONAL LABORATORY, BATTELLE MEMORIAL INSTITUTE

Thank you Mr. Chairman and members of the Committee for the opportunity to testify here this morning on energy and climate change. My presence here today is possible because the U.S. Department of Energy has provided me and my team at PNNL long-term research support. Without that support much of the knowledge base upon which I draw today would not exist. That having been said, I come here today to speak as a researcher and the views I express are mine alone. They do not necessarily reflect those of any organization. I will focus my remarks on two matters: 1. The timing of the global response to climate change needed to stabilize the

concentration of greenhouse gases in the atmosphere, and 2. The need to expedite the development of technologies to achieve this goal at reasonable cost.

My remarks are grounded in a small number of important observations. First, the United States is a party to the Framework Convention on Climate Change (FCCC). The FCCC has as its objective the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." (Article 2) This is not the same as stabilizing emissions. Because emissions accumulate in the atmosphere, the concentration of carbon dioxide will continue to rise indefinitely even if emissions are held at current levels or slightly reduced. Limiting the concentration of CO_2, the most important greenhouse gas, means that the global energy system must be transformed by the end of the 21st century. Given the long life of energy infrastructure, preparations for that transformation must start today.

Second, research that I have conducted with Tom Wigley at the National Center for Atmospheric Research and Richard Richels at EPRI indicates that, to attain global CO_2 concentrations ranging from 350 parts per million volume (ppmv) to 750 ppmv, global emissions of CO_2 must peak in this century and then begin a long-term decline. Recall that the average concentration in 1999 was 368 ppmv and pre-industrial values were in the neighborhood of 275 ppmv. The timing and magnitude of the peak depends on the desired CO_2 concentration as well as on a variety of factors shaping future U.S. and global technology and economy. In 1997 global fossil fuel carbon emissions were approximately 6.6 billion tonnes of carbon per year with an additional approximately 1.5 billion tonnes of carbon per year from land-use change such as deforestation. (The values for land-use change emissions are known with much less accuracy than those of fossil fuel emissions.) Values taken from the paper Drs. Wigley, Richels and I published in Nature in 1996 for alternative CO_2 concentrations, peak emissions and associated timing are given in the table below:

CO_2 Concentration (ppmv)	350	450	550	650	750
Maximum Global CO_2 Emissions (billions of tonnes carbon per year)	8.5	9.5	11.2	12.9	14.0
Year in which Global Emissions Must Break from Present Trends	Today	2007	2013	2018	2023
Year of Maximum Global Emission	2005	2011	2033	2049	2062
Year 2100 Global Fossil Fuel Emissions (billions of tonnes carbon per year)	0	3.7	6.8	10.0	12.5

The time path of emissions will have a profound effect on the cost of achieving atmospheric stabilization. The emissions paths we developed were constructed to lower costs by avoiding the premature retirement of capital stocks, taking advantage of the potential for improvements in technology, reflecting the time-value of capital resources, and taking advantage of the workings of the natural carbon cycle-regardless of which concentration was eventually determined to "prevent dangerous anthropogenic interference with the climate." It is also important to note that the transition must begin in the very near future. For example, for a global concentration of 550 ppmv, global CO_2 emissions must begin to break from present trends (i.e. deviations of more than 100 million tonnes of carbon from present trends) within the next 10 to 15 years. Given that it takes decades to go from "energy research" to the practical application of the research within some commercial "energy technology" and then perhaps another three to four decades before that technology is widely deployed throughout the global energy market, we will likely have to make this deflection from present trends with technologies that are already developed. To reduce global emissions even further will require a fundamental transformation in the way we use energy and that will only be possible if we have an energy technology revolution and that will only come about if we increase our investments in energy R&D.

The table above shows that the global energy system, not just the United States energy system, must undergo a transition from one in which emissions continue to grow throughout this century into one in which emissions peak and then decline. Coupled with significant global population and economic growth, this transition represents a daunting task even if a concentration as high as 750 ppmv is eventually determined to meet the goal of the Framework Convention. A credible commitment to limit cumulative emissions is also needed to move new energy technologies "off the shelf' and into wide spread adoption in the marketplace.

Stabilizing the concentration of greenhouse gases in the atmosphere will require a credible commitment to limit cumulative global emissions of CO_2. Such a limit is unlikely to be achieved without cost. The cost of stabilizing the concentration of greenhouse gases will depend on many factors including the desired concentration, economic and population growth, and the portfolio of energy technologies that might be made available. Not surprisingly costs are higher the lower the desired concentration of greenhouse gases. They are higher for higher rates of economic and population growth. And, they are lower the better and more cost effective the portfolio of energy technologies that can be developed.

It is not well recognized that most long-term future projections of global energy and greenhouse gas emissions and hence, most estimates of the cost of emission reductions, assume dramatic successes in the development and deployment of advanced energy technologies occur for free. For example, the Intergovernmental Panel on Climate Change developed a set of scenarios based on the assumption that no actions were implemented to mitigate greenhouse gas emissions. The central reference case that assumes technological change as usual is called IS92a. This central reference scenario assumes that by the year 2100 three-quarters of all electric power would be generated by non-carbon emitting energy technologies such as nuclear, solar, wind, and hydro, and that the growth of crops for energy (commercial biomass) would account for more energy than the entire world's oil and gas production in 1985. Yet with all these assumptions of technological success, the need to provide for the growth in population and living standards around the world drive fossil fuel emissions well beyond 1997 levels of 6.6 billion tonnes of carbon per year to approximately 20 billion tonnes of carbon per year. Subsequent analysis by the IPCC as well as independent researchers serves to buttress the conclusion that even with optimistic assumptions about the development of technologies that the concentration of in the atmosphere can be expected to continue rise throughout the century.

My second point follows directly from the preceding observations. Technology development is critical to controlling the cost of stabilizing CO_2 concentrations. Improved technology can both reduce the amount of energy needed to produce a unit of economic output and lower the carbon emissions per unit of energy used.

The Global Energy Technology Strategy Program to Address Climate Change is an international, public/private sector collaboration[1] advised by an eminent Steering Group[2]. Analysis conducted at the Pacific Northwest National Laboratory as well as in collaborating institutions during Phase I supports the need for a diversified technology portfolio. No single technology controls the cost of stabilizing CO_2 concentrations under all circumstances. The portfolio of energy technologies that is employed varies across space and time. Regional differences in such factors as resource endowments, institutions, demographics and economics, inevitably lead to

[1]Sponsors of the program were: Battelle Memorial Institute, BP, EPRI, ExxonMobil, Kansai Electric Power, National Institute for Environmental Studies (Japan), New Economic and Development Organization (Japan), North American Free Trade Agreement-Commission for Environmental Cooperation, PEMEX (Mexico), Tokyo Electric Power, Toyota Motor Company, and the U.S. Department of Energy. Collaborating research institutions were: The Autonomous National University of Mexico, Centre International de Recherche sur l'Environnment et le Developpement (France), China Energy Research Institute, Council on Agricultural Science and Technology, Council on Energy and Environment (Korea), Council on Foreign Relations, Indian Institute of Management, International Institute for Applied Systems Analysis (Austria), Japan Science and Technology Corporation, National Renewable Energy Laboratory, Potsdam Institute for Climate Impact Research (Germany), Stanford China Project, Stanford Energy Modeling Forum, and Tata Energy Research Institute (India).

[2]Richard Balzhiser, President Emeritus, EPRI; Richard Benedick, Former U.S. Ambassador to the Montreal Protocol; Ralph Cavanagh, Co-director, Energy Program, Natural Resources Defense Council; Charles Curtis, Executive Vice President, United Nations Foundation; Zhou Dadi, Director, China Energy Research Institute; E. Linn Draper, Chairman, President and CEO, American Electric Power; Daniel Dudek, Senior Economist, Environmental Defense Fund; John H. Gibbons, Former Director, Office of Science and Technology Policy, Executive Office of the President; Jose Goldemberg, Former Environment Minister, Brazil; Jim Katzer, Strategic Planning and Programs Manager, ExxonMobil; Yoicbi Kaya, Director, Research Institute of Innovative Technology for the Earth, Government of Japan; Hoesung Lee, President, Korean Council on Energy and Environment; Robert McNamara, Former President, World Bank; John Mogford, Group Vice President, Health, Safety and Environment BP; Granger Morgan, Professor, Carnegie-Mellon University; Hazel O'Leary, Former Secretary, U.S. Department of Energy; Rajendra K. Pachauri, Director, Tata Energy Research Institute; Thomas Schelling, Distinguished University Professor of Economics, University of Maryland; Hans-Joachim Schellnhuber, Director, Potsdam Institute for Climate Impact Research; Pryadarshi R. Shukla, Professor, Indian Institute of Management; Gerald Stokes, Assistant Laboratory Director, Pacific Northwest National Laboratory; John Weyant, Director, Stanford Energy Modeling Forum; and Robert White, Former Director, National Academy of Engineering.

different technology mixes in different nations, while changes in technology options inevitably lead to different technology mixes across time.

Technologies that are potentially important in stabilizing the concentration of CO_2 include energy efficiency and renewable energy forms, non-carbon energy sources such as nuclear power and fusion, improved applications of fossil fuels, and technologies such as terrestrial carbon capture by plants and soils, carbon capture and geologic sequestration, fuel cells and batteries, and commercial biomass. Many of these technologies are undeveloped or play only a minor role in their present state of development. Energy research and development by both the public and private sectors will be needed to provide the scientific foundations needed to achieve improved economic and technical performance, establish reliable mechanisms for monitoring and verifying the disposition of carbon, and to develop and market competitive carbon management technologies. For example, advances in the biological sciences hold the promise of dramatically improving the competitiveness of commercial biomass as an energy form.

Recent trends in public and private spending on energy research and development in the world and in the United States suggest that the role of technology in addressing climate change may not be fully understood nor appreciated. Although public investment in energy R&D has increased slightly in Japan, it has declined somewhat in the United States and dramatically in Europe, where reductions of 70 percent or more since the 1 980's are the norm. Moreover, less than 3 percent of this investment is directed at technologies that, although not currently available commercially at an appreciable level, have the potential to lower the costs of stabilization significantly.

In summary, stabilizing the concentration of greenhouse gases at levels ranging up to 750 ppmv represents a necessary but daunting challenge to the world community. Energy related emissions of CO_2 must peak and begin a permanent decline during this century. The lower the desired concentration, the more urgent the need to begin the transition. Both a credible global commitment to limit cumulative emissions and a portfolio of technologies will be needed to minimize the cost of achieving that end including technologies that are not presently a significant part of the global energy system. Their development and deployment will require enhanced energy R&D by both the public and private sectors. Unfortunately, current trends in energy R&D are cause for concern.

Mr. Chairman, thank you for this opportunity to testify. I will be happy to answer your and the committee's questions.

GLOBAL ENERGY TECHNOLOGY STRATEGY

ADDRESSING CLIMATE CHANGE

Initial Findings from
an International Public-Private Collaboration

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In 1998, Battelle, together with EPRI, established the ***Global Energy Technology Strategy Program*** with the aim of assessing the role that technology can play in addressing the long-term risks of climate change. Led by a core group of Battelle scientists, the program benefits from analyses and insights provided by a network of partner institutions around the world. The process is guided by an international steering group representing diverse perspectives and is funded by government agencies, research institutions, and private industry. This document was reviewed by the Steering Group and was principally drafted by Jae Edmonds, Tom Wilson, and Richard Rosenzweig with substantive contributions from Richard Benedick, Elizabeth L. Malone, John F. Clarke, James J. Dooley, and Son H. Kim. The authors appreciate the support of Chet Cooper and Bill Pennell. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the sponsoring or participating institutions.

Executive Summary

Global climate change is one of the most complex environmental, energy, economic, and political issues confronting the international community. The impacts of climate change are likely to vary considerably by geographic region and occur over a time scale of decades to centuries. The actions needed to manage the risks ultimately require substantial long-term commitments to technological change on the part of societies worldwide.

The Challenge

The Earth's climate is governed primarily by complex interactions among the sun, oceans, and atmosphere. The increased concentration of heat-trapping "greenhouse gases" in the atmosphere has led to concerns that human activities could warm the Earth and fundamentally change the natural processes controlling climate.

This report focuses on carbon dioxide, the greenhouse gas contributing the majority of the projected human influence on climate. Carbon dioxide emissions can affect the atmosphere for hundreds of years. Some of the carbon dioxide emitted in 1800 is still in the atmosphere—and today's emissions will continue to influence climate in 2100. The total concentration of carbon dioxide in the atmosphere at any given time is much more important in determining climate than are emissions in any single year. Limiting the human impact on the climate system therefore requires that atmospheric concentrations be stabilized.

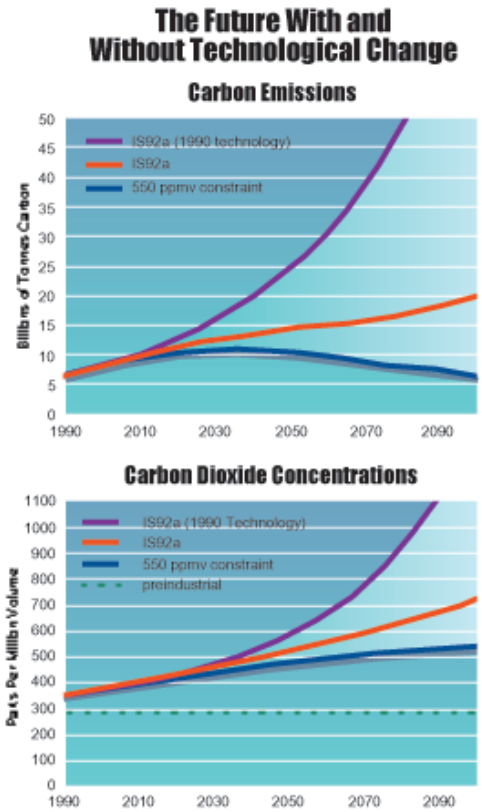
Recognizing this fact, more than 180 countries ratified the 1992 United Nations Framework Convention on Climate Change (FCCC), and it has entered into force under international law. The *ultimate objective* of this treaty is to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." (Article 2)

The objective of the FCCC—stabilizing the concentrations of carbon dioxide and other greenhouse gases—is not the same as stabilizing emissions. Because emissions accumulate in the atmosphere, the concentration of carbon dioxide will continue to rise for several hundred years even if emissions are held at current levels or slightly reduced.

The FCCC process has not yet specified a particular target concentration. But in order to stabilize concentrations at any level ranging from 450 parts per million to 750 parts per million, very large reductions of worldwide emissions (from emissions that might be anticipated were present trends to continue) would be required during the course of the present century.

Technology is Critical

Energy is central to the climate issue. Energy use appears to be the primary contributor to the global increase in carbon dioxide concentrations. Increasing world population, together with the universal desire for economic development, will lead to growing demand for the products and services that the energy system provides. The future evo-



The middle curve in the first chart depicts the carbon dioxide emissions associated with the Intergovernmental Panel on Climate Change (IPCC) central scenario, denoted IS92a, and the middle curve in the second chart represents the concentrations in the atmosphere that result from these emissions. This IPCC "business-as-usual" scenario incorporates significant technological advances. In contrast, while the top curves assumes the same population and economic growth as IS92a, they hold energy technology constant at its 1990 level. The difference between the upper and middle curves thus illustrates the technological improvement needed merely to achieve the IS92a emissions path with its corresponding impact on concentrations. The lower curves depict an emissions path and its corresponding concentration path consistent with a 550 parts per million volume (ppmv) concentration ceiling. The dotted line on the concentrations chart indicates the pre-industrial level of carbon dioxide concentrations (i.e., a level virtually unaffected by human activities).

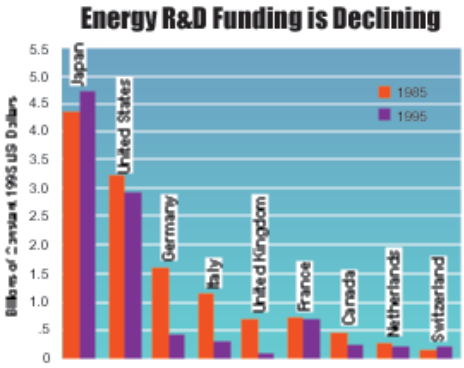
lution of that system—dominated today by coal, oil, and gas—is the key determinant of the magnitude of future human influence on the climate.

Managing the risks of climate change will require a transformation in the production and consumption of energy. Technology is critical to such a transformation. Improved technology can both reduce the amount of energy needed to produce a unit of economic output and lower the carbon emissions per unit of energy used. Successful development and deployment of new and improved technologies can significantly reduce the cost of achieving any concentration target.

Recent trends in public and private spending on energy research and development suggest that the role of technology in addressing climate change may not be fully understood. Although public investment in energy R&D has increased slightly in Japan, it has declined somewhat in the United States and dramatically in Europe, where reductions of 70 percent or more since the 1980s are the norm. Moreover, less than 3 percent of this investment is directed at a few technologies that, although not currently available commercially at an appreciable level, have the potential to lower the costs of stabilization significantly.

Energy Technology Strategy

Fundamental changes in the energy system are required to stabilize concentrations of greenhouse gases in the atmosphere.



Total public funding of energy research in the OECD is falling. Although Japan's outlays increased slightly, US spending declined and leading European nations reduced their funding dramatically.

Incremental improvements in technology help, but will not by themselves lead to stabilization.

A technology strategy is an essential complement to national and international policies aimed at limiting emissions, enhancing adaptation, and improving scientific understanding. A technology strategy will provide value by reducing costs under a wide range of possible futures, which is essential given the uncertainties in the science, policies, technologies, and energy resources. The lack of a technology strategy would greatly increase the difficulties of addressing the issue of climate change successfully.

The findings and recommendations of the Global Energy Technology Strategy Program, listed below, represent an initial attempt at delineating the elements that will be needed to guide the development of a technology strategy to address climate change.

Key Findings

Stabilizing concentrations of greenhouse gases in the atmosphere requires fundamental change in the energy system.

Energy is central to the climate change issue. Carbon dioxide emissions from the production and consumption of fossil fuels are the largest contributor to human emissions of greenhouse gases. Fossil fuel resources are abundant, and, if used in conjunction with present energy technology, have the potential to increase the concentrations of greenhouse gases in the atmosphere substantially.

If present trends continue, carbon dioxide emissions from energy will continue to grow. The influences of future population growth and economic development on the demand for energy services are likely to exceed currently projected improvements in energy intensity and the ongoing transition to less carbon-intensive fuels. However, trends are not destiny—a global technology strategy could help change the present course.

In order to stabilize concentrations of greenhouse gases in the atmosphere, global carbon emissions must peak during the 21st century and then decline indefinitely. This can occur only if lower carbon-emitting technologies are deployed worldwide.

Technology breakthroughs are essential both to stabilize greenhouse gas concentrations and to control costs.

Although incremental technology improvements are essential, they will not lead to stabilization. Even with significant improvements in the performance of existing commercial technologies, the concentration of carbon dioxide in the atmosphere would grow to more than 2.5 times pre-industrial levels by 2100.

Technology breakthroughs can reduce the cost of greenhouse gas stabilization dramatically. Technological advances can reduce the annual cost of stabilizing atmospheric concentrations of greenhouse gases by at least 1-2 percent of global world product. The savings will depend upon the concentration target and the level of technology improvement.

It is time to get started. The energy system is capital-intensive, and the development and deployment of new technologies can take decades. Given the lead-time necessary to develop and deploy new technologies with their associated systems and infrastructure, we must begin the process without delay.

A portfolio of technologies is necessary to manage the risks of climate change and to respond to evolving conditions.

A diversified portfolio accommodates future uncertainties. Changing scientific knowledge and economic conditions, combined with uncertainty in the resource base, require a diversified initial portfolio of technology investments. Portfolio investment priorities will evolve over time as these uncertainties are better understood.

A broad portfolio can control costs. A portfolio encompassing a broad suite of technologies can lower the costs of stabilization significantly. However, the public and private sectors cannot fund every idea. Technology investment priorities must be established to reflect available funding.

A broad portfolio can meet the differing needs of key regions. Countries will need and employ different technologies based on their geography, indigenous resources, and economic, social, and political systems.

A flexible portfolio can accommodate alternative policy responses to the climate issue. A technology portfolio complements a wide range of possible national and international policies, including trading, taxes, and other policies and measures.

A broad portfolio also can reflect the diversity of the energy system. Technologies are needed to improve the efficiency of energy use, develop non-carbon energy sources, and limit the free venting of carbon from the fossil energy that will continue to be burned.

Current investments in energy research and development are inadequate.

Energy research and development outlays are declining. Both public and private sector investments in energy research and development have declined significantly since the 1980s.

Energy research and development expenditures are unfocused and poorly coordinated. Neither public nor private sector investments are adequately focused on the technologies that could be critical for stabilizing concentrations in the long term. Among the few governments with national energy research and development programs, investments are poorly coordinated and fail to take advantage of possibilities for joint, complementary, or specialized research.

Terrestrial sequestration, hydrogen, and carbon capture, use, and storage technologies potentially play an important role in stabilizing concentrations, but are currently funded at minimal levels.

Recommendations

Emissions limitations and controlling costs complement a technology strateg y.

Emissions limits are needed to stabilize concentrations. Without such limits, individual nations have little incentive to reduce greenhouse gas emissions. It is unlikely that the required technologies to achieve stabilization will be developed and deployed if there is not any value placed on developing such technologies.

Controlling the costs of stabilization is necessary. The costs of stabilizing concentrations of greenhouse gases are uncertain and are distributed unevenly across generations, nations, and sectors of the economy. Better definition and control of these costs is critical to achieving societal consensus to take action.

Increase global investments in energy research and development.

Increase investment in energy research and development to improve the performance of existing technologies and to develop the next generation of technologies that are required to stabilize greenhouse gas concentrations.

Develop dedicated long-term funding sources for energy research and development to support the necessary technology transformation.

Direct investments to specific technologies that have significant potential to substantially reduce greenhouse gas emissions over the long term.

Build broad-based public support by communicating the climate and ancillary benefits of energy research and development.

Next Steps

These findings and recommendations demonstrate the importance of technology in addressing climate change and provide general principles for moving forward. These results will be actively communicated to all global climate change stakeholders, and particularly those involved in the international discussions. However, they are only a beginning.

Over the next three years, the Global Energy Technology Strategy Program will explore in more depth some of the key issues and principles outlined here. In particular, the program will examine approaches for improving international collaboration in technology research and

Improve the implementation and performance of energ y research and development.

Incorporate climate change when revisiting current energy research and development priorities.

Better coordinate the roles of the public and private sectors in the research and development process to reflect their specific strengths.

Fund all stages of the innovation process from basic research to market deployment of the most promising technologies.

Establish long-term goals and near-term milestones for technological performance to drive progress and to maximize returns on technology investments.

Design flexible research and development programs to allow for the shifting of resources to accommodate new knowledge and conditions, particularly when sufficient technological progress is not being achieved.

Reflect the international nature of the research challenge.

Develop and coordinate international and national energy technology research and development strategies to take advantage of national scientific strengths and regional needs.

Provide assistance to key developing countries to build their technical and institutional capacities for implementing energy research and development programs effectively and for deploying advanced technologies.

deployment, analyze in more detail key carbon-free resources and technologies, and expand the research to address non-carbon dioxide greenhouse gases and additional options for enhancing carbon sinks. The program also will conduct technical analyses and communications efforts to help stakeholders and decision makers better understand principles for implementing an energy technology strategy for climate change.

Through periodic reports and the existing website (http://gtsp.battelle.org), the program will continue to communicate insights gained through collaborative research on the technological and policy pathways that governments, businesses, institutions, and individuals can take to minimize the risks of human interference with the climate system.

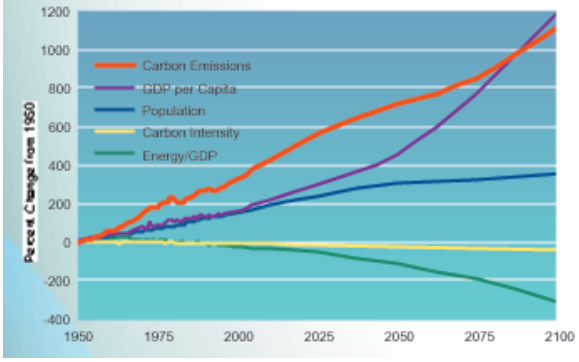
Stabilizing atmospheric concentrations of carbon dioxide and other greenhouse gases ultimately requires the reduction of global emissions to levels that are significantly below current emissions. Global population and economic growth, and the consequent increases in demand for the services that energy provides, suggest that fundamental changes in the energy system will be required to achieve the reductions in emissions needed to achieve stabilization.

The Earth's climate is governed primarily by complex interactions among the sun, oceans, and atmosphere. To clarify why sustained research to develop new technologies is essential to manage the risks of climate change, let us begin by considering the basic principles at work, starting with the greenhouse effect.

Most of the incoming solar radiation that falls on the Earth is absorbed, allowing it to warm the surface. Some is radiated back toward space as heat. Rather than passing through the atmosphere to space, most of that heat is absorbed by gases in the atmosphere and redirected back to the surface where it further warms the Earth. Various constituents of the atmosphere—water vapor, carbon dioxide, methane, nitrous oxide, and minor trace gases—retain heat and create a natural greenhouse effect.

The heat-trapping property of these greenhouse gases is well established, as is the role of human activities in the buildup of

Factors Driving Emissions



Changes in population, per capita income, energy intensity, and carbon dioxide intensity can be totaled up to calculate changes in emissions. Since 1950, population and per capita income increases have exceeded decreases in energy and carbon intensity, leading to an increase in carbon dioxide emissions. Each of these trends is projected to continue through the 21st century under the International Panel on Climate Change's (IPCC) IS92a scenario, resulting in significantly increased emissions in 2100.

these gases. Uncertainty remains about when and how significantly we might be affected by the resulting intensified greenhouse effect. However, global climate change poses significant risks that we need to be prepared to manage.

Framework Convention on Climate Change

Concerns about possible changes in climate induced by a rapid increase in greenhouse gases from human activities led nations worldwide to sign the United Nations Framework Convention on Climate Change (FCCC). The Convention was drafted for signature at the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992. Since then, 186 nations—including the United States, Japan, most of Western Europe, the Russian Federation, and many of the rest of the nations of the world—have ratified the Convention. It entered into force under international law on 21 March 1994.

The FCCC establishes both a short-term aim and a long-term objective. In the short term, the Convention directs developed countries to take actions aimed at returning *emissions* of greenhouse gases to their 1990 levels by the year 2000. The ultimate objective, contained in Article 2 of the FCCC, is that the *concentrations* of greenhouse gases in the atmosphere should be stabilized "at a level that would prevent dangerous anthropogenic interference with the climate system." The stabilization is to be achieved "within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."

In addition, the Parties to the Convention agreed, "that polices and measures to deal

Stabilization of GHG Concentrations—At What Level?

Science has not determined the level of concentration of greenhouse gases (GHG) in the atmosphere that would have to be avoided to "prevent dangerous anthropogenic interference with the climate system," as mandated by the FCCC. Accordingly, we have performed the analyses presented in this report for levels ranging from 350 ppmv (parts per million volume) to 750 ppmv.

Although the numerical results presented in the report's graphics vary depending on the concentration level analyzed, the qualitative insights hold across the various targets. To simplify the presentation, we sometimes present results for only one concentration target, 550 ppmv, rather than for a range of levels. The choice of 550 ppmv was not based on any evaluation of the criterion laid out by the FCCC.

with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost." Within this Framework, they agreed to adopt national policies and take corresponding measures to mitigate (moderate or lessen) climate change. The mitigation measures involve limiting the Parties' anthropogenic emissions of greenhouse gases and enhancing carbon sinks worldwide.

The Role of Carbon Dioxide and Energy Use

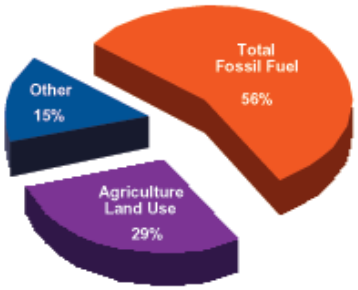
Carbon dioxide emissions comprise the majority of humanity's annual contribution to greenhouse gas concentrations. The majority of these carbon emissions result from energy use. Although all greenhouse gases are important, this document focuses on efforts to control carbon dioxide emissions. The other gases will be the subject of future research efforts by the Global Energy Technology Strategy Program.

Carbon dioxide has been accumulating in the atmosphere at an accelerating rate since the start of the Industrial Revolution. Increases in carbon emissions from energy use have resulted in corresponding increases in concentrations. Stabilizing the concentration of carbon dioxide in the atmosphere requires reversing the current trend of increasing emissions.

Concentration Ceilings and Cumulative Emissions

The relationship between carbon emissions and concentrations is governed by the global exchange of carbon among the oceans, vegetation, and the atmosphere. One relatively straightforward way to relate emissions and

Distribution of Global Greenhouse Gas Emissions in 1989



The majority of greenhouse gas emissions are associated with energy production, transformation, distribution, and end use. The remainder are produced by agriculture, land-use changes (including deforestation), and other sources including industrial processes that produce specialty chemicals such as chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride.

Tonnes and Joules

Most people think of weight in terms of kilograms or pounds, and consider quantities of energy in terms of litres or gallons of gasoline, barrels of oil, or kilowatt-hours of electricity. Because global energy use dwarfs personal energy use, less widely known measures are often used. In this document, we consistently present energy in joules, megajoules (million joules or in mathematic notation, 106 joules), or exajoules (1 018 joules). Weights are presented in tonnes (metric tons).

1 tonne = 1 metric ton = 1000 kilograms = 2204 pounds

1 exajoule = 10^{18} joules = 163 million barrels of oil equivalent

concentrations is to calculate the cumulative emissions that would be allowable (over the next three centuries) to achieve each concentration target. In other words, each concentration target has a corresponding cumulative emissions budget. For a 450-ppmv ceiling, the cumulative budget is approximately 1,225 billion tonnes of carbon. For a 550-ppmv ceiling, the budget is about 1,800 billion tonnes, and for a 650-ppmv ceiling, it is approximately 2,350 billion tonnes.

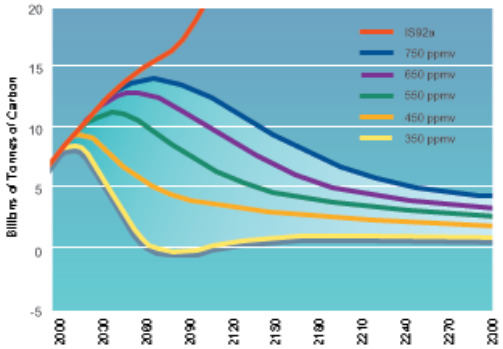
The concept of a cumulative emissions budget yields two insights. First, cumulative emissions matter much more than the level of emissions in any single year. A second key insight relates to the magnitude of the challenge that we face in limiting concentrations. Even if annual global emissions of carbon dioxide were to remain indefinitely at their 1990 level of approximately 7.5 billion tonnes, the concentration of carbon in the atmosphere would continue to increase for centuries.

Factors Driving Carbon Emissions

Understanding the key drivers of historic and future carbon emissions is critical to developing policies to control emissions. According to an equation developed by Yoichi Kaya, director of the Research Institute of Innovative Technology for the Earth and a member of the Global Energy Technology Strategy Program's Steering Group, the global increase in carbon dioxide emissions since the Industrial Revolution is a byproduct of four interrelated factors: (1) population growth, (2) per capita economic development, (3) reliance on increased energy use to fuel this economic growth, and (4) the dominance of fossil fuels in providing this energy. Expressing this concept as an equation yields the following:

Population growth rate
+ per capita economic growth rate
+ energy intensity growth rate
+ carbon intensity growth rate
= growth rate in carbon dioxide (CO_2) emissions

Emissions Trajectories Consistent With Various Atmospheric CO_2 Concentration Ceilings



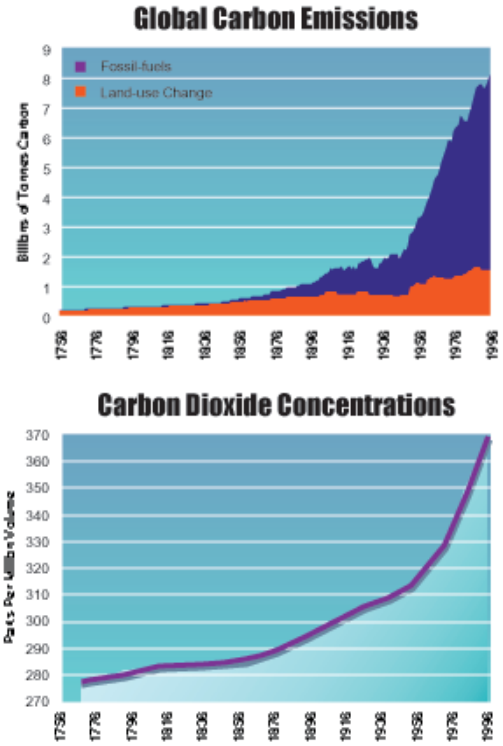
Any concentration ceiling can be attained through an unlimited set of possible global emission paths. The paths pictured here are ones designed to limit the economic impact of achieving the target concentrations–thereby achieving the twin goals of the FCCC of stabilization at the lowest economic cost. For concentrations 350 ppmv and above, global emissions rise for a period of time, peak, and then begin a long decline.

Energy intensity refers to the amount of energy needed to produce a unit of economic output, and carbon intensity means the amount of carbon released for each unit of energy produced.

Using this equation, it is possible to project future emissions based on projections of the four factors. For example, if population were to double over the next century and the other three factors—economic growth per capita, energy use per dollar of income, and the role of fossil fuels in supplying energy services—did not change, carbon dioxide emissions would double.

Most scenarios of the future suggest that the expected increases in population and economic growth will outweigh the continued decreases in energy and carbon intensities. For example, a plausible scenario would be a doubling of population over the next century combined with continued annual economic growth rate of 1.8 percent in per capita income, resulting in a global economy in 2100 that is 12 times the current size. If the other two factors did not change, then a 12-fold increase in carbon dioxide emissions would occur during the 21st century.

With these population and economic growth rates, the only way to stabilize concentrations of greenhouse gases at any level that is currently under serious discussion would be to reduce the carbon emissions per dollar of economic output to less than one-twelfth of their current value, more than a 92 percent reduction. Part of this reduction would be accomplished through improvements in the amount of energy used to create a dollar of economic output (energy intensity), and part through dramatically reducing carbon emissions from the energy sector (carbon intensity). In other words, population and economic growth will lead to rising emissions unless a fundamental technological change occurs.



Increases in global carbon emissions over the past 150 years, driven primarily by increased use of fossil fuels for energy, have led to consequent increases in the concentration of carbon dioxide in the atmosphere.

Increasing Population

Global population continues to increase, although the rate of growth is declining. In 1999 it reached 6 billion people. IPCC estimates developed in the early 1990s suggested that global population could increase to almost 18 billion by 2100. More recent estimates are somewhat more modest, but follow the same basic patterns. For example, the most recent United Nations estimates for 2050 range from a low of 7.3 billion to a high of 10.7 billion, with 8.9 billion currently considered as most likely. By 2100 the global population could climb to 15 billion people, or it could begin a decline by mid-century that would eventually bring it back close to present levels.

In some developed countries—France, Germany, and Japan, for example—populations are already in decline. The population of the United States continues to grow, but immigration is an important factor contributing to that growth. Certainly, rates of growth are in decline across a broad spectrum of nations. But total population, driven by growth in developing countries, continues to rise.

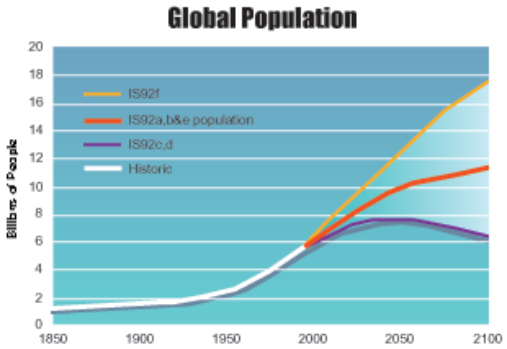
Uncertainties in Future Scenarios

Forecasting changes in population, economic growth, and energy technology over the course of a century is fraught with uncertainties. The Intergovernmental Panel on Climate Change (IPCC), established by the United Nations Environment Programme and the World Meteorological Organization in 1988, developed an extensive set of future scenarios for use in its Second and Third Assessment reports – IS92 and SRES scenarios respectively. We used IS92 because the SRES was available only recently. Even so, the ranges of the IS92 and SRES scenarios are similar. And, regardless, all of the scenarios envision substantial economic growth over the next century and consequently require dramatic reductions in carbon per unit of economic output in order to stabilize concentrations of carbon dioxide.

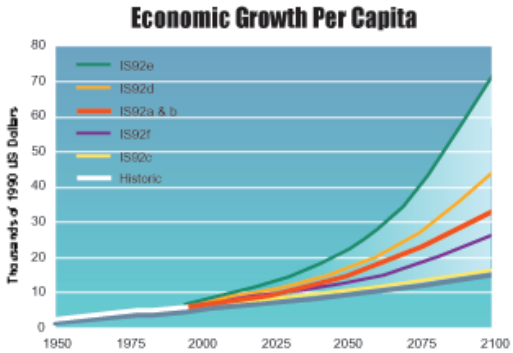
Expanding Economic Growth

The world economy continues to grow at a faster rate than population. Since the late 1940s, national economic growth has been measured in terms of "gross national product"—the total value of goods and services produced by residents of a nation during a year. Gross world product is calculated by summing the gross national products of individual nations, adjusting for differences in currencies. Today's world economy is more than five times larger than it was in 1950, and per capita income has grown at 2.7 percent annually during that period.

Like population growth, economic growth is slowing in developed countries, which are the nations that provided much of the



Global population has grown consistently over the past 150 years. Most scenarios predict continued, but slower, growth over the next 100 years.



The global economy has historically grown much more rapidly than global population. Most scenarios project continued growth, slowing as more developing countries mature.

growth over the last 50 years. Developing countries such as China and India continue to grow rapidly, both in absolute terms and on a per capita basis. Most projections for the next century suggest a slowing in the growth of the world economy. But even if the growth rate per capita were slowed to 1.8 percent annually (two-thirds of the rate during the past 50 years), it would still result in a six-fold increase in per capita goods and services over the next century.

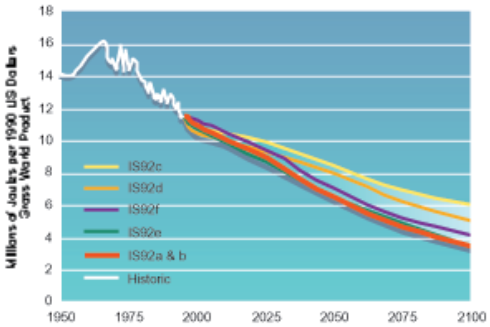
Declining Energy Intensity

Commercial energy intensity typically increases for a period of time and then declines as a country develops. The initial increase in energy use per dollar of real goods and services produced is caused by the shift from nonmarketed energy such as wood, dung, and straw to commercial fuels, as well as the shift from agricultural to manufacturing economies. In later development stages, the value of new goods and services grows faster than the energy needed to provide them. The cause is a shift away from high energy-intensive products such as steel toward less energy-intensive goods and services.

For the United States, the peak in energy intensity occurred around 1920. Since then, US energy intensity has declined, sometimes dramatically over the last three decades. For example, from 1973 to 1986, US economic growth in excess of 40 percent was accompanied by no increase in energy use.

Global energy intensity is declining, with the reductions in the developed countries exceeding the increases in some developing coun-

Global Energy Intensity



Global energy intensity has declined for the past 50 years, with decreases in developed countries outweighing increases in developing countries as they make the transition to commercial fuels. Most scenarios suggest that this factor will continue to decline, perhaps substantially.

tries. It is expected to continue to decline in the future as the energy intensities of more developing countries begin to decrease.

Declining Carbon Intensity

Fossil fuels differ in the amount of carbon that is released for each unit of energy produced. Wood is more carbon-intensive than coal. Coal is more carbon-intensive than oil, and natural gas has the lowest carbon intensity of all of the fossil fuels. Technologies such as nuclear fission, nuclear fusion, wind, solar, and hydropower generate no direct releases of carbon.

The average carbon intensity of all fuels used to produce energy has declined over the past century. In 1860, the average was about the same as wood. By 1920 it had fallen to about the rate associated with coal. By 1990, the average rate had declined to about the same level as oil. The higher carbon intensity of the coal used in 1990 was balanced by the lower carbon intensity of the natural gas, nuclear, and renewable energy that were increasingly coming into use.

Carbon intensity may continue to decline in the future. If natural gas turns out to be abundant and renewable energy technologies continue to improve, the average intensity could

Changes in Geographic Diversity of Emissions

Emissions were once limited largely to the developed world. In 1900, Western Europe and North America accounted for 87 percent of the world's fossil fuel carbon dioxide emissions. In 1995, their share had fallen to 39 percent. Developing countries, on the other hand, accounted for only 1 percent of global emissions in 1900, but their share had grown to 39 percent by 1995.

As more and more countries develop economies that provide their people with material goods and services, the need for energy services will increase. The developing countries' share of global emissions will pass 50 percent and continue to grow. If fossil fuels remain abundant and reasonably priced, they are likely to remain the energy source of choice for the world's growing demand for energy.

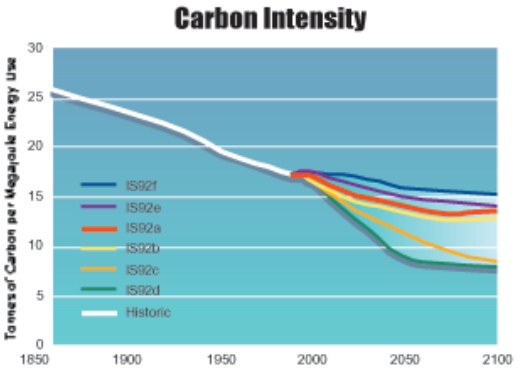
decline still further. On the other hand, if oil and gas resources ultimately are restricted to conventional forms, then coal and its synthetic derivatives may become increasingly important, and the decline in average carbon intensity could reverse.

Future Carbon Emissions

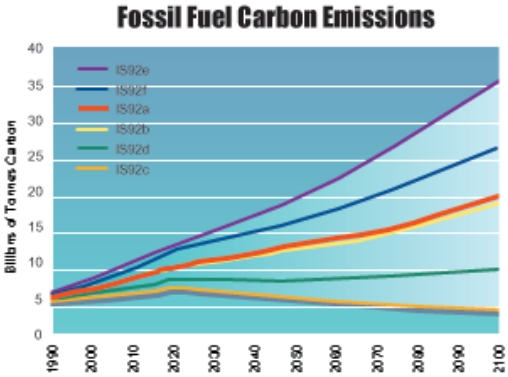
Combining these four factors can provide insights into how the future might evolve in the absence of a carbon policy. The IPCC prepared such an analysis for use in its Second Assessment Report.

The IPCC scenario IS92a (the most commonly cited scenario) assumes a world population growing from 5.2 billion in 1990 to more than double that number in 2100, moderate economic growth, and no strong action to reduce carbon dioxide emissions—best known as the "business-as-usual" scenario or the "reference emissions path." This IS92a scenario shows nearly a threefold rise in total emissions during the 21st century.

Current emission trends suggest that the emissions increases envisioned in IS92a or even in the higher emissions scenarios are plausible. However, trend is not destiny. A sustained effort to improve the performance of existing technologies and to develop and deploy new energy technologies can halt and reverse this trend, leading to lower emissions in the future. The remainder of this report describes in more depth the nature of this technological challenge and the characteristics of a technology strategy for limiting emissions.



Carbon intensity fell over the past 150 years as society switched from wood to coal to oil and gas. The introduction of nuclear and large-scale hydroelectric power has contributed significantly to the reductions in intensity over the past few decades.



The IPCC Second Assessment Report developed a set of possible scenarios for future carbon emissions in a world without carbon policy intervention. The more recent set of Standard Reference Emissions Scenarios (SRES), developed for the Third Assessment Report, cover roughly the same range of emission futures.

Energy Today and Tomorrow

The energy system today is dominated by fossil fuels, which are abundant and relatively inexpensive. Carbon dioxide emissions resulting from the use of fossil fuels are responsible for most of the projected human influence on climate. Today, coal is the primary energy resource in the two most populous countries in the world, India and China, and is likely to fuel their future economic development. Accordingly, tomorrow's energy system also will be dominated by fossil fuels in all likelihood. Achieving fundamental change in the energy system is a slow process, requiring coordinated changes in energy supply, conversion, distribution, and end use.

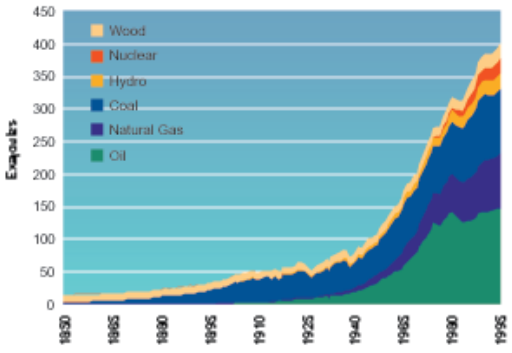
Prior to 1900, most goods and services were produced with the use of energy from animals, wood and other biomass, and early forms of hydropower. The Industrial Revolution and the growth in the world's energy use were made possible by harnessing ever more powerful and denser forms of energy. Wood was surpassed by coal, which was predominant from the late 1800s through the late 1960s. Oil, driven primarily by the increase in demand for transportation, has been the predominant fuel since then.

During the latter half of the 20th century, large-scale hydroelectric, natural gas, and nuclear power were added to the energy mix. Renewable technologies such as solar and wind power have only recently come into use, but to date they have had a minimal impact on the overall picture.

As the production of goods and services has grown worldwide, so too has the global use of energy. In 1850, global energy use was about 9 exajoules. Since then, energy use has grown steadily to almost 400 exajoules in 1995.

Historically, the global energy system has been dominated by carbon-emitting fuels—first wood, then coal, and now oil.

Global Energy Production and Consumption



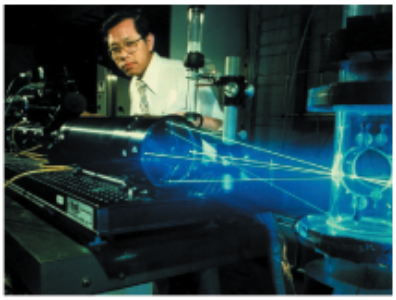
Energy Today

Today's energy system—the supply, conversion, transport, and end-use of energy—is dominated by fossil fuels. Of the energy used in 1995 worldwide, 88 percent was supplied by fossil fuels and only a small fraction—12 percent—was provided by nonfossil energy sources such as nuclear, hydroelectric, solar, and wind power.

Although virtually all of global transportation needs are fueled by fossil energy, the electricity sector uses more diverse sources of energy. Approximately one-third of global electricity in1995 was generated using nonfossil energy.

Use of natural gas, another fossil fuel, is growing rapidly—both in direct uses and in electricity generation. Natural gas provided 19 percent of the world's energy in 1995, representing a larger percentage than all of the commercial nonfossil energy sources combined.

Countries around the world differ in the types of energy they use. This diversity in the energy mix is governed by differences in indigenous fuel resources, land area, climate, economy, and political standing vis-à-vis energy-rich neighbors. Traditionally, for example, China has been energy-independent, relying almost exclusively on its extensive coal resources to meet its internal energy requirements—although petroleum imports have begun to rise as the demand for transportation has increased. On the other hand, two of its neighbors, Korea and Japan, lack significant indigenous energy resources and import most of their energy supplies.



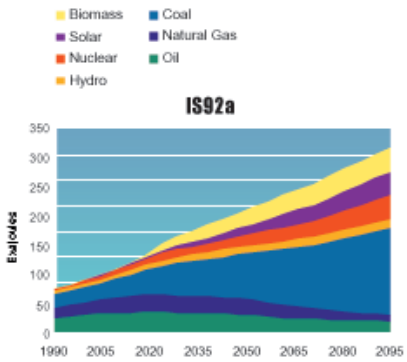
Energy Tomorrow

Forecasting the future composition of the energy industry 100 years from now is a risky business. The only thing that is almost certain is that the future will prove different from any nontrivial predictions made today. On a regional basis, energy use will continue to be influenced by available energy resources, existing technologies, and the mix of energy services needed.

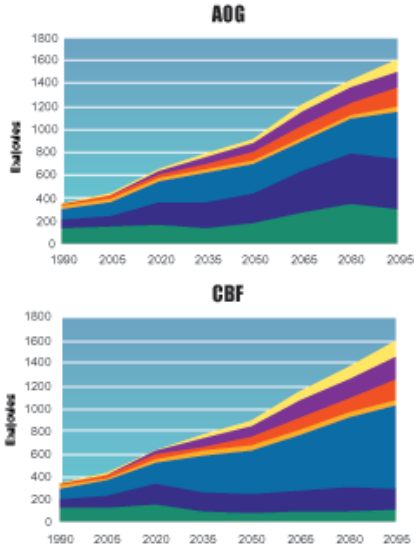
However, regional fuel choices also will be influenced by public policies, such as environmental regulations, energy subsidies in the form of low prices, and foreign investment in energy supplies, which are harder to project. Even the restructuring and privatization of electricity and natural gas markets around the world may affect the energy mix significantly in the future, by changing the fundamental dynamics of energy capital investments.

To look forward a century, we consider again the four fundamental factors influencing

Global Energy Use Today and Tomorrow



Under the IS92a scenario, global energy use is projected to increase in the future. A key uncertainty that affects the evolution of this energy system is the future price and availability of oil and gas. This figure shows projected energy use under two future resource scenarios. In one plausible future, lower grades of oil and natural gas would become available at approximately current prices—the Abundant Oil and Gas (AOG) scenario. In another plausible future, liquid and gaseous fuels will have to be produced from coal and commercial biomass. In that case, which we call the Coal Bridge to the Future (CBF) scenario, the price of energy would be higher, resulting in lower overall demand.



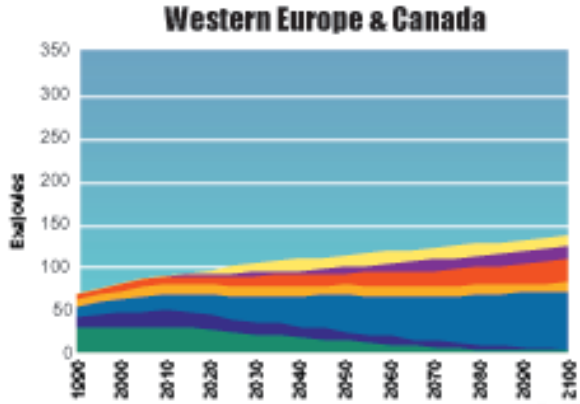
Resulting fuels mixes for the two energy resource scenarios are similar for 2025, but very different for 2100. The scenarios are similar in 2025 because much of today's energy producing and using capital stock may still be operating in 2025, which limits change from the present, and because the resource constraints on oil and gas are just beginning in the CBF case. Both resource scenarios suggest major changes in the energy system over the next 100 years even in the absence of climate policies.

future emissions: population growth, economic growth, energy intensity, and carbon intensity. If the past is any guide, the demand for energy services, which is a function of population growth, economic growth, and energy intensity, will increase dramatically. Given the current dominance of fossil fuels, future carbon intensity will be strongly influenced by the availability of fossil fuels over the next century and their price.

Fossil Fuel Availability

Energy resource surveys indicate that the world has more than enough fossil fuel resources to supply the energy needs of the 21st century. Coal dominates the fossil fuels that are readily available using current conventional methods of extraction.

Most of the world's coal resources are located in a small number of countries. In 1998,


Western Europe & Canada
Exajoules
350
300
250
200
150
100
50
0
1990
2000
2010
2020
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2040
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2060
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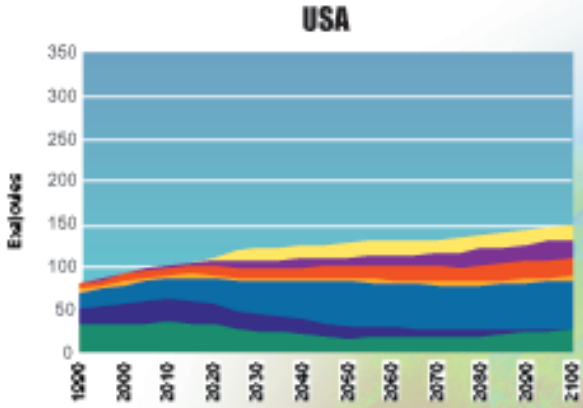
2080
2090
2100


USA
Exajoules
350
300
250
200
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1990
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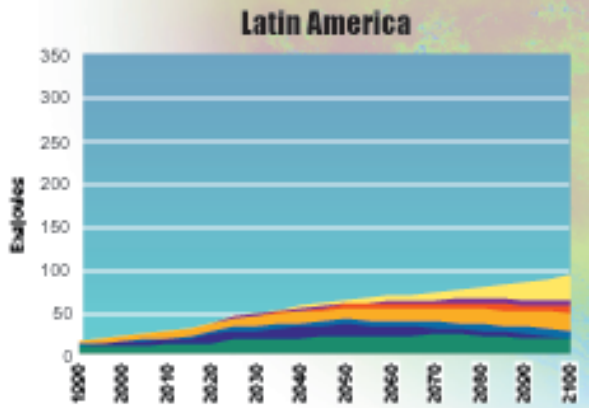
2100


Latin America
Exajoules
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200
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0
1990
2000
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2020
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2040
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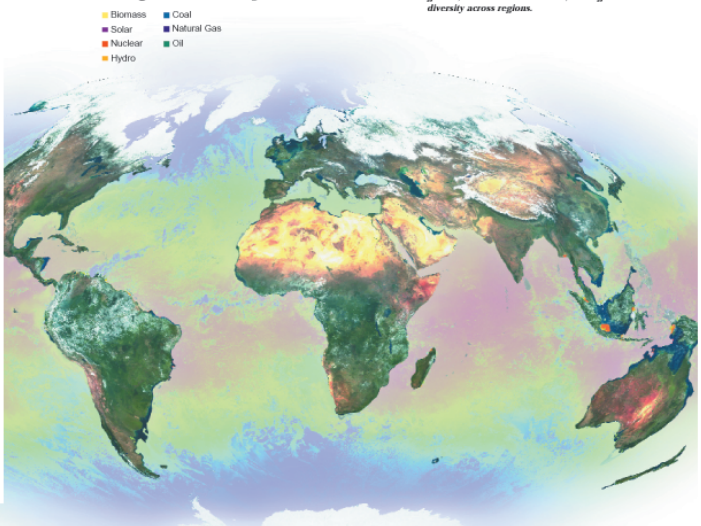
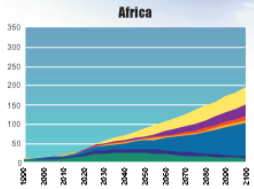
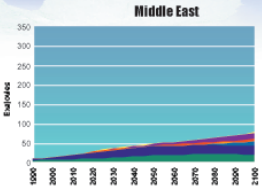
2070
2080
2090
2100

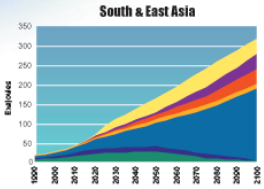
Regional Energy Use Today and Tomorrow: Growth, Structural Change and Diversity

Energy choices around the world will vary depending upon indigenous energy resources, energy and environmental policies, national security issues, and technical capacity. This graphic shows possible energy development paths for nine regions of the world for the IS92a scenario. The story overall is one of growth, fundamental fuel shifts, and significant diversity across regions.









Former Soviet Union & Eastern Europe
Exajoules
350
300
250
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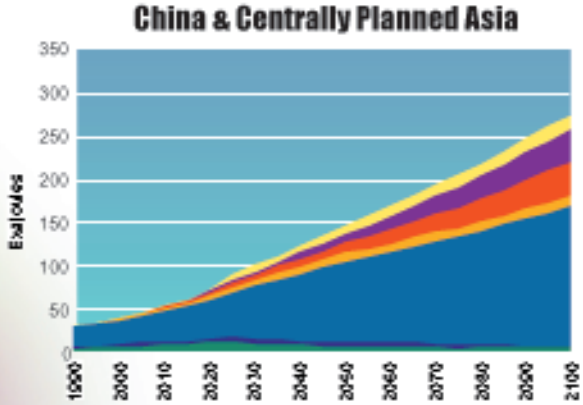
China & Centrally Planned Asia
Exajoules
350
300
250
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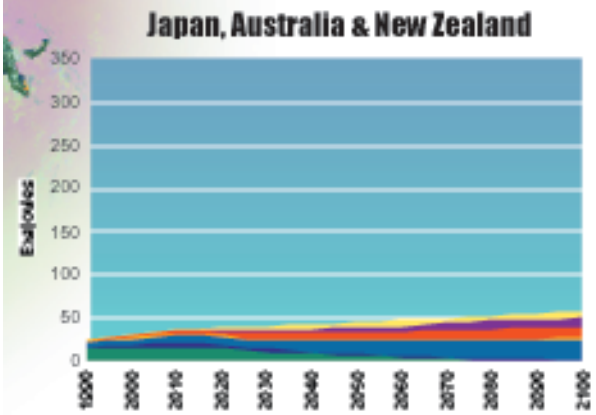
Japan, Australia & New Zealand
Exajoules
350
300
250
200
150
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1990
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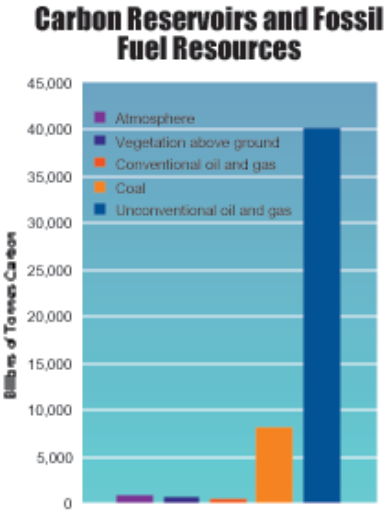
2100

the United States, China, the former Soviet Union, and India produced 3,195 million short tons, or 63 percent, of the global total coal production of 5,043 million short tons. The United States, China, and the former Soviet Union possess the majority of the world's coal resources. Adding fewer than a dozen additional countries would account for more than 95 percent of the total coal resources.

Unconventional oil (including oil found in shales, tar sands, and heavy oils) and unconventional gas (including gas found in deep formations, tight seams, and clathrates) represent the bulk of the remaining energy resources. With anticipated technological improvement, even these currently unconventional sources are likely to become cost-competitive with nonfossil energy sources. Unconventional energy deposits are more evenly distributed among countries than conventional fossil resources are. For example, virtually every nation with a coastline has natural gas in the form of gas hydrates.



Conventional coal resources are abundant enough to meet the world's energy needs for the 21st century and beyond. The amount of carbon stored in conventional coal resources and in unconventional oil and gas is many times the amount currently stored in the atmosphere and in vegetation. If these resources are used in conjunction with current technologies, they could increase the concentration of carbon dioxide in the atmosphere significantly.

Even if conventional oil and gas resources prove to be limited, coal resources are virtually unlimited. Increases in the cost of energy will be limited ultimately by the cost of transforming coal into liquids and gases—a cost that is relatively well understood. Fossil fuel energy therefore will be available and may well be cost-competitive for the next century and beyond.

Changing the Energy System

Fundamental shifts in the energy system have occurred very slowly. They have been driven principally by the demand for new energy services and the availability of supply. Oil, which has been in use since at least the 1850s, did not surpass coal as the predominant global fuel until the 1960s. Its growth was very slow until transportation demand started to grow rapidly around the middle of the 20th century. Natural gas, which has been used in small amounts since the early 1800s, did not become a significant fuel source until seamless tubing became available in the 1940s, allowing for low-cost, long-range transport. Unlike oil, where the increased usage was driven by the demand for new energy services, the growth of natu-

ral gas occurred primarily because it is more cost-effective and cleaner than oil and coal.

Changes in energy use have been slow because the energy system is complex (involving myriad decisionmakers) and because it is capital intensive. A shift to a new fuel requires changes not only in investment and the technology to extract the fuel, but also in the technology to transport it, store it, convert it to useful forms, and distribute it to end-users, as well as changes in the end-use technology.

Fundamental changes in power generation can occur more rapidly because electric utilities can shift fuels without requiring any changes on the part of end-users, who are still receiving the same electricity, no matter what the fuel source is. In the 1970s and 1980s, nuclear power represented a large proportion of the additions in capacity. In the United States, natural gas, which in 1978 was outlawed for use in new electric generation due to perceived shortages, is currently the fuel of choice for capacity additions.

In any case, the speed of these transitions was limited not only by the availability of new technologies but also by the demand for new energy equipment. A new car is purchased when consumers decide they need to replace their old cars or need an additional vehicle; a new generating technology is employed only when it becomes cost-effective to replace the old plant or regulations force a change.

Completing a major transformation in the energy system takes time. Oil is expected to remain the leading global fuel for the next few decades. Achieving the fundamental revolution of the global energy system required to stabilize greenhouse gas concentrations will require multiple changes. For example, switching from petroleum to electricity, hydrogen, or another fuel for transportation will require designing and producing vehicles that use these fuels—and, more importantly, putting in place the complex supporting infrastructure.

Four Long-Term Questions

The need for a major change in the energy system raises four long-term questions:

(1) Will different regions of the world require different energy systems and, if so, what are they?
(2) Specifically, what portfolio of new energy technologies is needed to build those systems?
(3) When will those new technologies be needed?
(4) Given the long time frame necessary to change the energy system, how do we make the transition away from carbon-emitting energy technologies?

Although the fundamental technology challenge is clear, the path forward is less apparent. In the chapters that follow, we begin the exploration of some of these questions.

Technology Needs

Energy technology will play a critical role in future emissions, both with and without climate policies. The most frequently cited scenario of the future assumes substantial improvement in energy technology, which will require R&D breakthroughs. Stabilizing concentrations will require even greater technological change. Since technological change takes time, the nations of the world will need to start now. Technology research should focus on the two channels through which almost all energy flows: electricity generation and conversion of fossil fuels.

With substantial increases in the global demand for energy services expected over the next century, energy technology holds the key to effective limitation of greenhouse gas emissions. As described in the last chapter, carbon-based fuels and their associated technologies supplied 88 percent of the world's energy in 1995. Over the coming decades, technologies that are carbon-free will compete in the global marketplace with ever-improving fossil fuel technologies. How successfully they compete will determine future emissions.

The Intergovernmental Panel on Climate Change (IPCC) in 1992 developed six peer-reviewed descriptions of possible future emissions paths in a world with no climate policies. The one that is most often cited is the middle-of-the-range scenario, generally referred to as the IS92a scenario.

Technology Assumptions in the IPCC IS92a Scenario

The IPCC's IS92a scenario assumes that significant technological change will take place under a "business-as-usual scenario," that is, a world without climate policy. The following are examples of the IPCC's energy technology assumptions:

- 75 percent of electricity in 2100 will be generated from nonfossil sources compared to roughly 33 percent in 1995.
- 57 percent of energy needs in 2100 will be supplied by fossil fuels—down from 88 percent in 1995.
- Biomass energy in 2100 will be used at a scale that exceeds the total global energy use in 1975.
- End-use efficiency in all sectors and regions will improve at 1 percent per year. This assumption implies a 45 percent improvement in energy efficiency in all sectors and regions by 2050.

The IS92a scenario assumes that population will double and moderate economic growth will continue, resulting in a 12-fold increase in the global economy during the 21st century. Combining this economic growth with the scenario's assumed shift toward more efficient use of energy (declining energy intensity) and toward carbon-free energy sources yields a 3-fold rise in emissions.

The IS92a scenario also assumes substantial improvements in the efficiency of power plants that use fossil fuels. At the same time, despite marked efficiency improvements in fossil technology, the scenario envisions a world in which carbon-free technologies such as wind, solar, biomass, nuclear, and hydropower will become sufficiently cheap relative to fossil fuels that they will supply 75 percent of global electricity by the end of the century, up from approximately a third in 1995. Overall, fossil fuels are assumed to supply 57 percent of energy needs in 2100, substantially down from the 88 percent share these fuels held in 1995.

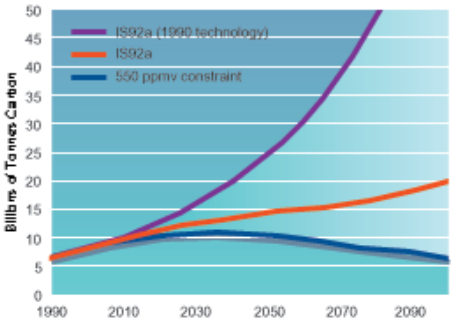
The middle curve in the first chart depicts the carbon dioxide emissions associated with the Intergovernmental Panel on Climate Change (IPCC) central scenario, denoted IS92a, and the middle curve in the second chart represents the concentrations in the atmosphere that result from these emissions. This IPCC "business-as-usual" scenario incorporates significant technological advances. In contrast, while the top curves assume the same population and economic growth as IS92a, they hold energy technology constant at its 1990 level. The difference between the upper and middle curves thus illustrates the technological improvement needed merely to achieve the IS92a emissions path with its corresponding impact on concentrations. The lower curves depict an emissions path and its corresponding concentration path consistent with a 550 parts per million volume (ppmv) concentration ceiling. The dotted line on the concentrations chart indicates the pre-industrial level of carbon dioxide concentrations (i.e., a level virtually unaffected by human activities).

In summary, the IPCC's central scenario assumes major improvements in technology that will require significant future research breakthroughs and fundamental shifts in the energy system toward carbon-free fuels. Some have questioned whether these technology assumptions are realistic or optimistic, but the more salient question is: "Even if we achieve the IPCC's assumptions, will that get us to stabilization?"

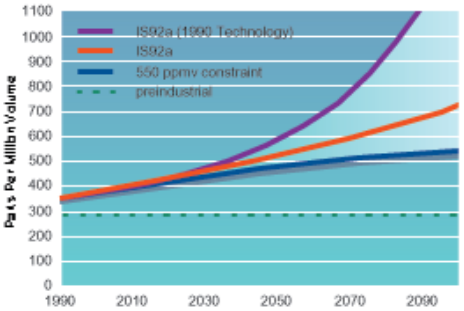
Technology is improving and can be expected to continue to change in a way that makes it

The Future With and Without Technological Change

Carbon Emissions



Carbon Dioxide Concentrations



possible for increasing amounts of wealth to be generated per unit of energy used, while enabling carbon intensity to fall as well. Yet, even under the advanced technology assumptions of IS92a, emissions will continue to grow.

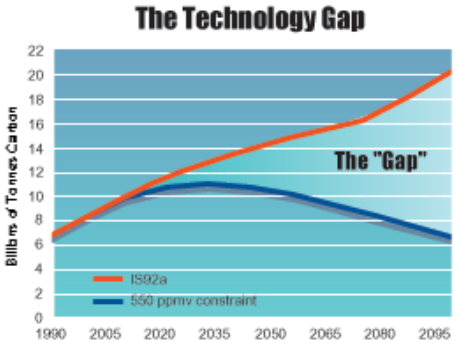
They will increase at a significantly slower rate than they would have without the technology developments envisioned by IS92a. Nevertheless, under the IS92a scenario, the concentration of carbon dioxide will rise to more than 700 ppmv by the end of the 21st century—nearly triple the preindustrial level—and will continue rising.

Thus, a gap emerges between the technologies that are anticipated to come into use under the IS92a scenario and those needed for stabilization. Substantial development of energy technologies is necessary to achieve the IS92a goals, and even greater development and deployment is needed to achieve stabilization.

Changing Energy Technologies—Development and Deployment

Shifting the dominant fuels that run the energy system from wood to coal, oil, and natural gas took decades, even centuries. (See "Changing the Energy System" in Chapter 3.) The shifts were slow because of the time needed to research, develop, and deploy individual technologies, and because of the intricacies of the energy system.

R&D takes time. Innovation and demonstration can take decades before the new technologies become widely accepted and economically competitive. New technologies often vie for supremacy. For several decades, the internal combustion engine was only one of many options that competed to become the power plant of the automobile. A significant number of early cars were powered by electricity.



The gap refers to the difference between future emissions based on IS92a technologies and an emissions path that would achieve a 550-ppmv concentration target. Achieving this stabilization emissions path would require even greater use of advanced technologies than is assumed in IS92a.

Energy capital stock is often long-lived. Deployment of new technology can be slowed by the rate at which existing equipment is retired. Much of the technology and infrastructure that supplies our energy services is long-lived. It is not unusual for a power plant to be in service for more than 50 years, and the transmission and distribution infrastructure may be even longer-lived. Existing technologies will likely remain in place even if their operating costs are higher, because switching to newer technologies requires capital expenditures. Even in rapidly developing countries, new technologies may be slow

Focusing the Search for New Technologies

Despite an increasing diversity of fuel sources and energy uses, the world's commercial energy still makes its way through two channels: electric power generation for stationary uses, and refining and processing for mobile uses.

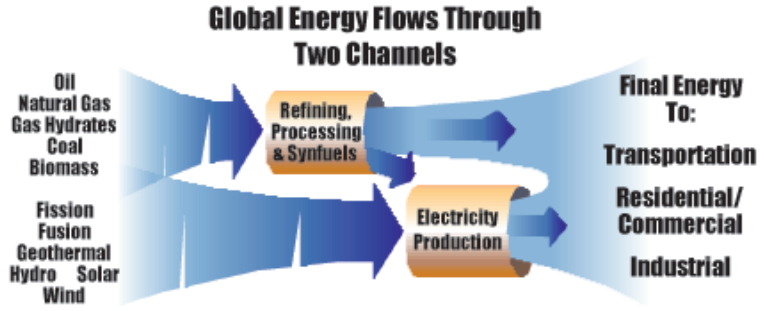
Stationary energy technologies such as power plants, industrial facilities, and office buildings often are large in scale. These stationary facilities can use boilers, large-scale turbines, and large electrical motors. They can use a variety of fuels, including oil, coal, natural gas, hydropower, and nuclear fuel.

Mobile energy technologies, on the other hand, are dominated by the internal combustion engine and have become restricted to oil as the power source. The technologies needed to support these end-uses include oil wells, ocean and land transport, refineries, and internal combustion engines.

The fact that almost all energy undergoes either conversion to electricity or refining and processing is important for developing a targeted technology strategy. Unless one of the channels becomes dominant in the future, a climate technology strategy has to address the technology needs of both types of energy flow

And the technological needs of the two channels may be quite different. Approaches for taking carbon out of electricity production and distribution can be implemented without affecting end-use technologies. In other words the same light bulb can be used whether the electricity is generated by a coal-fired power plant that has no carbon scrubbing technolog or by a coal-fired power plant that does have carbon scrubbing. Conversely, approaches for taking the carbon out of transportation are likely to require not only changes to refining and conversion techniques, but also fundamental changes in automobiles, service stations, and the rest of the transport infrastructure.

The structure of the energy system thus gives us two areas to focus on, but it also gives us few clues about which technologies will be needed to fill the gap. The next section addresses this crucial question.



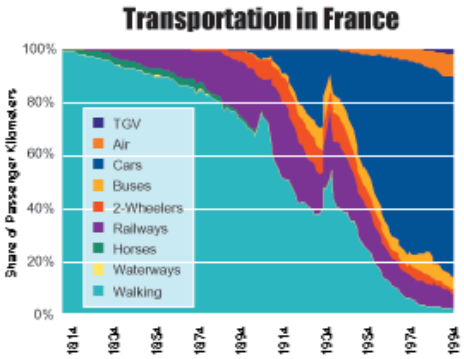
Primary commercial energy flows through two channels to meet an ever-increasing array of end-use demands.

to gain acceptance due to a limited capacity to install and maintain advanced, relatively high-priced technologies.

Changing a single technology may require replacing an entire energy infrastructure. Changing an energy technology may require a complex changeover in the supporting infrastructure. The automobile, for example, was not an overnight success. A long series of investments in supporting technologies was needed. Roads had to be made auto-friendly. Fueling stations had to be designed and constructed. Roadside restaurants and other services had to be built.

In cases where broad changes in infrastructure are not required, the effect of improvements in technology can be much more rapid. For example, fuel switches in power generation can occur more rapidly than economy-wide switches in fuels because electric utilities can make the shift without requiring any changes on the part of end-users, who are still receiving the same electricity, no matter what the fuel source is.

End-use technology efficiencies can improve quite rapidly as well. For example, the average fuel economy of new US automobiles doubled between 1975 and 1985; the average electricity use of new refrigerators will have dropped by more than two-thirds by 2001, compared with the mid-1970s. However, the rate of improvement in overall energy efficiency is still limited by stock turnover. Government efficiency standards, direct financial incentives, and R&D (both public and private) were all needed to achieve a substantial slowing in the growth of US energy use. Partially as a result of



In France, it took 50 years for the automobile's share of passenger transport to rise from 1 percent to 50 percent. The speed of change was limited by technology, societal preferences, and the time required to develop a supporting infrastructure of roads and gasoline stations.

these efforts, energy intensity in the United States fell 42 percent between 1970 and 1999, continuing a pattern of decline observed since the 1920s.

Technical capacity development is necessary to achieve global deployment. New technology is useful only to those who are capable of using it productively and maintaining it. A key limiting factor in the global deployment of technology is the lack of institutions and strategies for spreading these capabilities.

In summary, developing new technologies, bringing them successfully to market, and improving them over time are processes that can consume years to decades. Since it will take time to achieve the fundamental changes to the energy system that are required to stabilize concentrations of greenhouses, we must start to develop the needed technologies now.

Technology Portfolio

Development of new technologies and improvement in existing technologies can control the costs of stabilization. A broad portfolio of investments is needed to manage future uncertainties about climate science, economic development, the price and availability of energy resources, and public policies that are implemented to address the climate issue. The portfolio must be broad to accommodate the diversity in regional technology needs and to address all major energy flows. R&D priorities should be revised periodically to reflect new knowledge.

Climate change is a complex issue that involves many countries, a number of decision-makers, and a myriad of possible responses. A strategy for addressing climate change will have several elements, of which technology is just one. From a technology perspective, managing the risks of climate change requires making investments in research projects that are most likely to improve our understanding of the roles that specific technologies might play in reducing the costs of stabilizing concentrations and in a broad-based portfolio of the technologies that are most likely to achieve that objective.

A technology investment portfolio must accommodate several key uncertainties: uncertainties in climate science, uncertainties about future policies, technological uncertainty, and fundamental uncertainties about the energy resource base. In addition, a portfolio must be broad enough to include the range of technologies needed to address all major sources of carbon dioxide emissions and to reflect diverse regional technology preferences.

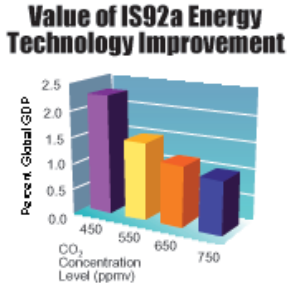
The important future uncertainties are formidable. For example, as the 21st century evolves, we will gain a better understanding of the science of climate change, and the risks that it presents. We will learn what policies nations will choose to implement in order to limit greenhouse gas emissions. We will find out whether oil and natural gas will remain abundant and inexpensive for the next century or through only part of it. We will discover whether current concerns about nuclear power technology can be addressed. We will learn whether carbon capture and storage will be acceptable from both economic and environmental perspectives.

In the face of all these uncertainties, it is clear that society cannot adopt a plan today and follow it over the next 100 years. Actions can and will be modified as the decades pass. A global energy technology strategy will need to be adaptable. Society will need to act, then learn, and then act again.

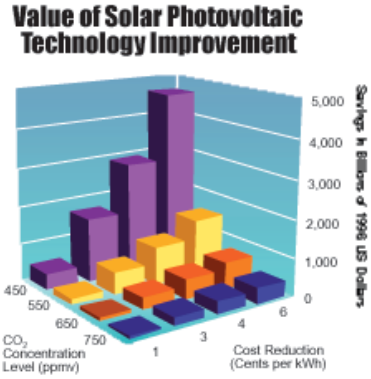
Technology Improvements Dramatically Reduce the Costs of Stabilization

Countries around the world are implementing a number of individual strategies for reducing near-term greenhouse gas emissions, such as promoting energy efficiency to reduce energy consumption, expanding the use of currently available renewable energy technologies and developing flexible policy instruments (e.g., emissions trading) that will allow technological innovation to occur where it is most cost effective. Although efforts employing currently available technologies can slow the growth of emissions, considerable technology advancement is needed to reduce the cost of making these near-term emission reductions and the much larger reductions required to stabilize concentrations.

In the previous chapter, we presented two technology variants of the IS92a scenario: one with technology frozen at 1990 levels and the other



The value of technology advances can be calculated by comparing the costs of stabilization with the IS92a technologies to the cost of stabilization with no technological advances. The value, expressed here in terms of present value of cost reductions divided by the present value of gross world product, is substantial for all concentration targets analyzed.



The value of reducing the cost per kWh of solar photovoltaics from a reference value of 9 cents per kWh can be calculated for a range of stabilization targets, holding all other technologies at reference prices and efficiencies. The value of technology improvements in solar increases as the stabilization target tightens. This value pattern across targets would not necessarily hold for all technologies. Some technologies might have high value when only moderate reductions are required, but lesser value if more stringent reductions were required.

incorporating the dramatically improved technologies assumed under the IPCC's IS92a scenario. The value of this technological improvement can also be estimated. For a 550 ppmv concentration target, the value of moving from 1990 technology to those assumed under IS92a is almost 1.5% of gross world product.

Improvements in the price and performance of currently commercial technologies can save literally trillions of dollars in the cost of addressing climate change. For example, if solar power could be developed that cost 3 cents per kilowatt-hour (a 6 cent per kWh reduction from the reference value of 9 cents and a price which is competitive with today's electricity sources), the global cost of stabilizing atmospheric carbon dioxide at 550 ppmv

could be reduced by about $1.5 trillion. Clearly, failure to invest in the improvement of existing technologies that can reduce emissions, such as end-use efficiency, solar power, wind, biomass, nuclear, and hydropower, would increase the potential costs of stabilization substantially.

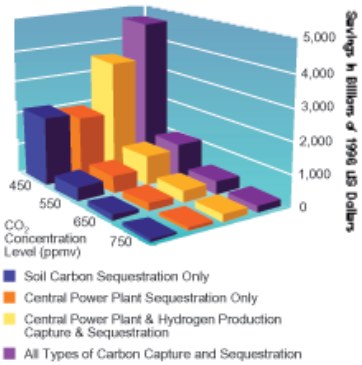
Similarly, successful investments in technologies that are not yet in widespread commercial use, such as those to sequester carbon by storing it in soils or to capture and store carbon from fuels or power plants, can save literally trillions of dollars in the cost of addressing climate change. Whenever a key technology is taken out of the portfolio, the cost of stabilization increases significantly. For example, the value of adding soil carbon sequestration to the complete suite of carbon capture and sequestration technologies available to stabilize at 450 ppmv is about $1.1 trillion. Removing all of the carbon capture and sequestration technologies more than triples the cost of stabilization for all concentration levels analyzed.

A Technology Investment Portfolio

Achieving the necessary technological advances requires investments in a number of technologies at different stages of development. An investment portfolio needs to include a broad array of technologies to be able to deal effectively with critical future uncertainties and to cope with the range of technologies in the energy system and the diversity of regional technology preferences.

A diversified portfolio accommodates evolving knowledge about climate science.

Value of Carbon Capture and Sequestration Technologies



The value of having carbon sequestration technologies available to help achieve stabilization can also be calculated. Calculations were made both for individual classes of technology and for combinations of these technologies. In combination, the individual technologies compete for market share so that the value of the combination is less than the sum of the values calculated for individual technologies. Integrated analysis like this is critical for assessing technology value.

The evolving understanding of climate science may either increase or reduce the pressure for emission reductions from the energy sector. For example, improved understanding of the roles of various greenhouse gases other than carbon dioxide in affecting climate or additional information on the possibilities for carbon sequestration could significantly affect research priorities.

A diversified portfolio also accommodates uncertainties about future energy resources. At present, we cannot forecast whether oil and natural gas resources will be confined to conventional sources because of technology limitations or whether technolog-

ical advances will enable unconventional fossil resources to become accessible at prices comparable to current costs.

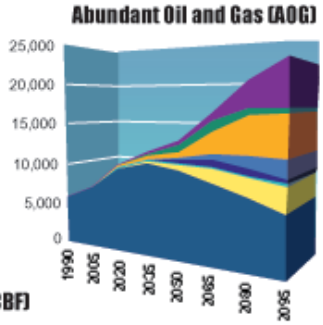
In one plausible future, lower grades of oil and natural gas would become available at approximately current prices—the Abundant Oil and Gas (AOG) scenario. In another plausible future, liquid and gaseous fuels will have to be produced from coal and commercial biomass. In that case, which we call the Coal Bridge to the Future (CBF) scenario, the liquid and gaseous fuel prices would be higher. The only difference between these plausible futures is whether coal, oil, or natural gas will be the most inexpensive fuel choices.

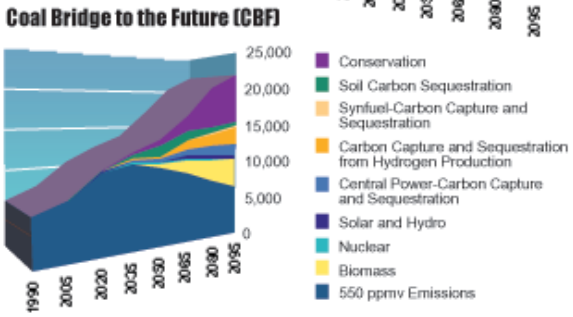
This uncertainty, however, drives important differences in the mix of technologies that are deployed to limit carbon dioxide emissions. Carbon capture and sequestration from hydrogen production would play a much smaller role in the CBF case, but biomass production would play a greater one.

The graphic shows a relatively small direct effect of energy conservation in the CBF case, but the indirect effect would be much larger in the form of reduced demand for energy services. Because end-use energy would be more expensive under the CBF scenario than under AOG, people would be motivated to implement a wide range of conservation measures. For example, since much of the end-use energy under the CBF model would be either electricity or synthetic liquid and gas derived from coal, conserving emissions at the point of use also avoids

Technologies that Could Fill the Gap Under Different Energy Resource Futures

Shown in Million Tonnes of Carbon





These figures illustrate the effect of energy resource uncertainty on the portfolio of technologies that could be used to reduce emissions from the IPCC's mid-range projection of the future to a 550 ppmv stabilization path. In the AOG future, conventional oil and gas remain available at approximately current prices. In CBF, energy prices increase leading to additional end-use efficiency improvements and to increased use of coal for the production of synthetic fuels. Technologies are chosen in the analysis based upon their relative prices and availabilities. These figures identify only the technologies chosen to reduce emissions from the IS92a path to a stabilization path. As noted earlier, substantial technology improvements are required to move from a 1990 technology path to the IS92a path.

the additional emissions that would have occurred during the production of that secondary energy source (e.g., using less gasoline derived from coal).

In summary, different possible energy resource futures argue for investing in a broad range of technologies.

A broad portfolio can control costs. Investments in a wide range of technologies are needed to accommodate uncertainty in the outcome of research and development. We will encounter dead ends as some technology paths turn out to be too costly or unrealizable, and almost certainly breakthroughs will be achieved that cannot possibly be anticipated. The key challenge in exploring technological routes to a stabilization goal is to fund enough research to determine whether the approach is practical, yet be willing to terminate the research if neccessary. The technology strategy should provide practical guidance on how to initiate and terminate focused research efforts. Although having additional technologies available always makes sense from an analytical standpoint, there must be a winnowing process to recognize real-world budget constraints.

A portfolio can meet the differing needs of key regions. Technology needs vary from one country and region to another. For example, India has considerable potential to produce modern commercial biomass, but China does not. China has significantly greater space heating needs than India. Neither country, both of which have rapidly growing economies and energy demands, faces exactly the same challenges as the United States, Europe or Japan, whose economies are more mature.

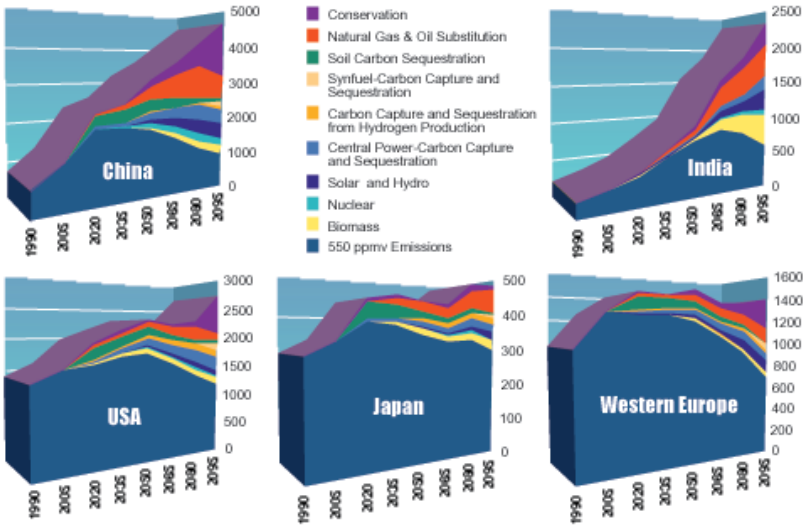
The diversity in indigenous energy resources, energy services required and demands for them, and a number of non-economic issues affect the technologies that might be used in a country or region to achieve stabilization. A technology investment portfolio must have the flexibility to address these differences in geography, energy resources, technical capacity, culture, institutions, and economic systems.

A flexible portfolio can accommodate alternative policy responses to the climate issue. A technology strategy is consistent with a wide range of possible national and regional climate policies, including standards, taxes and trading. A flexible investment portfolio can change as policies evolve. For example, the stringency of carbon emissions limitation policies will affect the value of carbon and accordingly, the fundamental economics and potential competitiveness of technologies. This may lead to substantial changes in R&D investment priorities over time. The goals of the investment portfolio should also evolve to reflect the impacts of broader changes in policies that could affect the climate issue indirectly (e.g., controls on other air pollutants or on urban growth).

A broad portfolio also can reflect the diversity of the energy system. The diversity of the energy system suggests that innovation is needed in a wide array of technologies. Improvements are needed in the overall efficiency of energy use as well as in efforts to limit the free venting of carbon from the energy that is used. Efforts to remove the carbon should focus on the two channels through which commercial energy flows – electricity generation and fuel refining and processing.

Technologies that Could Fill the Regional "Gaps"

Shown in Millions of Tonnes Carbon



These figures illustrate one possible portfolio of technologies for moving from the IPCC's mid-range projection of the future to an emissions path leading to stabilization of concentrations at 550 ppmv. Five regions are presented. These regions represent the majority of today's emissions of carbon dioxide and are projected to represent the majority of emissions for the foreseeable future. The estimates are provided by the Global Energy Technology Strategy Program's regional collaborators. The top line in each region denotes regional emissions under the IS92a scenario. The gray regions denote the emissions paths that minimize the cost of achieving a concentration target of 550ppmv. Emission reductions are made where most economic, with no regard to the critical issue of who pays for these reductions. These figures highlight the technologies needed to reduce emissions from the IS92a path to a stabilization path. As noted earlier, substantial technology improvements are required to move from a 1990 technology path to the IS92a path.

Improvements in the efficiency of energy use are critical. As we have learned over the last three decades, economic development is driven by growth in energy services not by growth in energy use. Providing energy services more efficiently is a key element of a technology portfolio and helps achieve other societal objectives.

The next focus is to limit the free venting of carbon from the energy that is needed. Investments to develop technologies for reducing emissions from electric generation need to focus on non-fossil systems to generate power as well as carbon capture and sequestration technologies that could allow the continued use of fossil fuels.

Removing carbon from transportation will require fundamental changes in personal vehicles, possibly so that they operate on carbon-free fuels such as hydrogen. Shifting to hydrogen as a fuel would require the development of methods to produce large amounts of hydrogen without venting carbon to the atmosphere. A new transport system also would require new fuel transport and storage technologies and the development of a fueling infrastructure.

Reassessment of Technology Investment Priorities

The priorities for technology investment will change as the 21st century evolves. Technology investments must be reviewed on a regular basis to incorporate new information. Some of the information, such as fuel costs and availability and the concentration target chosen to meet the Framework Convention's ultimate goal are uncertainties that will guide investment priorities, but are not directly controlled by the technology research effort. Technological uncertainty, on the other hand, will be resolved only through a process of research, application, assessment, and improvement, probably requiring further research.

One key goal of these periodic assessments will be to evaluate how well we are doing in terms of the overall development and deployment of the technologies needed to achieve stabilization. Specific technology milestones need to be developed based upon integrated analysis of the energy system in order to guide this assessment. A periodic assessment of this type can help refocus the R&D effort, can identify issues associated with technology deployment and can provide an indication of the adequacy of funding. In addition, this type of assessment can assist in the important objective of halting inquiry into technologies that have failed to realize their initial promise.

Technologies That Fill the Gap

A series of global and regional analyses conducted by the Global Energy Technology Strategy Program have assessed literally hundreds of technologies that may help fill the technology gap. If resources were unlimited, it would make sense to invest in all of those technologies. Given that funding is limited, however, a detailed analysis of specific R&D paths is needed to determine those of greatest importance.

As demonstrated above, it is critical to continue to fund the improvement of currently commercial technologies that can help reduce carbon emissions. The rapid development and deployment of these technologies are required in order to achieve the IS92a, "business as usual," scenario and to prepare for the next step of achieving stabilization.

Of the technologies that are not currently commercial, the GTSP analyses identify three technology paths that currently merit substantially increased R&D investment to determine more clearly their future potential:

- Carbon sequestration technologies
- Low carbon-emitting methods to produce hydrogen in combination with improved hydrogen storage and fuel cells
- Carbon capture, transport and storage technologies

Carbon sequestration technologies. The overall purpose of these technologies is to retain or store carbon in plants, soils, and oceans and to develop energy sources that balance the uptake and release of carbon, for example, by producing energy from plants. Some of these technologies have additional benefits such as restoring degraded lands. Others enlarge the suite of options for producing energy regionally, such as electricity and liquid fuels from biomass.

To develop current carbon sequestration technologies will require an increase in our understanding of the carbon cycle and the mechanisms by which carbon is sequestered. Research and development is needed to design processes to convert biomass to electricity and liquid fuels efficiently and at low cost.

Hydrogen-based Transportation. Fuel cells might power vehicles with greater efficiency and lower emissions than conventional engines. Vehicular fuel cells currently are being commercialized, but the onboard fuel used is projected to be either methanol or a liquid hydrocarbon. As long as vehicular fuel cells are fed by carbon-based fuels, they will not reduce carbon dioxide emissions sufficiently to achieve stabilization. If the carbon associated with hydrogen production were captured and sequestered, fuel cells would be much more effective in stemming the carbon dioxide emissions from transportation –illustrating the interdependent nature of the technologies within the R&D portfolio.

Alternatively, hydrogen fed fuel cells could be an important non-emitting source of energy if the hydrogen were produced from non-carbon energy sources such as fission, fusion, or solar electricity. To complement ongoing R&D in fuel cells, basic research into the most efficient ways to produce, distribute and store hydrogen is needed.

Carbon capture, use, and storage. Current scientific research suggests that sustained basic R&D today could result in effective technologies to capture and store carbon on a scale that would significantly help mitigate climate change. Carbon capture, use, and storage technologies would allow the continued use of fossil fuels but would prevent carbon from being released to the atmosphere. Technologies to remove carbon dioxide from combustion flue gases are already operational at small scale, but are expensive.

The primary question is what to do with the captured carbon dioxide. Some of it has commercial value. Since the early 1970s, carbon dioxide has been used in mature oil fields to enhance recovery of oil. The gas is injected into old reservoirs (sometimes alternating with water to increase the pressure and the flow of oil). Other commercial uses include enhancing the production of coal bed methane and increasing the production of urea, methanol, and soda ash.

A large percentage of the captured carbon dioxide could be stored in geological formations such as deep saline aquifers, depleted natural gas and oil reservoirs, and coal seams. Carbon capture and storage are new technologies, and many questions remain to be addressed through geologic, energy, and environmental research.

Based upon our analyses, these three technology paths are ones that are currently under-fund-

Challenges for Today's Commercial Energy Technologies

Individuals, companies, and countries consider a range of factors when making energy technology choices. Economics is very important, but environment, safety, energy security, national security, and other factors also affect investment decisions. Four key categories of existing commercial technologies face unique challenges over the coming decades that research can help to address:

End-use efficiency . End-use efficiency has played and will continue to play a critical role in limiting carbon dioxide emissions. Key issues facing energy efficiency technologies include technological improvement and creating products that consumers will embrace.

Hydroelectric generation. Hydroelectric generation supplied about 6 percent of global energy in 1995. There is considerable hydroelectric capacity around the world that has not been developed. Key challenges for hydroelectric generation include concerns about the environmental impacts associated with new and existing facilities and long-distance transmission since many remaining hydro resources are far from population centers.

Nuclear. Nuclear energy also supplied 6 percent of global energy in 1995. Nuclear energy, however, faces several critical challenges that research might help address: concerns about safety, the final disposition of radioactive wastes, and nuclear weapon proliferation, along with basic issues about its capital costs in an era of electric industry restructuring.

Renewables. Renewables contributed only a small amount of the global commercial energy supply in 1995. The challenges for renewables include cost, intermittent availability (for solar and wind), emissions (for biomass resources) and regional availability. Technology improvements are needed to reduce costs, and advances in storage and long-distance transmission can help address the availability issues.

ed relative to their potential contribution to atmospheric stabilization. They all deserve R&D priority today, but these priorities should be revisited on a regular basis.

In summary, the key elements of a technology investment strategy involve developing a broad-based portfolio and revisiting it on a regular basis to determine progress. R&D priorities should be reviewed on a regular basis within the context of the overall carbon management technology system to re-optimize the portfolio. The need for new technology is clear, and guiding principles for determining research priorities are starting to emerge. The question that also must be answered is how are we doing in developing the technologies needed to manage the risk of climate change.

Research and Development

Dramatic improvements in conventional energy technologies will be required just to keep atmospheric carbon dioxide concentrations from exceeding three times pre-industrial levels. Fundamentally new technologies will be required to stabilize concentrations of greenhouse gases at lower levels at a reasonable cost. The needed improvements in conventional technologies have not yet been realized, and the development of fundamentally new technologies is not being supported at any significant level.

The research and development challenge presented by climate change is novel. The scope extends beyond traditional energy R&D into agricultural and environmental science and technology. A great deal of integration will be required throughout the innovation process, coordinating knowledge gained from basic research and fundamental science and applying it to the development of commercial applications and technology deployment.

Large-scale, integrated technologies, such as those required for atmospheric stabilization, do not simply appear in the marketplace. Because of their scale, it will take several decades to achieve significant commercial application. Integration will require focused efforts during all stages of the innovation process to achieve the necessary technological breakthroughs. Continuous commitments of resources by government, industry, and universities over decades will be needed to reduce the cost of new technologies and ensure environmental acceptability.

During the past two centuries, investments in research and development have greatly improved the performance of conventional energy production and end-use technologies. But support for energy R&D has been episodic and driven largely by changes in energy markets and by political dynamics. For example, periods of low energy prices coupled with market and policy uncertainty are characterized by low and declining energy R&D efforts by both the public and private sectors. Conversely, during periods of sustained high energy prices, energy R&D efforts tend to increase in quantity, if not efficiency. In order to produce the fundamentally new technologies needed to stabilize greenhouse gas concentrations, a much more concerted and consistent R&D effort will be required.

The Innovation Process

Technology innovation is a continuous process with several definable but overlapping stages. Technology development aimed at a specific goal requires investment and coordination at all stages. It is critical to engage both the public and private sectors in the effort in a way that recognizes the unique strengths and weaknesses of each. This chapter describes the stages of the innovation process required to address the climate goal and highlights the overlapping and interlocking roles of the public and private sectors.

Basic research. At the front end of innovation, fundamental science is critical to building the knowledge necessary for new technology discoveries. The benefits of investments in basic research are difficult to quantify. National governments view investment in fundamental science as necessary to maintain their national security and economic and environmental well-being. For this reason, governments are often the principal supporters of basic research.

For the most part, governments will have to take the lead in funding basic research needed to address climate change because of the diffuse private benefits of that kind of expenditure and the long delays between discovery and application. Although a broad basic research program is consistent with the need to support innovation, some fields are particularly in need of emphasis, either because of cost or technical feasibility. Clearly, carbon management areas such as advanced fuels processing, carbon or hydrogen separation, biosequestration, and geological storage would benefit from advances in the biological, computational, materials, and molecular sciences, to name just a few.

Stages from Innovation to Use

Technology innovation consists of a web of definable but overlapping stages. Breakthroughs or barriers encountered in any of the stages should inform activities in the other stages.

Applied research and development. Applied research is designed to turn the knowledge derived from basic science into useful products and applications such as biomass cropping systems, photovoltaic cells, hydrogen storage, fuel cells, battery technology, carbon capture and storage technologies, and highly efficient, low-emission vehicles. Each of these practical applications involves the integration of a number of different disciplines and frequently generates new questions and scientific puzzles requiring yet more basic discoveries. Once applied research indicates that a practical application has a chance of succeeding in the marketplace, market-focused technology development is required to justify substantial investments in the new technology.

Commercialization. In the process of introducing a new technology to the marketplace, experience leads to improvements and adaptation, sometimes requiring developments in the supporting infrastructure. Diffusion of a new technology reveals new applications and requirements based on economic and technical performance and productivity standards. The new applications suggest new goals to guide further technology development.

Innovation – An Iterative Process

Successes and failures in one stage of the innovation process often stimulate refocused efforts in other stages. For example, successes in fundamental materials science can suggest new approaches for developing commercial fuel cells or photovoltaics or carbon scrubbers. Conversely, failure to develop cost-effective processes for manufacture can reduce a fundamental breakthrough to an interesting scientific note or stimulate a completely different innovation. The various stages of the innovation process inform, guide and stimulate each other.

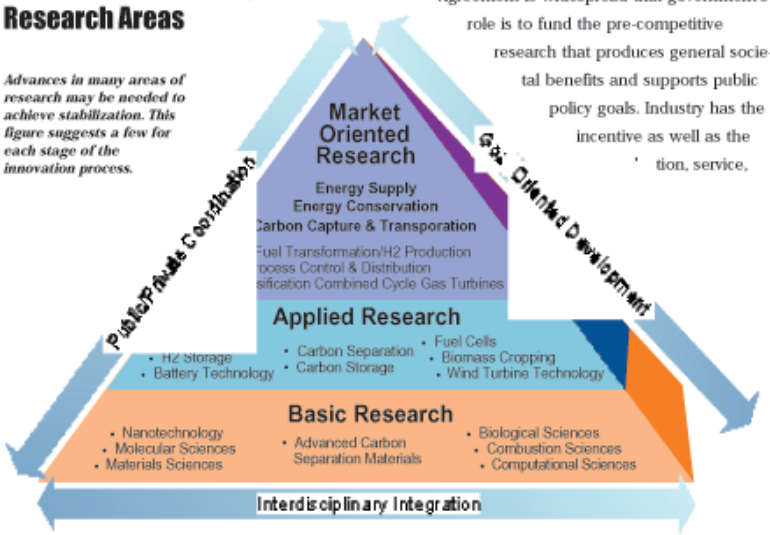
In the context of climate change, this iterative aspect of the innovation process underscores the importance of reviewing the climate technology strategy on a regular basis. This review process is sometimes described as act, then learn, then act again.

Public and Private Roles in Innovation

Agreement is widespread that government's role is to fund the pre-competitive research that produces general societal benefits and supports public policy goals. Industry has the incentive as well as the tion, service,

Illustrative Technology Research Areas

Advances in many areas of research may be needed to achieve stabilization. This figure suggests a few for each stage of the innovation process.



and marketing skills needed to take a new product or technology from the laboratory to the marketplace. Consequently, industry takes on greater R&D responsibility as the product moves closer to commercialization and technology issues begin to involve the manufacture of specific products for competitive markets.

Private industry tries to complement and leverage the public energy research portfolio. And the public R&D agencies are increasingly looking to industry for market guidance. Despite successes such as the search for clean coal technologies and the efforts made by the Partnership for a New Generation of Vehicles in the US, coordination between public and private sectors can be and will have to be significantly improved to address the climate technology development issues.

Achieving the public sector goal of stabilizing the atmosphere at a reasonable cost requires a dramatic improvement in existing commercial technologies, plus development and deployment on a global scale of new technologies that do not yet have a commercial market. Clearly defining the roles of the public and private sectors in addressing this complex issue appears to be impossible, but the general principles provide guidance. Atmospheric stabilization is a public goal, and both the programs needed to spur technology innovation and the necessary basic research are the responsibility of the public sector. Deployment remains a primary responsibility of the private sector.

Significant consultation, planning, and coordination between the public and private sectors will be required to develop the required new

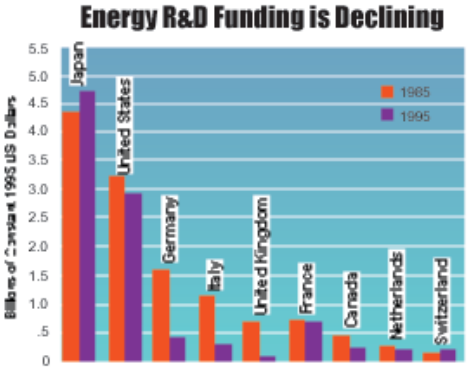
technology and integrate it with existing conventional energy technologies. These sectors will have to integrate research in many different fields of science and technology and throughout the three stages of the innovation process: basic research, applied research, and commercialization. Together they must create a goal-oriented technology development program that links basic research to the needs of applied research, and supports practical development and deployment.

Global Investments in Energy Research and Development

How then are we doing in terms of developing the new technologies needed to manage the risk of climate change? Data on energy research and development are difficult to locate, compile and interpret. However, the

findings from an extensive Pacific Northwest National Laboratory study of R&D funding are not encouraging.

Every year, the public and private sectors devote billions of dollars to energy R&D, representing a significant investment. Still, those billions represent only a small fraction of the global economy and of the world's total investments in R&D. We have been able to document less than $15 billion annually invested in the development of improved energy technologies by the world's governments and private firms. Although the US commitment is one of the world's largest, it represents less than 0.05 percent of US gross domestic product and less than 2 percent of all R&D conducted in the US. Private energy R&D investments in the US, United Kingdom and Netherlands represent less than 1 percent of total sales for utilities as compared to a 3 percent R&D to sales ratio for US industry and 8-10 percent investment rates for R&D leaders such as the pharmaceutical, computer and communications industries.



Total public funding of energy research in the OECD is falling. Although Japan's outlays increased slightly, US spending declined and leading European nations reduced their funding dramatically.

Resources for energy R & D are declining. Resource commitments are an imperfect yardstick for measuring the benefits of energy R&D. Nevertheless, it may be significant that almost 96 percent of the industrialized world's public energy R&D is conducted in only nine developed nations.

Moreover, data from 1985 to 1995 suggest that both public and private investments in energy R&D are clearly declining. Between 1985 and 1995, public sector investment by the nine Organisation for Economic Co-operation and Development (OECD) countries that undertake such research decreased by 23 percent in real terms. More recent data points to a continuation of these reductions.

The United States and Japan together finance approximately 75 percent of global energy R&D. Investment by the US government fell by 23 percent from 1985-1998. During the same period, private sector investments in energy R&D in the US declined 67 percent in real terms. These reductions equate to nearly $3.5 billion less spent per year in 1998 than in 1985. Programs designed to create new advanced environmentally preferred electric generation technologies have been particularly hard hit by these reductions.

The reasons for these declines range from governmental budgetary pressures to low energy prices, greater competition in energy markets, and market

uncertainty brought about by efforts to create more competitive energy markets. Some argue that reduced funding is a poor measurement of progress, since the R&D process may simply have become more efficient in recent years. In the context of the magnitude of the challenge posed by climate change, however, these investment figures suggest reason for concern.

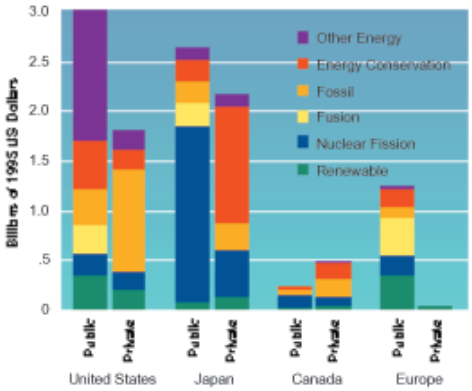
The Japanese government's R&D spending actually grew between 1985 and 1998 by 1 percent. Looking behind the numbers, moreover, reveals that Japan's nuclear fission and fusion programs comprised approximately 75 percent of its public R&D portfolio. Japanese private sector energy R&D investments in electric power generation technologies have recently begun to decline modestly as Japan moves to create a more competitive energy market.

The trends were even more pronounced in European nations. In Germany, Great Britain, and Italy, public sector investments in energy R&D declined anywhere from 75-90 percent between 1985 and 1995. Where data are available for these country's private sector energy R&D investments, there is evidence that programs designed to create new, lower carbon emitting generation technologies are suffering in this funding environment.

Energy R & D is uncoordinated. At the national level, another trend that is cause for concern is the investment of public and private resources in different energy technologies, reducing the potential to leverage limited resources. As governments throughout the industrialized world deregulate their gas and electric utility sectors, they are creating an incentive system that encourages private energy R&D to focus increasingly on short-term, proprietary projects. At the same time, the government energy R&D sector is trying to create programs (often with the hope of private sector cost sharing) to deal with broad and diffuse public benefit issues. In this environment, the challenge is to determine the appropriate roles for public and private entities in creating the needed, new technologies.

Similarly, at the international level, coordination between nations is minimal. Climate change is a global problem. Yet govern-

Energy R&D Portfolios of Selected OECD Countries in 1995



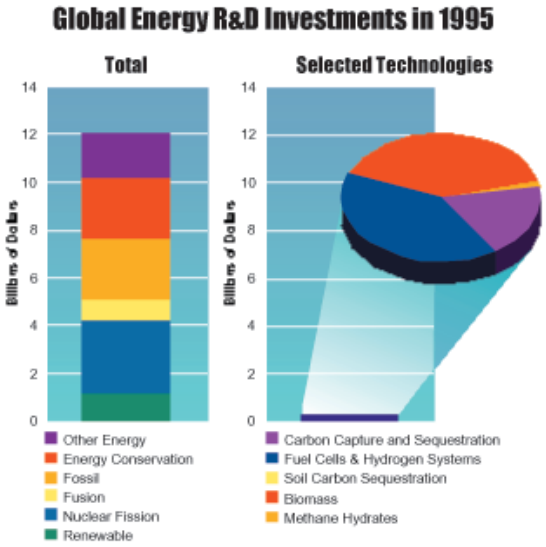
The composition of documented energy investments varies widely between public and private sectors within countries and also varies widely across countries. To simplify the figure, an aggregate portfolio is presented for the European Union and its member countries (Germany, the United Kingdom, the Netherlands and Italy).

ments are missing opportunities to meet their national requirements and global needs by cooperating internationally in funding and conducting R&D. Cooperation and coordination are essential to make best use of society's limited resources for addressing the climate issue.

Energy R&D is not climate-focused. Finally, in almost every major area of energy R&D, research programs focus on short- and medium-term applications rather than on the fundamental knowledge that will be required to develop advanced technologies. For example, in some of the analyses presented earlier, 60 percent of the reductions required to fill the global emissions "gap" just a few decades from now come from increased use of biomass and carbon sequestration. Fuel cells, hydrogen systems, and methane hydrates also figure to be important technologies in filling the global technology gap. Yet these technologies receive less than 2.5 percent of the global investment going into energy research and development.

The recent trends in energy R&D spending stand in stark contrast with the technology needs to manage the risk of climate change. If this funding trend continues, the likelihood of realizing the technologies embodied in the IS92a scenario goes down. Accordingly, the likelihood of stabilizing concentrations declines even farther. The following section describes actions that will be required to stabilize concentrations of greenhouse gases in the atmosphere.

Only 2.5 percent of the global energy R&D investment is targeted at a suite of new technologies that could play a significant role in stabilization. This is not to say that continued investment in other critical emission-reducing technologies is not important, but rather to emphasize the need to understand more clearly the true potential of these new technologies.



CHAPTER VII

Conclusion

The Global Energy Technology Strategy Program concludes: (1) energy technology advances are critical to achieving the ultimate objective of the Framework Convention on Climate Change, the stabilization of concentrations of greenhouse gases in the atmosphere, (2) current energy R&D investments are inadequate to meet this technological challenge, and (3) a global energy technology strategy will help achieve the needed technology advances, complements other global or regional climate policies, and is robust in the face of future uncertainties. As an initial step forward, we identify key elements to guide the development of a technology strategy.

The Global Energy Technology Strategy Program combines technical analyses from Battelle and research collaborators around the world with the expertise of a diverse group of senior representatives from the public and private sectors and from nongovernmental organizations. This chapter characterizes the fundamental challenge that the climate issue poses for the energy sector, summarizes the findings from analyses conducted over the past three years, and puts forward recommendations for policymakers to consider in devising a technological response to the climate issue.

The Challenge

The future evolution of the energy system is central to the climate issue. Emissions of carbon dioxide from the energy sector comprise the largest human contribution to greenhouse gases in the atmosphere. If historic trends continue, future population and economic growth will outpace improvements in energy efficiency, resulting in continuing growth in the demand for energy.

Currently, fossil fuels provide approximately 88 percent of the world's energy and are dominant throughout the global economy. Fossil fuel use dominates every major sector. Fossil fuels provide 97 percent of the energy for the transportation system and approximately 65 percent of the world's electricity, although nuclear and hydroelectric generation are responsible for nearly a third of the electric power supply. With

continued growth in energy demand, future fuel and energy technology choices will be a key determinant of the magnitude of future human influence on the climate.

The ultimate goal of the Framework Convention on Climate Change—the stabilization of concentrations of greenhouse gases in the atmosphere—requires that global carbon emissions peak and ultimately decline to zero. Moving from an energy system dominated by technologies that freely vent carbon dioxide to the atmosphere to one that significantly limits carbon dioxide emissions requires a fundamental change in technology choices. Meeting that challenge, while controlling cost, requires major innovations that increase the efficiency of energy use, remove obstacles to the wider use of current carbon-free energy technologies, and lead to the development and deployment of new technologies that are not currently deployed in the market at an appreciable level.

This technological innovation must accommodate important uncertainties. Uncertainties exist in many key areas: the concentration level ultimately required to achieve the objective of the FCCC and other aspects of climate science, global and regional technology needs, the future price and availability of fuels, and the structure of regional and international policies adopted to address climate change.

A diverse technology investment portfolio can address these, and potentially other, uncertainties. A broad array of technology development pathways spurred by research and development investments can provide society with the flexibility to respond to changing conditions while accommodating evolving circumstances. This does not imply that every investment in energy research and development will succeed. There will be failures. However, a broad portfolio, frequently revisited to minimize losses in unproductive areas of inquiry, provides insurance against multiple potential outcomes in science and policy and can address diverse regional technology needs.

The technological challenge in stabilizing greenhouse gas concentrations is clear. Society can address this challenge. However, if recent trends in global energy research and development funding are not reversed, meeting the challenge will be exceptionally difficult. Global investments in energy research and development are declining. Japan's commitment increased modestly since the 1980s; the US effort has declined over the same time period, and the public investments in energy research and development by the European Union have declined precipitously.

In addition, it is not clear that climate change is playing an important role in determining R&D investment priorities. For example, minimal investments are being made in new technologies that may play an important role in stabilizing concentrations in the long term. It will be difficult, if not impossible, to develop technologies capable of addressing the climate issue unless society makes a commitment to research and development commensurate with the objective of the FCCC.

What follows are elements of a strategic vision that are important to improving the performance of existing technologies and developing the new generation of technologies that will be needed to stabilize concentrations of greenhouse gases in the atmosphere.

Key Findings

Stabilizing concentrations of greenhouse gases in the atmosphere requires fundamental change in the energy system.

- *Energy is central to the climate change issue.* Carbon dioxide emissions from the production and consumption of fossil fuels are the largest contributor to human emissions of greenhouse gases. Fossil fuel resources are abundant, and, if used in conjunction with present energy technology, have the potential to increase the concentrations of greenhouse gases in the atmosphere substantially.
- *If present trends continue, carbon dioxide emissions from energy will continue to grow.* The influences of future population growth and economic development on the demand for energy services are likely to exceed currently projected improvements in energy intensity and the ongoing transition to less carbon-intensive fuels. However, trends are not destiny—a global technology strategy could help change the present course.
- *In order to stabilize concentrations of greenhouse gases in the atmosphere, global carbon emissions must peak during the 21st century and then decline indefinitely.* This can occur only if lower carbon-emitting technologies are deployed worldwide.

Technology breakthroughs are essential both to stabilize greenhouse gas concentrations and to control costs.

- *Although incremental technology improvements are essential, they will not lead to stabilization.* Even with significant improvements in the performance of existing commercial technologies, the concentration of carbon dioxide in the atmosphere would grow to more than 2.5 times pre-industrial levels by 2100.
- *Technology breakthroughs can reduce the cost of greenhouse gas stabilization dramatically.* Technological advances can reduce the annual cost of stabilizing atmospheric concentrations of greenhouse gases by at least 1-2 percent of global world product. The savings will depend upon the concentration target and the level of technology improvement.
- *It is time to get started.* The energy system is capital-intensive, and the development and deployment of new technologies can take decades. Given the lead-time necessary to develop and deploy new technologies with their associated systems and infrastructure, we must begin the process without delay.

A portfolio of technologies is necessary to manage the risks of climate change and to respond to evolving conditions.

- *A diversified portfolio accommodates future uncertainties.* Changing scientific knowledge and economic conditions, combined with uncertainty in the resource base, requires a diversified initial portfolio of technology investments. Portfolio investment priorities will evolve over time as these uncertainties evolve or are resolved.
- *A broad portfolio can control costs.* A portfolio encompassing a broad suite of technologies can lower the costs of stabilization significantly. However, the public and private sectors cannot fund every idea. Technology investment priorities must be established to reflect available funding.
- *A broad portfolio can meet the differing*

needs of key regions. Countries will need and employ different technologies based on their geography, indigenous resources, and economic, social, and political systems.

- *A flexible portfolio can accommodate alternative policy responses to the climate issue.* A technology portfolio complements a wide range of possible national and international policies, including trading, taxes, and other policies and measures.
- *A broad portfolio also can reflect the diversity of the energy system.* Technologies are needed to improve the efficiency of energy use, develop non-carbon energy sources, and limit the free venting of carbon from the fossil energy that will continue to be burned.

Current investments in energy research and development are inadequate.

- *Energy research and development outlays are declining.* Both public and private sector investments in energy research and development have declined significantly since the 1980s.
- *Energy research and development expenditures are unfocused and poorly coordinated.* Neither public nor private sector investments are adequately focused on the technologies that could be critical for stabilizing concentrations in the long term. Among the few governments with national energy research and development programs, investments are poorly coordinated and fail to take advantage of possibilities for joint, complementary, or specialized research.
- *Terrestrial sequestration, hydrogen, and carbon capture, use, and storage technologies* potentially play an important role in stabilizing concentrations, but are currently funded at minimal levels.

Recommendations

Emissions limitations and controlling costs complement a technology strategy.

- *Emissions limits are needed to stabilize concentrations.* Without such limits, individual nations have little incentive to reduce greenhouse gas emissions. It is unlikely that the required technologies to achieve stabilization will be developed and deployed if there is not any value placed on developing such technologies.
- *Controlling the costs of stabilization is necessary.* The costs of stabilizing concentrations of greenhouse gases are uncertain and are distributed unevenly across generations, nations, and sectors of the economy. Better definition and control of these costs is critical to achieving societal consensus to take action.

Increase global investments in energy research and development.

- *Increase investment in energy research and development to improve the performance of existing technologies and to develop the next generation of technologies that are required to stabilize greenhouse gas concentrations.* A fundamental restructuring of the energy system will be extremely difficult without significant investments in energy research and development.
- *Develop dedicated long-term funding sources for energy research and development to support the necessary technology transformation.* Climate change is a 21st

century problem. Long-term challenges often are given inadequate attention in annual processes that allocate resources. Dedicated funding sources for energy research and development would ensure that adequate resources are available to develop and implement a technology strategy.

- *Direct investments to specific technologies that have significant potential to substantially reduce greenhouse gas emissions over the long term.* A fraction of research and development efforts are being applied towards a suite of new technologies that could play a key role in reducing greenhouse gas emissions. Additional resources should be devoted to these new technologies. This support should not come at the expense of improving currently available technologies that have the potential to reduce emissions.
- *Build broad-based public support by communicating the climate and ancillary benefits of energy research and development.*

Improve the implementation and performance of energy research and development.

- *Incorporate climate change when revisiting current energy research and development priorities.* Current energy R&D portfolios should be revisited to ensure that they incorporate climate change as a key priority.
- *Better coordinate the roles of the public and private sectors in the research and development process to reflect their specific strengths.* Both sectors have key roles to play in all stages of energy research and development but their emphases should reflect their primary capabilities. For example, agreement is widespread that government support of basic research and fundamental science is essential to build knowledge for technological breakthroughs, while industry plays a greater role as technology moves closer to market.
- *Fund all stages of the innovation process from basic research to market deployment of the most promising technologies.* Fundamental breakthroughs are likely to be derived from successes in basic research in fields such as biology, combustion, computing, and materials science. Funding of basic research will be required to provide this foundation. Resources will also be required as these technologies move closer to demonstration and to market.
- *Establish long-term goals and near-term milestones for technological performance to drive progress and to maximize returns on technology investments.* Resources often become locked into supporting certain technologies regardless of performance. Given the challenges in addressing climate change, policy-makers must establish processes that ensure this does not occur.
- *Design flexible research and development programs to allow for the shifting of resources to accommodate new knowledge and conditions, particularly when sufficient technological progress is not being achieved.* The future is uncertain. A technology strategy must adapt to changed circumstances.

Reflect the international nature of the research challenge.

- *Develop and coordinate international and national energy technology research and development strategies to take advantage of national scientific strengths and regional needs.* Investment portfolios of nations that

invest in energy research and development should be adjusted and coordinated to support more promising technologies consistent with national interests and objectives.

- *Provide assistance to key developing countries to build their technical and institutional capacities for implementing energy research and development programs effectively and for deploying advanced technologies.* Key developing countries require the capability to conduct energy research and development and successfully deploy advanced technologies. Without eventual deployment of advanced energy technologies in the developing world, stabilization of greenhouse gases is not achievable.

Next Steps

These findings and recommendations demonstrate the importance of technology in addressing climate change and provide general principles for moving forward. These results will be actively communicated to all global climate change stakeholders, and particularly those involved in the international discussions. However, they are only a beginning. With the assistance of our steering group, funders, and international collaborators we have identified general future directions, which will be refined as we move forward.

Refine the Technology Strategy

The Program's first three years provided a range of important insights and raised important new questions. In the next three years, we plan to refine and enhance these analyses by expanding and deepening our international collaborations, by examining in more detail the special issues facing the transportation sector, and by conducting additional analyses to improve understanding of the value of specific technologies.

Extend the Technology Strategy

The first phase of the Global Energy Technology Strategy Program focused on carbon dioxide emissions from the energy sector. In the next phase, the Program will broaden its scope to examine the roles of other greenhouse gases and additional categories of carbon sinks in the climate issue. We will examine both projected trends and possible technological responses.

Investigate Implementation Issues

Key recommendations from the first phase of the program emphasize the need for sustained funding of research and development and for improved coordination of research efforts. In the next phase of the Program, we will engage our team of international collaborators to explore some of these issues in more depth. We will also begin to consider the myriad of issues associated with the deployment of new technologies in developing countries.

Communicate

Through briefings, periodic reports and the existing website (http://gtsp.battelle.org), the program will continue to communicate insights gained through collaborative research on the technological and policy pathways that governments, businesses, institutions, and individuals can take to minimize the risks of human interference with the climate system.

Notes

The analyses in this document utilized MiniCAM, an integrated assessment model developed at Battelle in collaboration with scientists in the geographic regions included in the model. The model, its use in developing the technology strategy, and the future scenarios, "Abundant Oil and Gas (AOG)" and "Coal Bridge to the Future (CBF)," are described in the following publications:

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Energy R&D Funding is Declining. Source: Dooley 1998.

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Factors Driving Emissions. Sources: Data for population, gdp per capita, energy intensity and carbon intensity from sources listed later in this chapter.

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Emissions Trajectories Consistent with Various Atmospheric CO_2 Concentration Ceilings. Source: WRE 1996.

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Fossil Fuel Carbon Emissions. Source: Pepper et al. 1992 (projections).

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Chapter 4

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Chapter 5

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Technologies that Could Fill the Regional Gaps. Source: Battelle analysis (US, Japan, Europe); Battelle analysis in coordination with the China Energy Research Institute (China), Indian Institute for Management analysis (India).

Chapter 6

Energy R&D Funding is Declining. Source: Dooley 1998.

Energy R&D Portfolios of Selected OECD Countries in 1995. Source: Dooley 2000.

Global Energy R&D Investments in 1995. Source: Dooley 2000.

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For More Information

The Global Energy Technology Strategy Program's website provides access to the technical papers that form the basis of the analyses presented in this report. References for the Global Energy Technology Strategy Addressing Climate Change may be found on the website: http://gtsp.battelle.org.

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Jae and John

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STATEMENT OF RATTAN LAL, DIRECTOR, CARBON MANAGEMENT AND SEQUESTRATION PROGRAM, OHIO AGRICULTURE RESEARCH AND DEVELOPMENT CENTER, OHIO STATE UNIVERSITY, COLUMBUS, OH

Soil Carbon Sequestration To Reduce Net Gaseous Emissions

Mr. Chairman, members of the Committee on Environment and Public Works. I am Rattan Lal, Professor of Soil Science and Director of the Carbon Management

and Sequestration Program at The Ohio State University. I am especially thankful to Senator Voinovich for the opportunity to offer testimony on "Soil Carbon Sequestration to Reduce Net Gaseous Emissions."

Let me begin by expressing my appreciation of strong cooperation with several institutions and organizations across the country. During the past decade, the program at The Ohio State University (OSU) has been supported by USDA-Natural Resource Conservation Service (NRCS). I cannot thank NRCS enough for its past, present and future support. We have also worked with scientists from USDA-Agricultural Research Service (ARS). The multi-institutional team comprised of OSU/NRCS/ARS has published 12 books, which constitute a major literature on this topic. In addition, OSU also has on-going programs with the Pacific Northwest National Laboratory and the Oak Ridge National Laboratory. Being a founding member of the "Consortium for Agricultural Soils Mitigation of Greenhouse Gases (CASMGS)," the OSU team is collaborating with faculty from ten universities in developing a long-term program on soil carbon sequestration. Following up on the research done for estimating the potential of U.S. cropland and grazing lands to sequester carbon, OSU/NRCS group is now working with USDA-Forest Service (FS) to estimate the potential of U.S. forest soils to sequester carbon. We are presently formulating a program with the Los Alamos National Laboratory, in cooperation with the Ohio Coal Development Office and American Electric Power, to develop a long-term program on soil C sequestration, soil quality and net primary productivity of different ecosystems, with immediate focus on reclamation of mineland sites in Ohio, West Texas and New Mexico. We are also working with USDA-Economic Research Service (ERS) on the topic of soil degradation and its effects on productivity and the C dynamics. We are working with these partners because we share the same values and goals of "sustainable management of soil and water resources, reducing net emissions, and creating a clean environment."

The basis of our shared commitment is the mutual concern about the quality of the nation's soil and water resources and the environment. We realize how important and critical the quality of soil resources is for maintaining high economic agricultural production while moderating the quality of air and water. Advances in soil science, especially those in relation to efficient use of water and nutrients by input-responsive and high yielding varieties, broke the yield barriers, ushered in the Green Revolution, and brought about a quantum jump in agricultural production in the post-World War II era. Gains in agricultural production globally during the second half of the 20th century saved millions from starvation, and once again proved the neo-Malthusian views wrong. Now we want to use the knowledge of soil science in addressing another important and global issue of the modern era—reducing net emissions of greenhouse gases into the atmosphere.

The atmosphere is a classic example of a common pool resource that is prone to exploitation. With industrialization and expansion of agriculture, through deforestation and plowing, comes soil degradation and emission of gases into the atmosphere. Indeed, the atmospheric concentration of three important greenhouse gases (carbon dioxide, methane and nitrous oxide) has been increasing due to anthropogenic perturbations of the global carbon and nitrogen cycles. For example, the pre-industrial concentration of carbon dioxide at 280 parts per million (0.028 percent or 600 billion tons or Gt) increased to almost 365 ppm (0.037 percent or 770 Gt) in 1998 and is increasing at the rate of 0.5 percent/yr or 3.8 Pg/yr. The historic gaseous increase between 1850 and 1998 has occurred due to two activities: (1) fossil fuel burning and cement production which has contributed 270 (+30) Gt of carbon as CO_2, and (2) deforestation and soil cultivation which has emitted 136 (+55) Gt. Of this, the contribution from world soils may have been 78 (+17) Gt of which 26 (+9) Gt may be due to erosion and related soil-degradative processes. In comparison with the global emissions, cropland soils of the United States have lost 3 to 5 Gt of carbon since conversion from natural to agricultural ecosystems.

Greenhouse gases are released into the atmosphere when trees are cut down and burnt, soils plowed, and wetlands are drained and cultivated. In addition, excessive soil cultivation and inappropriate or inefficient use of nitrogenous fertilizers can result in emission of greenhouse gases from soil to the atmosphere. Finally, accelerated soil erosion can lead to a drastic reduction in soil organic carbon (SOC) content. Although the fate of the carbon that is transported by wind and water is not well understood, it is believed that a considerable portion of the eroded carbon may be mineralized and emitted into the atmosphere. It is estimated that soil erosion annually emits 1.1 Gt of C globally and 0.15 Gt from soils of the United States. Although agricultural processes are presently not the main source of gaseous emissions, they have clearly been a significant source. Yet, the emissions of C from soils are reversible through conversion to a restorative land use and adoption of recommended agricultural practices. These estimates of the amount of lost C, crude as these may be,

provide a reference point about the sink capacity through land use conversion and adoption of recommended practices.

Soil organic matter (SOM), of which 58 percent is carbon, is one of our most important national resources. It consists of a mixture of plant and animal residues at various stages of decomposition and by-products of microbial activity. The SOM is a minor component of the soil (1–3 percent), but plays a very important role in biological productivity and ecosystem functions. Enhancing SOM content is important to improving soil quality, reducing risks of pollution and contamination of natural waters, and decreasing net gaseous emissions to the atmosphere. The SOM pool can be enhanced through: (1) restoration of degraded soils and ecosystems, and (2) intensification of agriculture on prime soils.

Enhancing the SOM pool is an important aspect of restoration of soils degraded by severe erosion, salinization, compaction, and mineland disturbance. Degraded soils have been stripped of a large fraction of their original SOM pool. There are 305 million hectares (Mha) of moderately and severely degraded soils worldwide. U.S. cropland prone to moderate and severe erosion is estimated at 20.4 Mha by wind erosion and 24.3 Mha by water erosion. An additional 20 Mha are prone to salinization, and 0.6 Mha of land strip-mined for coal is in need of restoration.

Land conversion and restoration transforms degraded lands into ecologically compatible land use systems. The Conservation Reserve Program (CRP) is designed to convert highly erodible land from active crop production to permanent vegetative cover for a 10-year period. In addition to erosion control, land under CRP can sequester carbon in soil at the rate of 0.5 to 1.0 t/ha/year (450 to 900 lbs C/acre/yr). Erosion control also involves establishing conservation buffers and filter strips. These vegetated strips, ranging from 5 to 50 m wide (16.5 to 165 ft. wide) are installed along streams as riparian buffers and on agricultural lands to minimize soil erosion and risks of transport of non-point source pollutants into streams. The rate of C accumulation in soil under conservation buffers is similar to that of the land under CRP. The USDA has a voluntary program to develop 3.2 million km (2 million miles) of conservation buffers.

Wetlands are also an important component of the overall environment. Approximately 15 percent of the world's wetlands occur in the United States (40 Mha or 100 million acres) of which 2 Mha (5 million acres) are in need of restoration. Natural wetlands have a potential to accumulate carbon (net of methane) at the rate of 0.2 to 0.3 t/ha/yr (180 to 270 lbs/acre/yr).

Surface mining of coal affected 30,375 ha (75,025 acres) of land in the U.S. during 1998. Restoring minelands, through leveling and using amendments for establishment of pastures and trees, has a potential to sequester 0.5 to 1 t C/ha/yr (450 to 900 lbs C/acre/yr) for 50 years. Similar potential exists in restoring salt-affected soils.

The overall potential of restoration of degraded soils in the United States is 17 to 39 million metric tons or Tg per year for the next 50 years. Intensification of agriculture involves cultivating the best soils using the best management practices to produce the optimum sustainable yield. Some recommended agricultural practices, along with the potential of SOC sequestration are listed in Table 1. Conversion from plowing to no till or any other form of a permanent conservation till has a large potential to sequester carbon and improve soil quality. There is a strong need to encourage the farming community to adopt conservation tillage systems.

Adoption of recommended practices on 155 Mha (380 million acres) of U.S. cropland has a potential to sequester 58 to 170 Tg C/yr. Grazing lands, rangeland and pastures together, occupy 212 Mha (524 million acres) of privately owned land and 124 Mha (300 million acres) of publicly owned land.

Total soil C sequestration potential of U.S. grazing land is 22 to 98 Tg C/yr.

The potential of U.S. forest soils to sequester C is 48 to 86 Tg C/yr (Birdsey, 2001).

Thus, the total potential of U.S. agricultural and forest soils (Table 2) is 145 to 393 Tg C/yr or an average of 270 Tg C/yr.

Total U.S. emissions were 1840 Tg CE/yr in 1999 (USEPA, 2000), and are increasing at 2 percent/yr. Thus, the emissions in 2001 are about 1914 Tg C/yr, of which the contribution of all agricultural practices is 42.9 MMTCE/yr. Therefore the potential carbon sequestration in U.S. soils represents 14 percent of total U.S. emissions, and 6.3 times the emissions from agricultural activities. Thus, soil C sequestration alone can reduce the net emissions. The U.S. commitment under the Kyoto Protocol is reducing emissions by about 660 MMTCE. Thus, soil C sequestration can account for 40 percent of the commitment.

The current net C sinks are estimated at 270 Tg/yr, which comprise only 21 Tg/yr of soil C sequestration (USEPA, 2000). If the full potential of soil C sequestration is realized, the total sink capacity can be 519 Tg C/yr (Table 3), which is 78 percent

of the commitment under the Kyoto Protocol. These statistics indicate the need for a serious consideration of determining what fraction of the total potential is realizable, at what cost and by what policy instruments.

There is a widespread perception that agricultural practices cause environmental problems, especially those related to water contamination and the greenhouse effect. Our research has shown that scientific agriculture and conversion of degraded soils to a restorative land use can also be a solution to environmental issues in general and to reducing the net gaseous emissions in particular. Thus, soil carbon sequestration has a potential to reduce the net U.S. emissions by 270 Tg C/yr. This potential is realizable through promotion of CRP, WRP, erosion control and restoration of degraded soils, conservation tillage, growing cover crops, improving judicious fertilizer use and precision farming.

Actions that improve soil and water quality, enhance agronomic productivity and reduce net emissions of greenhouse gases are truly a win-win situation. It is true that soil C sequestration is a short-term solution to the problem of gaseous emissions. In the long term, reducing emissions from the burning of fossil fuels by developing alternative energy sources is the only solution. For the next 50 years, however, soil C sequestration is a very cost-effective option, a "bridge to the future" that buys us time in which to develop those alternative energy options.

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Table 1. Recommended practices for soil C sequestration. Practice Potential rate of soil carbon sequestration (t/ha/yr) Conservation tillage & mulch farming Compost and manuring Elimination of summer fallow Growing winter cover crops Integrated nutrient management/precision farming Improved varieties and cropping systems Water conservation and water table management Improved pasture management Afforestation/reforestation Fertilizer use in forest soils Restoration of eroded mineland and otherwise degraded soils 0.1–0.5 0.05–0.5 0.05–0.4 0.2–0.5 0.1–0.4 0.05–0.4 0.05–0.3 0.05–0.3 0.08–0.4 0.8–3.0 0.3–1

Source: Lal et al. (1998); Follett et al. (2000); Birdsey (2000) Table 2. Total potential of U.S. agricultural soils for C sequestration. Strategy Potential of soil C sequestration (MMT C/yr) Land conversion and restoration Intensification of cropland Improved management of grazing land Improved management of forest soils Total 17–39 58–170 22–98 48–86 145–393 (270 + 175)

Source: Lal et al. (1998); Follett et al. (2000); Birdsey (2000)

Table 3. Potential sink capacity of terrestrial ecosystems. Activity Sink capacity (Tg C/yr) Above-ground forest Soils Landfill Total 247 270 *2 519

*The soil sink potential can be realized through policy intervention, and needs to be adjusted for hidden C costs of input used.

RESPONSES OF RATTAN LAL TO ADDITIONAL QUESTIONS FROM SENATOR CORZINE

Question 1. What are your recommendations for carbon sequestration on a project level?

Response. Soil carbon plays an important role in the global carbon cycle. World soils contain 2300 billion tons of carbon to 1-meter depth, of which 1,550 billion tons is organic carbon and 750 billion tons is inorganic carbon. In comparison, world biota (trees, shrubs, grasses, plants, etc.) contain 560 billion tons of carbon. The atmospheric pool contains 760 billion tons, and is presently increasing at the rate of about 3.5 billion tons per year. Therefore, the soil carbon pool is about 4.1 times the biotic pool, and about 3 times the atmospheric pool.

There are 4 other points that are important with regards to soil carbon pool:

(i) There is a direct link between the soil carbon pool and the atmospheric pool. Change in soil carbon pool by 1 billion ton translates into the atmospheric concentration of carbon dioxide by 0.47 parts per million by volume.

(ii) The mean residence time of carbon in soil is longer than that in the biota, which is 25 years in soil and about 5 years in the biota on a global scale.

(iii) The carbon pool in world's managed soils is now lower than their potential capacity because of the historic loss (because of plowing, low input agriculture, biomass removal or burning) and prevalence of soil degradative processes (e.g., erosion, compaction, etc.) The historic loss of soil carbon pool is estimated at 60 to 90 billion tons for soils of the world and 3 to 5 billion tons for those of the U.S. The strategy is to increase soil carbon pool through management techniques that enhance carbon sequestration.

(iv) There is a close inter-dependence between soil carbon and the biotic carbon pools. Increase in soil carbon pool leads to increase in the biotic pool because of an overall improvement in soil quality.

Question 2. Would you agree that carbon sequestration should be conducted on project level?

Response. Yes, implementation of "projects" for carbon sequestration is a good strategy. However, a "project" must be considered in a broader context. The project may involve: (i) restoration of degraded soils (e.g., mineland soils and steeplands, eroded soils), (ii) adoption of improved management practices on croplands, and (iii) implementing improved management of grazing land. Improved management of disturbed/degraded soils may involve afforestation and use of amendments. Agricultural intensification on cropland may involve conversion from plow till to no till farming, application of manure, integrated nutrient management with precision farming, growing winter cover crops, elimination of summer fallow, and changing methods of irrigation. Further, highly erodible land (HEL) can be taken out of production and converted to Conservation Reserve Program (CRP).

Adoption of improved practices on grazing land may involve establishing different species, and injecting manure in the rangeland. All land use projects have soil carbon sequestration as an integral component of carbon balance.

In all projects, including these involving afforestation, it is utterly important to monitor "total or ecosystem carbon." The ecosystem carbon involves both above ground (biomass) and below ground (soil carbon) pools.

Similar to the carbon in the biomass (above ground), methodology exists to monitor and verify soil carbon pool and fluxes. The project level information on carbon

sequestration is incomplete unless full accounting is done for both above ground (biomass) and soil carbon pool and fluxes.

Question 3. In the absence of rules for sinks projects under the Kyoto Protocol, would it be possible to trade credits via a voluntary national scheme?

Response. Yes, private trading is already being done and must be encouraged. There is a U.S. voluntary carbon trading market. Several utility companies, including Greenhouse Emissions Management Consortium (GEMCO), are already trading credits. The AEP is involved in a large venture in Brazil, Bolivia and Belize. This is an encouraging development.

As a soil scientist, a major concern I have about carbon trading is the value of carbon. Soil carbon is currently being traded (by GEMCO and others) at a price of $3 to $6 per ton of carbon. This is too low a value because at a sequestration rate of 100 to 200 lbs/acre/year, farmers will practically get nothing for their efforts. Thus, there is an urgent need to identify parameters necessary to assess the "societal" value of soil carbon for trading carbon credits. The societal value must consider onsite benefits and ancillary effects of soil carbon sequestration.

Question 4. Should a partnership be established now between companies that manage forests for harvest?

Response. Yes, partnerships can be established. The objectives are to plant forest on degraded soils and save the existing forest especially in the tropical rainforest ecosystem. When forest is planted on degraded soils, companies that manage forests must monitor both biomass and soil carbon. Further, the land already cleared (for pastures or cropland) must be managed judiciously to reduce the need for clearing new land.

STATEMENT OF JAMES E. ROGERS, CHAIRMAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, CINERGY CORP.

Mr. Chairman and members of the committee, my name is Jim Rogers and I am the chairman, president, and CEO of Cinergy Corp. I would like to thank you for giving me the opportunity to share my thoughts on global climate change and suggest how Congress might consider this critical issue, especially in the context of developing a comprehensive emission reduction strategy for the electricity industry.

Introduction

It was my pleasure to testify before this subcommittee just 2 weeks short of a year ago on the need for a coordinated comprehensive emissions reduction program for coal-fired power plants.

My views have not changed since that hearing. With the growing national demand for more electric generation, energy producers more than ever need the certainty that a comprehensive longer-term program would bring. I believe that Congress, in considering a long-term comprehensive approach to power plant emissions, must consider the uncertainties and challenges posed to my industry by the climate change issue. If indeed, the legislation is intended to build some kind of "certainty" into our planning process, climate change must be on that environmental road map.

There are those in my industries and others who believe any plan that considers climate change will doom the coal industry. I disagree and, in fact, am a firm believer that no climate change policy—one that is accepted by the public—can be successful if it ignores our most plentiful domestic natural resource.

Coal-fired power plants, which supply more than half of the nation's electricity, face a battery of existing and proposed emission control requirements from Federal and State agencies and even neighboring countries. These requirements and proposed new programs are focused primarily on the reductions of four power plant emissions: Sulfur dioxide, nitrogen oxides, mercury and carbon dioxide.

Because these regulatory initiatives are largely uncoordinated and often conflicting, the electric power industry faces enormous uncertainties as it tries to develop appropriate plans to upgrade plants and add pollution control equipment. Utility planners are even more challenged by the need to ensure their customers continue to receive reliable and affordable energy.

But, the unfortunate results of today's regulatory soup are unnecessarily high costs for both shareholders and consumers, longer downtimes for our generating stations and continued uncertainty in an industry that is critical to the U.S. economy. Our progress on clean air has not been what it could—or should—be. We appreciate the interest expressed by Chairman Smith, Chairman Voinovich, Ranking Member Reid and Ranking Member Lieberman in promoting a legislative solution to this vexing regulatory problem. I am optimistic that this Congress and the new Adminis-

tration will work together to reduce power plant emissions in a comprehensive manner and I look forward to working with you to make that happen.

Cinergy's Environmental Commitment

Cinergy has a lot at stake. We are one of the nation's leading diversified energy companies with a total capitalization of $9.0 billion and assets of $12.0 billion. Our Energy Merchant segments owns or operates nearly 21,000 megawatts of electric and combined heat plant generation in the U.S. and overseas. Approximately 14,000 of those megawatts comprise our core system of 14 baseload stations and seven peaking stations located in Ohio, Indiana and Kentucky, where we serve 1.5 million electric and 500,000 retail gas customers.

While we have made substantial investments in renewable energy, combined heat and power plants, microturbines and fuel cells and other emerging technologies, much of the electricity we produce here in the U.S. is generated by coal-fired power plants located in the Ohio River valley.

Last year, Cinergy burned 29.2 million tons of coal in our generating stations and we project our coal consumption will continue to grow in the foreseeable future. As you can see from the chart, coal is vital to the Midwestern economy, supplying 80 percent of the generation in 1999.

We're proud that the fuel we've purchased has provided a livelihood to thousands from West Virginia to Illinois. But we're equally proud of our environmental record, which tells the story of progress made in reducing the emissions from our coal-fired power plants.

Since 1990, we've invested more than $650 million in scrubbers, precipitators, low nitrogen oxide burners, selective non-catalytic reduction units and a clean coal technology project at our Wabash River Station in Indiana. These technology improvements have resulted in a 47 percent decrease in our sulfur dioxide emission rate and a 25 percent drop in our emissions rate for nitrogen oxides. The future promises even more.

Over the next 5 years, we plan to buildup to 11 selective catalytic reduction units on our power plants, significantly reducing our nitrogen oxide emissions. We will also install sophisticated computer software to improve our plants' coal combustion process and boiler efficiency. We have already pioneered with success the use of selective non-catalytic reduction at one of our Ohio plants and will explore further use of this technology.

Our goal is clear: We will strive to reduce the impact the company's coal-fired power plants have on our environment as cost-effectively as possible in order to keep electricity costs reasonable. Congress can help put the logic back in environmental policy with a comprehensive multi-emission bill that sets the course for cleaner air, fuel diversity and reasonable goals. By passing such legislation, you can remove one of the "question marks" that hang over our industry as we struggle to meet a growing need for electric power.

A comprehensive approach must address reasonable timetables for further reductions in sulfur dioxide and nitrogen oxides and new reductions of mercury. It must fix New Source Review and give utilities maximum flexibility to meet the nation's environmental goals while still keeping the lights on.

The Climate Challenge

Obviously, I am not a climate scientist but I have tried to follow the scientific debate that has occurred over the years on global climate change.

Most atmospheric scientists seem to agree that human activities are affecting the climate on Earth although there is still debate over the significance, timing and impact on the planet. While the science will certainly advance in the years to come, I am convinced that it is prudent to take action now to address what we do know.

This does not mean we must act precipitously and without careful and complete debate over the proper long-term response. We should remember that this problem has been created by two centuries of industrialization. We cannot change our way of life overnight and we will be mired in endless debate if we try.

But we need to start down the road.

The U.S. electric utility industry, in fact, began that journey 7 years ago, becoming one of the earliest industrial sectors to take a major step to dramatically reduce its carbon emissions. Beginning in 1994 with the Climate Challenge, Cinergy and other utilities representing more than 70 percent of the electric generation in the United States, enrolled in a voluntary carbon emission reporting and reduction program. Under the Climate Challenge the electric utility industry reduced, avoided, or sequestered 124 million tons of CO_2 equivalent green house gases in 1999.

The industry believes that future voluntary programs to reduce or offset greenhouse gas emissions can be just as successful. Even though the Climate Challenge

pledged carbon reductions and offsets only through the year 2000, many of the programs initiated under the Challenge will continue to deliver reductions and offsets for many years.

CINERGY'S COMMITMENT TO ADDRESSING CLIMATE CHANGE

As an original participant in the Climate Challenge, Cinergy has been actively involved in a number of projects, both at home and abroad, to reduce or offset our carbon emissions. Ten years ago, Cinergy's operating companies, PSI Energy and The Cincinnati Gas & Electric Company, were more than 95 percent coal-fired. Our profile today is much different. Through our Cinergy Solutions, Global Power and Capital and Trading affiliates, we have invested in natural gas, combined heat and power, cogeneration and renewable projects that now account for 32 percent of our total electric production. Another Cinergy affiliate, Vestar, provides energy facility and infrastructure improvements and energy management services to large users, making them more energy efficient. We have chosen to invest many of our R&D dollars in so-called "disruptive technologies" that are already beginning to alter the way traditional utilities do business. These technologies fall into categories such as e-commerce, information management, digital utility, retail services and distributed generation—all of which contribute either directly or indirectly to increased efficiencies and reduced carbon emissions. Cinergy has partnered with The Nature Conservancy and other utilities in operating a 125,000-acre tropical forest preservation and management project in Belize. It is estimated that this project will sequester five million tons of carbon as well as protect the forest from being developed for agricultural purposes. We are investing over $2 million in cooperation with The Nature Conservancy, Ducks Unlimited, the National Wild Turkey Federation, Quail Unlimited and local communities to plant three million trees and thousands of acres of native grasses here in the United States. These projects not only sequester carbon but they also enhance the local environment and can be effective land conservation tools.

PRAGMATISM MUST UNDERPIN OUR NEXT STEPS

All these projects and plans say one thing loud and clear: The electric utility industry has already begun successfully addressing the climate change issue and is positioned to make further progress in the years ahead. This is not to say that we can do everything all at once without massive impacts on the reliability and cost of electricity. President Bush's recent letter to Senator Hagel and others on climate change highlights the reality that some cures may be unacceptably disruptive, at least in my industry. For example, Cinergy has not and cannot support the Kyoto Protocol. We have the same concerns regarding developing nation coverage that the Senate recognized in its 95–0 support for the Byrd-Hagel Resolution back in 1997. We cannot, as the Kyoto Protocol requires, turn back the clock to 1990 in a few short years. Cinergy, like most electric power companies in this country, fed the decade's economic boom with progressively higher demands for electricity. This robust growth led to similar growth in our carbon emissions. As a practical matter, we cannot return to those levels by the end of this year or by the end of this decade. As I read the President's letter, I noted his concern about global climate change and his desire to address it in a reasonable, timely matter and in a way that doesn't disrupt our economy. He said "no" to Kyoto but he didn't put global climate change on the shelf. I agree with the President's view and believe we need to move beyond the debate over the Kyoto Protocol to create a workable climate change program. I also agree with the President's view that carbon dioxide should not be regulated as a "pollutant" under the Clean Air Act. The tools provided in the Act to fight smog in Los Angeles or acid rain in New Hampshire are inappropriate to address the slow buildup of greenhouses gases worldwide. There are no silver bullets out there that can "fix" the greenhouse gas problem quickly. Global climate change is the most challenging environmental issue we've ever faced. We have technologies that can scrub most of the sulfur dioxide, nitrogen oxides and reduce mercury and particulates out of our smokestacks There is no such technology for carbon. That doesn't mean, of course, that power generators cannot go forward with a program to reduce greenhouse gases through other means, as the industry has demonstrated in the Climate Challenge program.

FIRST STEPS IN IDENTIFYING SOLUTIONS TO THE CLIMATE ISSUE

While global climate change is a long-term problem that demands a long-term solution, we need to take steps now to begin reducing our greenhouse gas emissions. Congress should base any response on three truisms: First, the national economy depends on an ample supply of energy and those of us who produce that energy can only do so if we are able to use all the fuel sources available to us. This country

is facing a looming energy shortage and we simply can't turn our backs on the abundant supply of fossil fuels that are providing most of America's electric generation. Second, voluntary programs, economic incentives and market approaches and flexibility are the keys to cost-effective greenhouse gas reductions. Third, there must be a recognition that a greenhouse gas strategy for the nation and, specifically, for the electric utility industry, must consist of both a near-term program that focuses on flattening our carbon growth curve and long-term goals that focus on the technological solutions that ultimately will be needed. Based on these considerations, a short to mid-term program should have the following attributes.

Reasonable Goals

The program should not set these early goals so high as to knock current generating stations out of the box. We need these plants for the foreseeable future and companies should be allowed to recoup the capital investments they have made to supply their customers with electric power.

Broad Goals

Congress should consider setting industry goals but should not try to impose these goals or targets on a unit-by-unit or generating station by generating station basis. Since there is no technological fix to reduce greenhouse gases on existing plants, targets aimed so narrowly would result in many of these plants being closed.

Consideration of Growth and Costs

Congress should consider both economic growth and the costs involved. Goals could be based on current emission levels or established by using a future level. A growth factor based on the most efficient generation available or a cost ceiling may provide appropriate safeguards.

Flexibility

Industry should have full flexibility in meeting any goal. On-system reductions, efficiency gains, demand side management, renewables, co-generation, carbon sinks, sequestration, carbon internment and reductions in other greenhouse gases such as methane—all must be recognized and endorsed as appropriate strategies.

Market-Based Mechanisms

Private sales and allowance trading should also be included. We know that market forces can work to keep costs in check and they should be employed here to the greatest extent possible.

Credibility

Congress should update Section 1605(b) of the Energy Policy Act to ensure all reductions are quantifiable, credible and independently verified. For the purposes of any future international agreement, the U.S. Government needs to stand by those demonstrated reductions.

Technology Promotion

A short-term policy ought to provide appropriate mechanisms to ensure that current technologies get into the marketplace. On the fossil fuel side, I'm thinking about the many advances that have been made in developing clean coal technologies but, for economic reasons, haven't been deployed. On the renewables and alternative generation side, I believe Congress should provide more economic incentives to jump start emerging wind, solar, fuel cell and microturbine technologies.

Incentives

To encourage widespread participation, the policy should include proper incentives such as New Source Review reform and financial assistance.

Safe Harbor for New Generation

In order to ensure continued development of needed generation during this period, we should consider creating a 10–20 year safe harbor for new facilities that meet "best carbon reduction practices." In the long run, technological solutions are the best hope for achieving a maximum level of carbon dioxide reductions. Legislation should encourage government and the private sector to work together to speed the development and deployment of new energy-efficient technologies and a mechanism to scrub greenhouse gases out of the fossil fuel energy production chain. In fact, the real solution to global climate change lies in our ability to develop breakthrough technologies that will decouple energy production from greenhouse gases. With sufficient resources and attention, I have no doubt that we can and will achieve that goal. If global climate change is as serious a threat as many experts say, the United States should attack this technological puzzle as single-mindedly as it did nearly 40

years when our best scientists focused on putting a man on the Moon. In summary, Congress needs to address the climate change issue and develop an initial climate change program for the industry as part of the comprehensive multi-emission bill. My company seeks comprehensive multi-emission power plant legislation because we want long-term clarity and certainty built into our environmental compliance planning process. I think there is general agreement on both sides of the aisle that this approach makes sense. For me, this line of reasoning dictates the necessity of including a carbon commitment in the legislation. Without some sense of what our carbon commitment might be over the next 10, 15 or 20 years, how can I or any other utility CEO think we have a complete picture of what major requirements our plants may face? Further, I know from personal experience that it's impossible to build new coal baseload power plants since the economics cannot be determined without knowing what requirements the plant will face on carbon. Congress has a unique opportunity to make a difference in our nation's long-term air quality and to take affirmative action toward establishing a workable global climate policy. Cinergy stands ready to do what we can to help. I thank you for the opportunity to speak to you today and I look forward to taking your questions.

RESPONSES OF JAMES E. ROGERS TO ADDITIONAL QUESTIONS FROM SENATOR SMITH

Question 1. What is a reasonable market penetration or generation capacity growth for renewables over the next 5 years, assuming today's economic factors?

Response. Cinergy is one of the leading U.S. electric utilities to have actively invested in renewable energy projects over the last 3 years. Since 1998, we've invested more than $260 million in renewable energy projects, generating over 300 megawatts of electricity here in the United States and in Europe. These projects include wind energy, run-of-the-river hydroelectric, landfill gas recovery, fuel cells and biomass.

Our primary emphasis has been the development of a wind energy strategy, which we believe holds the greatest immediate promise of adding to the company's "green energy" portfolio.

Renewable energy resources currently supply approximately 1 percent of electric energy consumed in the United States. Of all the renewable resources, wind generation is the least expensive and is the fastest growing technology being installed both in the U.S. and worldwide, with an annual growth rate in excess of 30 percent. During the course of this year alone, 1,500 megawatts of wind generation will be installed in this country, of which Cinergy's contribution will be approximately 10 percent.

Provided that the Production Tax Credit is maintained, I would expect that renewable energy generation capacity could form between three and 5 percent of the nation's electricity supply within the next 5 years. Renewable energy does not have to be a high cost alternative to more traditional fossil sources of supply. With the Production Tax Credit at its current level, a wind energy project in a good wind location can supply power for as cheaply as 2.5 c/kWh over the 20-year period, which is below what a new gas-fired plant can supply, given today's fuel prices.

In order to achieve a three to 5 percent market penetration for renewables in the next 5 years, a consistent long-term policy needs to be implemented, either through a long-term extension of the Production Tax Credit or establishment of a phased-in Federal renewable portfolio standard. The temporary termination, in June 1999, of the Production Tax Credit, resulted in an abrupt halt to all but a handful of wind energy projects. Its reintroduction several months later renewed interest in wind energy—an interest we maintain today.

This situation could be repeated next year and is illustrative of the need for a consistent, long-term policy on the Production Tax Credit.

Cinergy is currently planning to increase its renewable energy generation capacity to be in excess of 5 percent of our overall generating capacity within the next 5 years. I would envision this to be a reasonable objective for market penetration nationwide over the next 5 years, as part of a responsible and well-balanced energy policy.

Question 2. Your comments regarding the need for certainty and a multi-pollutant bill that covers carbon dioxide have been echoed by other industry leaders in private, but few have come forward apparently because of the President's campaign promise reversal. What might motivate them to most effectively and constructively encourage the Administration and Congress to move forward on legislation?

Response. Over the last 3 years as chairman of the Edison Electric Institute's CEO Environmental Committee, I have seen our industry's thinking evolve on the

climate issue to a point today where I believe the majority of my fellow CEOs would support a sensible, cost-effective greenhouse gas reduction program.

The industry certainly doesn't speak with one voice but I sense that most of us are prepared to address this issue constructively, acknowledging that we have responsibility to do our part in reducing the emissions that contribute to climate change.

I have said to this committee that a multi-pollutant bill is necessary because we, the sector that is entrusted to produce the energy that fuels our economy, can best do our job if we know what emissions we need to control and when we need to control them. Ideally, Congress would give us a long-term environmental road map and the flexibility to make power plant emission reductions in the most economic way possible.

To me, and others, it makes no sense to pursue a comprehensive multi-pollutant bill without dealing with carbon dioxide. This issue is ripe now and we need to deal with it. No CEO wants to be in the position of having to invest hundreds of millions of dollars to control SO_2, NOx and mercury while still being left to "guess" on carbon dioxide.

The electric utility industry needs a long-term carbon program—not the draconian one that Kyoto would have inspired. We need a commitment to technology and to the future of coal. Finally, it needs assurances that the government will be partner and not an antagonist as we move together to address climate change.

Question 3. When could your company cost-effectively reduce carbon dioxide emissions to 1990 levels? How much would it cost and what would need to be done?

Response. With our company's baseload generation more than 95 percent coal-fired, our only alternative would be to convert most, if not all, our units to natural gas. I would venture to say that this would be the same strategy employed by most Midwest utilities that rely on coal, resulting in a virtual one-fuel economy. Such a strategy would be expensive and shortsighted. It would significantly drive up the cost of energy with its negative effects on the overall economy. And, because natural gas-fired turbines also emit carbon dioxide, eventually, with increased demand for electricity, you'd see the emissions creep up again.

What distinguishes carbon dioxide from other power plant emissions is that there is currently no technological fix. And that's where I think, as I mentioned in my testimony, that the Federal Government and the private sector need to concentrate their efforts. Let's get the best scientists on the job with all the tools possible at their disposal to invent a technology that can reduce or eliminate carbon dioxide from a power plant's flue gas. Let's put in place the proper incentives to encourage the private sector to improve operating efficiencies and develop carbonless energy technologies.

With a technological solution comes the opportunity to make serious reductions in carbon emissions, without jeopardizing the economy.

STATEMENT OF MARILYN A. BROWN, DIRECTOR, ENERGY EFFICIENCY AND RENEWABLE ENERGY PROGRAM, OAK RIDGE NATIONAL LABORATORY

Mr. Chairman and members of the committee, thank you for inviting me to summarize for you the findings of a recent study that examines the ability of energy-efficient and clean energy technologies to reduce U.S. greenhouse gas emissions.

I am Marilyn Brown, Director of the Energy Efficiency and Renewable Energy Program at the Oak Ridge National Laboratory in Oak Ridge, Tennessee, and I am one of the lead authors of the study completed late last year titled Scenarios for a Clean Energy Future. [1]

Introduction

The Clean Energy Future study is the most comprehensive assessment to date of technologies and market-based policies to address the energy-related challenges facing this Nation. It involved the analysis of hundreds of energy-related technologies and 50 policies. The focus is the United States, and the timeframe is the next 20 years. Thus, it is not a global or long-term study; rather, it is an assessment of what could be done here and now.

The study was commissioned by the U.S. Department of Energy and was co-funded by the U.S. Environmental Protection Agency. It was prepared by researchers from five DOE national laboratories: Argonne National Laboratory, Lawrence

[1]The report is posted on the World Wide Web at http://www.ornl.gov/ORNL/Energy—Eff/CEF.htm

Berkeley National Laboratory, the National Renewable Energy Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory.

The Clean Energy Future study concludes that accelerating the development and deployment of energy-efficient and renewable energy technologies could significantly reduce air pollution and greenhouse gas emissions, oil dependence, and economic inefficiencies, at no net cost to the economy. The overall economic benefits of the technologies and policies that are modeled result in energy savings that equal or exceed the cost of implementing the policies and of investing in the technologies.

Barriers to Energy Efficiency and Clean Energy Policies

Like many other analyses, the Clean Energy Future study describes a large reservoir of highly cost-effective, energy-efficient technologies that are available or could soon be available to U.S. consumers; yet many of these technologies remain unexploited. These technologies could save us money, make our power system more reliable, make our society less energy wasteful, and preserve our environment—so why aren't we using them? If energy-efficient technology is cost-effective, why isn't more of it hitting the markets? If individuals and businesses can make money from energy efficiency, why don't they just do it?

Although some like to assert that markets are perfect, practical experience tells us otherwise. Energy markets, like many markets, are plagued by barriers that can impede the adoption of new products, even those that are beneficial and economical. These market failures and barriers include:

- Misplaced incentives (for instance, these often occur in apartment buildings where landlords pay the utility bills, giving tenants no incentive to conserve)
- Distorting fiscal and regulatory policies (for example, electricity rates that do not reflect the real-time cost of electricity production)
- Unpriced costs (such as the health problems associated with burning hydrocarbons: because energy prices do not include the full cost of environmental externalities, they understate the societal cost of energy), and
- Unpriced benefits (such as the public benefits associated with energy R&D: because the benefits of private-sector investments in R&D extend beyond any individual firm, investments are insufficient from a public perspective).

The existence of market barriers that inhibit investment in improved energy technologies is a primary driver for public policy intervention. In many cases, feasible, low-cost policies and programs can be put in place to eliminate or compensate for market imperfections and barriers, enabling markets to operate more efficiently for the benefit of the society.

Scope of the Study

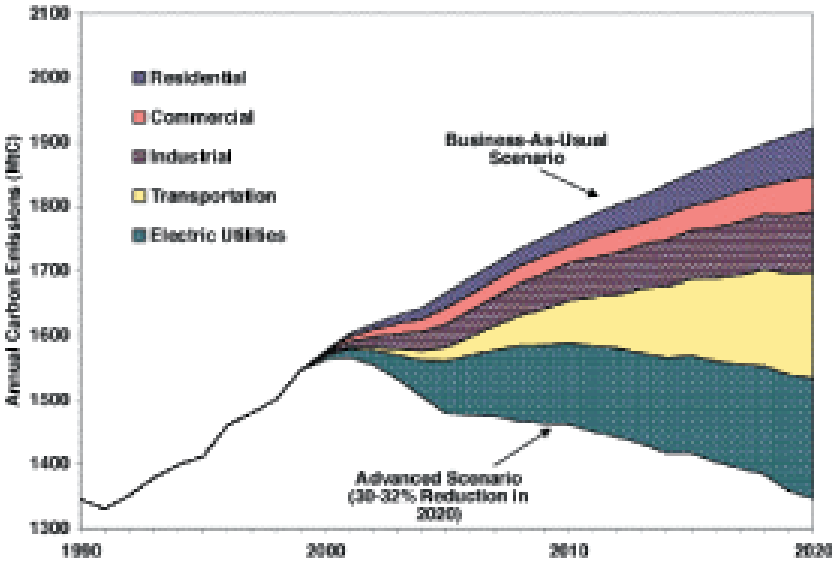
Scenarios for a Clean Energy Future assesses promising energy technologies and a range of public policies that could reduce the bamers to their use. It does so by developing scenarios that characterize how the future might unfold under different sets of policies. Three primary scenarios are presented: a business-as-usual (BAU) forecast and two alternative policy cases that reflect increasing levels of public commitment and political resolve to solving the nation's energy-related problems.

- The BAU forecast assumes that current energy policies and programs continue, resulting in a steady but modest pace of technological progress and improved efficiencies.
- The Moderate scenario is defined by an array of market-based policies including a 50 percent increase in cost-shared Federal energy R&D, expanded voluntary programs, and tax credits for efficient appliances, vehicles, and non-hydro renewable electricity.
- The Advanced scenario is defined by more aggressive policies including a doubling of Federal energy R&D; voluntary agreements to promote energy efficiency in vehicles and industrial processes; appliance efficiency standards; renewable portfolio standards; and a domestic carbon cap and trading system.

The impacts of these policies are examined using various assessment methods and modeling tools. A modified version of the Energy Information Administration's National Energy Modeling System is then used to quantitatively integrate the impacts of each scenario's policies.

Results

The BAU scenario forecasts that U.S. energy consumption will increase from nearly 100 quadrillion Btu (quads) in 2000 to 110 quads in 2010 and 119 quads in 2020. Carbon dioxide emissions are forecast to increase at a comparable rate, to 1,770 million metric tons of carbon (MtC) in 2010 and 1,920 MtC in 2020 (see Figure 1). While there is necessarily great uncertainty associated with any specific forecast, all indications are that, without change, the United States is on a path toward increasing energy consumption and carbon emissions well into the foreseeable future.



Under the Advanced scenario, the United States consumes 23 quads (20 percent) less energy in 2020 than is predicted under the BAU forecast. That savings amounts to almost 25 percent of our current energy use, and it is enough to meet the current energy needs of all the citizens, businesses, and industries located in the top three energy-consuming States—Texas, California, and Ohio. Other key findings of the Advanced scenario include the following:

- By 2020, U.S. CO_2 emissions have been reduced to 1990 levels [avoiding 565 MtC compared with the BAU forecast. By 2010, carbon emissions are approximately 300 MtC less than in the BAU case.
- Clean energy technologies and policies could shave $122 billion off the U.S. energy bill in 2020 ($189 billion in gross energy savings minus $67 billion in carbon permit costs). These savings far outweigh any costs of implementation. (See Figure 2.)

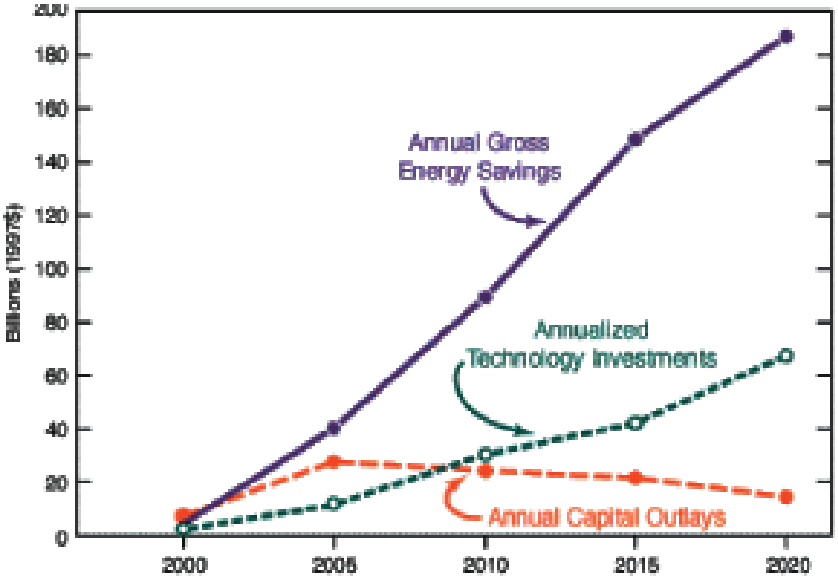


Figure 2. Annual energy bill savings and incremental technology investments of the Advanced Scenario: 2000 through 2020.

- Under the Advanced scenario, voluntary agreements to increase the fuel efficiency of cars and light trucks, combined with other measures, could cut U.S. oil consumption by 5 million barrels per day. This would result in an estimated $238 reduction in transfer of wealth from U.S. oil consumers to world oil exporters, in the year 2020, and reducing the cost to the U.S. economy of a future oil price shock such as we are presently experiencing. .
- hnproving the energy efficiency of U.S. buildings and industry through voluntary programs, tax credits, efficiency standards, and other measures could reduce electricity demand by 22 percent relative to the BAU forecast—all at a negative net cost.

Two policies that are key to the energy and emissions savings in the Advanced scenario are increased resources for R&D in energy efficiency and clean energy, and a domestic carbon trading system.

- The Advanced scenario assumes that the Federal Government doubles its spending for cost-shared energy R&D, resulting in an overall increase of $2.8 billion per year (half Federal appropriations and half private-sector cost sharing).
- A carbon trading system sets limits on the quantities of carbon emissions that can be released annually. Companies that produce emissions can comply with the cap by either reducing their emissions or purchasing emissions permits from other companies. The Federal Government would collect revenues from the emissions permits and transfer them to taxpayers. The goal of this policy is to change the relative price of carbon-based fuels without lowering personal incomes.

A Sampling of Technology Opportunities

The foundation of a clean energy future is efficient, clean energy technologies and sources. These technologies deliver the reductions in energy consumption, energy costs, and polluting emissions envisioned in the report. But what evidence do we have that these new technologies are real possibilities, not just wishful thinking? Consider the outcome of a major R&D effort that began in the late 1970's to improve the efficiency of household refrigerators, as one example.

Between 1977 and 1982, DOE invested approximately $5 million in R&D to make home refrigerators more energy-efficient. Working in a public/private partnership with compressor and appliance manufacturers, DOE and two Federal laboratories identified ways of improving the performance of refrigerator compressors, motors,

insulation, and controls, and they provided test data for use in the setting of national standards. These technology investments, in conjunction with the issuance of appliance standards, cut the energy use of the average new refrigerator in half by the year 1990 and saved U.S. consumers $9 billion in energy costs from 1981 to 1990 (1999 dollars) (see Figure 3).

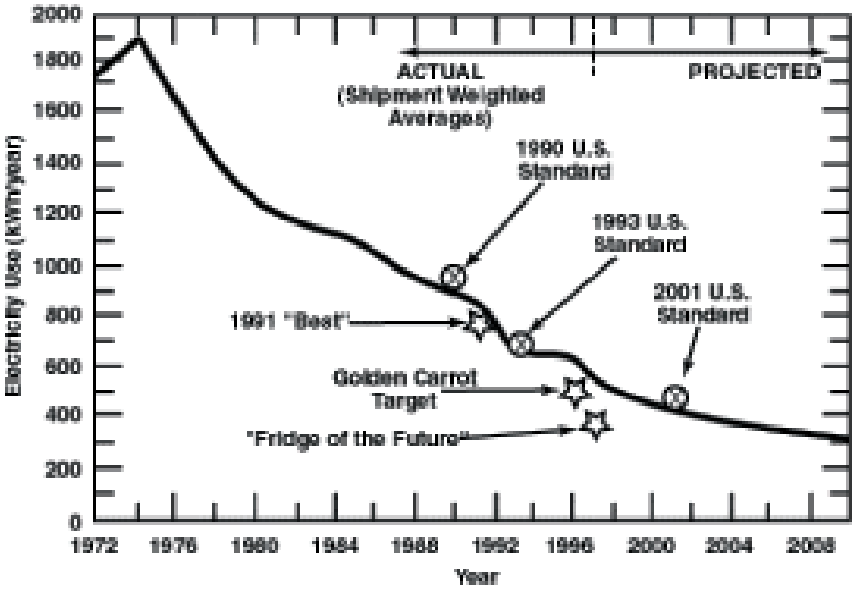


Figure 3. Average electricity use of household refrigerator/freezers by year of purchase.

In 1997, a DOE-industry cooperative R&D effort developed a prototype "fridge of the future" that used nearly half as much energy again, as refrigerators then on the market and surpassed the 2001 efficiency standard for refrigerators. These developments in combination with the 2001 U.S. standard will save consumers billions of dollars each year.

With these advances, we are approaching the technical limits of home refrigerator/freezer technology. However, in other cooling applications, opportunities abound. For example, in Senator Reid's State of Nevada, a natural gas-powered absorption chiller will be installed this summer in the Clark County Government Center for performance testing. This novel technology promises dramatic improvements in efficiency and emissions over chillers now on the market, and it uses no ozone-depleting refrigerants. These, and other building efficiency opportunities are highlighted in the Clean Energy Future study, including lower-cost compact fluorescent lamps, light-emitting diodes (LEDs) to replace incandescent traffic lights, heat pump water heaters, and switch mode power supplies to reduce standby losses.

Numerous opportunities exist in the industrial sector, as well. Just this week, Delphi Automotive Systems is hosting an event in Saginaw, Michigan, to celebrate the success of nickel aluminide trays used in its steel carburizing heat-treating furnaces. Nickel aluminide alloys, developed through a DOE-industry R&D partnership, are extraordinarily strong, hard, and heat-resistant. Their use in fixtures for high-temperature manufacturing can cut energy use by 5 to 10 percent by making it feasible to operate furnaces at higher temperatures and with fewer shutdowns. Nearly 100 such emerging technologies for improving industrial energy efficiency are modeled in the Clean Energy Future study. These include, for example, near net shape casting technologies for reducing the cost of producing iron and steel, and improved black liquor gasification that could make kraft pulp mills net electricity exporters.

In the realm of the here and now, improvements to industrial utility systems (steam, compressed air, motors, and pumps, etc.) offer tremendous energy-saving op-

portunities. Industrial motor systems, for example, use 25 percent of all the electricity consumed in the United States. In the Advanced scenario they are a source of considerable energy savings, based on the presumption of expanded technical assistance and voluntary programs. For instance, this scenario doubles the funding for DOE's "Best Practices" program, which encourages the use of energy-efficient motor, steam, and process heating systems. In just the 5 most recently completed projects, annual energy savings of 131 trillion Btu were realized with an annual cost savings of $17 million, and an average payback on investment of 1.2 years. Full implementation of proven, cost-effective energy-efficient technologies could save 11 to 18 percent of the power used in motor-driven industrial systems, saving billions of dollars annually.

In transportation, the Clean Energy Future study underscores the availability of a collection of fuel-economy improvements to gasoline-powered vehicles that could be rapidly accelerated into the market through a combination of R&D, incentives, and voluntary agreements between government and automakers. These technologies include a range of engine technology improvements (such as advanced valve-timing and lift controls, friction reductions, direct injection, and 4- and 5-valve designs) as well as gasoline-hybrid technology and lightweight materials substitution, especially aluminum and plastics. Altogether the Advanced scenario policies and technologies improve the fuel economy of gasoline-powered passenger cars from 28 to 44 miles per gallon by the year 2020.

Over the course of these same two decades, the Clean Energy Future study indicates that other propulsion systems and alternative fuels for passenger vehicles could be propelled into the market with an aggressive slate of polities. These include fuel cells, which account for 2.2 million of the passenger cars and light trucks sold in the Advanced scenario in 2020, and turbocharged direct injection diesels, which account for 2.6 million of light duty vehicles sold in 2020. Expanded R&D is critical to achieving the technology breakthroughs necessary for such growth in market shares of these novel, fuel-saving systems.

In the electricity sector, combined heat and power is singled out in the Advanced scenario as a highly promising distributed energy resource. By locating power-producing equipment near industrial plants that require electricity, it is possible to also put the waste heat from the power generation to use in the industrial process. This enables the efficiency of the U.S. electric grid-which has ranged between 28 and 33 percent over the past four decades, to be dramatically increased. Through policies such as expanded research, tax credits, and interconnection standards, combined heat and power technologies in the Advanced scenario reduce U.S. energy consumption by nearly 2.5 quads in the year 2020.

The expanded research budget portrayed in the Advanced scenario also drives down the cost and improves the performance of natural gas combined cycled plants and nonhydro renewable power. In combination with other incentives for low-carbon power, these policies grow the nonhydro renewable contribution to 10 percent of electricity production in 2020, with the bulk of the increment coming from wind power. Research on turbines that operate in less-windy regimes promises even more opportunities for wind power. Economic turbines in less windy regimes means that wind power can be used closer to eastern loads without the need for large transmission investments. Natural gas grows to one-third of power generation, just surpassing coal's contribution. In addition to lowering the nation's carbon emissions, a revised fuel portfolio such as this would significantly reduce local air pollution.

Conclusion

Energy conservation does not have the rugged, dramatic appeal of oil drilling or coal mining. It does not wow us with massive dams, dramatic cooling towers, or tall smokestacks. But energy conservation makes a tremendous amount of energy available. In fact, over the past 25 years, energy efficiency has become the No. 1 domestic source of energy available for use by U.S. consumers. In 1999, almost a quarter of the energy we used was energy that would have been lost to waste without the energy-efficiency technologies that have been developed and implemented since the Arab oil embargo of 1973–74. A Btu saved is a Btu available to power our homes, industries, and cities, Energy efficiency is a clean energy source, producing no emissions or runoff. It improves our balance of payments, and we need not go to war periodically to defend it.

Clearly, following current approaches to energy policy in this Nation will bring substantial increases in carbon and other polluting emissions over the next 20 years. The BAU case in Scenarios for a Clean Energy Future projects carbon emissions 31 percent and 43 percent above 1990 levels by 2010 and 2020, respectively. Virtually any future based on continuing current trends would include large increases in carbon emissions. The inescapable conclusion is that, absent major shifts

in policy and the economy, the United States will be ever further from stabilizing its carbon emissions.

The Clean Energy Future study identifies a set of policy pathways that could speed the introduction of cost-effective, efficient, clean energy technologies into the marketplace. These technologies are good for business, good for consumers, good for the economy, and good for the environment. To secure these benefits, the Nation needs to move forward on many fronts—on policies to remove market barriers, R&D to accelerate technology advancements, and programs to facilitate deployment of the new technologies. These, in combination with the political leadership that the world expects of the United States, are all necessary ingredients of a clean energy future.

Thank you for this opportunity to talk with you today. I would be happy to answer any questions.

Biographical Sketch

Marilyn Brown is the Director of Oak Ridge National Laboratory's Energy Efficiency and Renewable Energy Program. During her 18 years at ORNL, she has researched the design and impacts of policies and programs aimed at accelerating the development and deployment of sustainable energy technologies. She currently manages a $110 million/year program of research to develop and assess advanced energy efficiency and renewable energy technologies. Prior to coming to ORNL in 1984, she was a tenured Associate Professor in the Department of Geography at the University of Illinois at Urbana-Champaign, where she taught graduate and undergraduate seminars on technological change, resource geography, and statistical analysis. She has received two NSF grants and funding from numerous other sources to support her research on the diffusion of energy innovations. She has a Ph.D. in geography from the Ohio State University where she was a University Fellow, a Masters Degree in resource planning from the University of Massachusetts, and a BA in political science (with a minor in mathematics) from Rutgers University. She has authored more than 140 publications and has received awards for her research from the American Council for an Energy-Efficient Economy, the Association of American Geographers, the Technology Transfer Society, and the Association of Women in Science. Dr. Brown sits on the boards of several energy and environmental organizations and journals.

RESPONSE OF DR. MARILYN A. BROWN TO ADDITIONAL QUESTION FROM SENATOR CORZINE

Question. The Clean Energy Future report contains strong conclusions about our ability to achieve greenhouse gas reductions at negative cost. By contrast, the IPCC's Third Assessment Report concludes that the cost of implementation of viable energy technologies .may at times be substantial, and must overcome other market barriers. To the extent that the two reports are directly comparable, can you highlight the differences in assumptions, data and/or methodology between the two reports?

Response. The IPCC's Third Assessment Report draws its conclusions about the cost of climate change mitigation by reviewing the literature. It does not rely on a single analysis, but rather integrates and summarizes the findings of studies that had been peer reviewed and published by approximately mid–2000. Since the Scenarios for a Clean Energy Future was not published until November 2000, its findings were not included in the IPCC's literature review. Nevertheless, some of the studies reviewed in the Third Assessment Report use methodologies and data that are similar to the Scenarios for a Clean Energy Future; others use very different approaches.

Based on a review of the "Summary for Policymakers: Climate Change 2001: Mitigation" (one part of the Third Assessment Report), I am struck by how similar its conclusions are to those of the Scenarios for a Clean Energy Future. For instance, consider the summary Table SPM (Estimates of Potential Global Greenhouse Gas Emission Reductions in 2010 and in 2020), from the IPCC report. It concludes the following regarding net direct costs per tonne of carbon avoided:

- Buildings: "Most reductions are available at negative net direct costs."
- Industry: "More than half available at net negative direct costs."
- Transportation: "Most studies indicate net direct costs less than $25/tC."
- Electricity generation: "Limited net negative direct cost options exist."

The Scenarios for a Clean Energy Future draws very similar conclusions about the cost of reducing U.S. carbon emissions to approximately 1990 levels, by 2020.

One notable difference between the two studies is in the transportation sector. The Scenarios for a Clean Energy Future assumes that a doubling of Federal energy

R&D resources (in combination with various supporting policies) produce several technology breakthroughs. These, in turn, enable sizable greenhouse gas emission reductions, particularly in the second decade (2010–2020), at no net direct cost.

The two studies also agree that successful implementation of "no-cost" greenhouse gas mitigation options requires policy initiatives that address the market and institutional barriers impeding adoption of cost-effective emission-reduction measures. Chapter 2 of the Scenarios for a Clean Energy Future overviews these barriers as a basis for selecting the policy scenarios that are modelled in the report.

RESPONSES OF DR. MARILYN A. BROWN TO ADDITIONAL QUESTIONS FROM SENATOR REID

Question 1. What is a reasonable market penetration or. generation capacity growth rate for renewables over the next 5 years, assuming today's economic factors?

Response. The Business-As-Usual (BAU) scenario of the Scenarios for a Clean Energy Future report (CEF) provides a basis from which to answer the above question once updated for events that have occurred since its development, i.e. since early 1999. Table 1 shows the CEF BAU estimates of generation capacity for renewables from 1999 through 2006. The most striking features of these estimates are their small size and lack of significant growth over time.

Table 1

Renewable Electric Generating Capacity in the CEF BAU Scenario (GW)

	1999	2000	2001	2002	2003	2004	2005	2006
Wind	2.68	2.8	2.99	3.18	3.2	3.22	3.24	3.27
Biomass	1.72	1.76	1.84	1.9	1.91	1.93	1.97	2.02
Geothermal	2.88	2.94	3.07	3.01	2.93	2.87	2.95	2.92
Other	3.85	3.97	4.02	4.1	4.17	4.24	4.32	4.4
Total non-hydro renewables	11.13	11.47	11.92	12.19	12.21	12.26	12.48	12.61

These CEF BAU-scenario values in Table 1 are essentially the same as those of the EIA's Annual Energy Outlook 1999 on which the CEF BAU scenario is based. As shown in Table 2, in the most recent Annual Energy Outlook 2001, the ETA has increased its estimate of the penetration of wind to reflect actual market installations and changes in market conditions. However even this Outlook, released only 7 months ago, has severely underestimated the market penetration of wind with its market projection of only 4.4 GW by 2005. Wind plants currently on order to be installed in 2001 will reach this level this year (2001), not in 2005.

Table 2

Estimates of Renewable Electric Capacity in 2005

	AE099	AE001	DOE/GPRA
Wind	3.24	4.43	8.4–10.5
Biomass	1.97	1.68	3.6–4.1
Geothermal	3.08	3.15	3.2–3.4
Other	4.32	4.24	4.3–4.6
Total non-hydro renewables	12.61	13.5	19.5–22.6

This rapid growth in actual wind capacity is largely the result of continuing improvements in wind technology, the extension of the Federal production tax credit for wind, mandates by the States for increased use of renewables, and recent volatility in natural gas prices. The Interlaboratory Working Group that produced the CEF has not examined the impact of all these recent market factors on the penetration of renewables. However it is fairly clear that their continued presence will yield significant growth in wind, biomass, and geothermal over the next 5 years. An independent estimate made for the DOE Office of Energy Efficiency and Renewable Energy in 2000 as part of its response to the Government Performance and Results

Act[1] projects that by 2005 nonhydro renewables could contribute as much as 22 GW (see Table 2). Given the recent rapid penetration of wind, these DOE/EERE estimates appear most reasonable.

Question 2. What would be the most cost-effective incentive or program that the Federal Government could offer to encourage a reduction in greenhouse gases to 1990 levels? What's the earliest that the level could be achieved, without serious harm to the economy?

Response. These are difficult questions, which I can only partially address. The Scenarios for a Clean Energy Future describes a set of public policies and programs that reduce U.S. carbon emissions to approximately 1990 levels by the year 2020. It also concludes that such an "advanced" scenario would not cause serious harm to the economy. To drive emissions down faster would require even more aggressive policies. A few examples of such policies are listed below:

- Buildings: mandate the demand-side management programs run by electric utility companies in the 1980's and first half of the 1990's, which were responsible for a substantial fraction of the energy efficiency improvements already realized in the buildings sector.
- Industry: establish tax incentives for new capital investments in energy equipment to accelerate the rate at which technological innovation diffuses into industries, thereby more quickly retiring outmoded and inefficient production equipment and facilities.
- Transportation: enact greenhouse gas standards for motor fuels that would be specified as a limit on the average greenhouse gas emissions factor of all motor fuels.
- Electricity: require all coal-fired power plants to meet the same emissions standards as new plants under the Clean Air Act, thereby removing the "grandfathering" clause that has allowed higher polluting, older coal-fired plants to continue to operate unabated.

Additional work would be required to model the costs and impacts of such policies. Indeed, there are numerous alternative packages of policies that would need to be assessed for costs and environmental (and other) impacts, in order to answer your question. It is my personal opinion that accelerated reductions would be more costly, but if promoted by smart policies they still might not cause serious harm to the economy.

I believe that enhanced Federal investment in energy R&D is the most effective Federal program for achieving significant long-term reductions in greenhouse gases. Reducing the costs and improving the performance of an array of clean energy technologies are essential enablers of low-cost/no-cost solutions. The Scenarios for a Clean Energy Future report documents the sizable benefits that could arise from a stronger program of energy R&D.

The study concludes that the following policies, in combination with doubling the Federal energy R&D budget, were most important in achieving the emission reductions of the advanced scenario:

- Buildings: efficiency standards for equipment and appliances; voluntary labeling and deployment programs.
- Industry: voluntary programs and voluntary agreements with individual industries and trade associations.
- Transportation: voluntary fuel economy agreements with auto manufacturers; "pay-at-the-pump" auto insurance.
- Electricity Generation: renewable energy portfolio standards and production tax credits.
- Cross-Economy Policies: domestic carbon trading system.

These would make up my short list of potentially most cost-effective policies and programs, in terms of cost of carbon reduction. However, many other policies are extremely promising, and are not in our "short list" because they are narrower in scope and impact. An example is the development of a national interconnection standard that would facilitate the development of distributed energy resources.

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[1]NREL, 2000, Projected Benefits of Federal Energy Efficiency and Renewable Energy Programs fiscal year 2001-FY 2020, National Renewable Energy Laboratory, Golden CO, July.

STATEMENT OF FLORENTIN KRAUSE, PH.D., DIRECTOR, INTERNATIONAL PROJECT FOR SUSTAINABLE ENERGY PATHS

Short Summary

This report identifies and corrects shortcomings in recent modeling studies on the economics of reducing greenhouse gas emissions in the U.S. The major assessments of the Kyoto Protocol—by the U.S. Energy Information Administration, the Clinton White House Council of Economic Advisers, the U.S. Department of Energy Interlaboratory Working Group, and the Stanford Energy Modeling Forum—are found to be seriously incomplete. Each study is shown to omit one or several of four major cost-reducing policy options, resulting in cost estimates that are far too pessimistic.

The present study is the first to integrate all cost-cutting policy options into a coherent least-cost policy framework. Three domestic policies—a national carbon cap and permit trading program, productivity-enhancing market reforms and technology programs, and recycling of permit auction revenues into economically advantageous tax cuts—are combined with international emission allowance trading. In analyzing this integrated least-cost approach, the present study introduces no new models. It relies on established, peer-reviewed methodologies used in the major U.S. assessments to date.

This reassessment leads to the following principal findings:

1) The U.S. could meet the emission reduction targets set forth in the Kyoto Protocol by 2010 and exceed them by 2020 while increasing economic output from baseline growth projections.

2) In 2010, an integrated least-cost strategy would produce an annual net output gain of about $50–60 billion/yr or roughly 0.5 percent of GDP. By 2020, this gain grows to $120 billion/yr or 1 percent of GDP. On a cumulative net present value basis, the U.S. would gain $250 billion by 2010 and $600 billion by 2020.

3) Most of these economic gains can be flexibly achieved through a purely domestic no-regrets strategy or through an international approach.

4) A strong synergy exists between a national energy policy aimed at safeguarding the economy and a least-cost policy aimed at slowing climate change. By reducing consumption of oil and natural gas relative to rising business-as-usual trends, a climate policy would help protect the U.S. against energy price shocks.

5) Net economic benefits can be realized in the early years of implementation and continue to grow over time. As energy-using equipment and capital stocks turn over, market, organizational, and institutional reforms have the effect of speeding up and completing the penetration of currently available, highly cost-effective energy efficiency technologies that require little or no time-consuming research, demonstration, and commercialization.

6) Potential economic savings from energy productivity gains far exceed the costs of technology R&D programs. Together with expanded markets under a climate protection policy, these have the effect of accelerating cost reductions for renewable energy sources and other low-carbon technology options.

7) Postponing least-cost emissions reduction policies or embarking on suboptimal policies would result in lost opportunities for the U.S. economy of $50–150 billion/yr in 2010.

8) In the context of an integrated least-cost strategy, credits for carbon sinks and constraints on the use of the Kyoto flexibility mechanisms are of only minor significance.

9) An integrated least-cost approach would more effectively insulate U.S. industries from competitiveness problems than a global emissions trading approach applied in isolation. Productivity gains and tax shifts would reduce production costs and export prices in most industries below baseline levels rather than merely limiting increases in costs and prices.

10) The perception that emission reduction targets such as those of the Kyoto Protocol are unavoidably costly or unfair is the result of outdated modeling assessments. Integrated economic analysis such as that contained in this report is needed as an input for future climate negotiations.

The findings of this study are in qualitative agreement with the Economists' Statement on Climate Change signed by over 2,500 economists including eight Nobel laureates in 1997, which states: "Economic studies have found that there are many potential policies to reduce greenhouse-gas emissions for which *the total benefits outweigh the total costs*. For the United States in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measures may in fact *improve U.S. productivity in the longer run*." (Italics added for emphasis).

EXECUTIVE SUMMARY

Conventional wisdom has it that implementing the Kyoto treaty would unavoidably lead to slower economic growth and higher costs for U.S. consumers and businesses. Recent energy supply problems have heightened these concerns. As a result, many policymakers in the U.S. feel that they are faced with an unhappy tradeoff between the environmental advantage of early and stronger climate policy action and the perceived economic benefit of later and weaker action.

This purported conflict between economic and environmental goals has strongly shaped the U.S. stance in the U.N. climate negotiations. In order to reduce domestic economic impacts, the U.S. has called on developing countries to make emission reduction commitments of their own, and it has demanded the unrestricted use of the Kyoto flexibility mechanisms and large credits for carbon sinks.

These positions have centrally contributed to the recent collapse of the U.N. Conference of Parties (COP) negotiations: many participants and observers saw the U.S. positions on sinks and flexibility mechanisms as indirect attempts to rewrite the Kyoto targets. More recently, the U.S. administration has entirely rejected the treaty in its current form.

The present report finds that U.S. perceptions of national interests in the pre-and post-Kyoto negotiations have been greatly distorted by flawed and outdated economic modeling studies. What has been missing in the assessments so far is an integration of individual policy options into a coherent least-cost framework drawing on all major cost-reducing policies simultaneously. New information presented in this report shows that such an economically efficient, integrated energy and climate approach would allow the U.S. to fully meet emission reduction targets such as those set forth in the Kyoto Protocol and significantly exceed them by 2020, and do so while increasing economic output, not decreasing it.

By 2010, an integrated least-cost strategy would produce a gain of $50–60 billion/yr to the U.S. economy (constant 1997 dollars). These gains grow to $120 billion/yr by 2020—before accounting for the benefits of slowing climate change. The cumulative gain over the next decade would be more than $250 billion, growing to a cumulative $600 billion over the second decade (net present value in 1997 dollars). The present report also shows that these positive economic impacts are neither dependent on—nor materially augmented by—U.S. proposals on sinks and flexibility mechanisms.

Furthermore, the present analysis shows that an integrated least-cost approach to climate mitigation solves two problems with one policy strategy. The most important element of a money-saving climate strategy—increased energy productivity investments—is also the most cost-efficient way for overcoming current energy supply problems in the U.S. Large opportunities for cost-effective investments in demand-side efficiency and cogeneration reduce not only the projected use of coal, but also of natural gas and oil. By doing so, a climate-oriented energy policy protects U.S. consumers and firms from rising costs of energy services and from risks of supply disruptions in the electricity, oil, and gas markets.

These conclusions arise from a fresh examination of the key economic analyses of the Kyoto Protocol that were published during 1997–2000, either by the U.S. Government itself or as an outflow of major academic projects. In the present report, we subject these studies to an analytical review and integrate their findings into an internally consistent economic perspective. We then use this perspective to evaluate the U.S. position in the U.N. climate treaty negotiations and proposed responses to energy challenges at home.

A LEAST-COST STRATEGY: FLEXIBILITY WITH NO REGRETS

To minimize abatement costs, climate change mitigation needs to combine four major policy approaches:

(1) Economy-wide policies that send uniform and consistent price signals to all economic actors through taxes or, alternatively, through domestic emission caps that are linked to a permit auction and trading scheme (cap-and-trade systems). The price and cost of permits adds a carbon charge to energy prices that works in the same manner as a carbon tax.

(2) Domestic reforms based on cost-benefit tested incentives, standards, and voluntary agreements. These reforms would reduce market, organizational, institutional, and regulatory barriers to highly profitable energy efficiency investments and other no-regrets technology options. Also included here are targeted technology R&D and commercialization programs for reducing the costs of renewable energy sources and other low carbon technologies.

(3) Linkage of emissions tax revenues or permit auction revenues with tax shifts and subsidy reforms, such as cuts in taxes on payrolls or investments, to offset reve-

nues received from taxes on emissions or permit auctions. Such fiscal reforms can further increase energy efficiency and total factor productivity in the economy, adding a second no-regrets element that produces economic and environmental double dividends.

(4) Trading of emission allowances with other countries that have lower-cost abatement opportunities than those available in the domestic economy. This is the 'flexibility' strategy based on the Kyoto mechanisms: international emissions trading (IET), Joint Implementation (JI), and the Clean Development Mechanism (CDM).

A fifth element consists of suitable adjustment policies that shield carbon-intensive industries and their workers from having to bear a disproportionate burden, such as border tax adjustments and regional adjustment funds. These policies do not improve economic efficiency per se but help reduce political conflicts that might otherwise impede or prevent timely action.

At the center of the present review is the treatment of these strategies for minimizing mitigation costs and social impacts in the studies supporting U.S. policy development. Since most cost assessments to date incorporate the first policy option—price signals based on a carbon tax or permit trading system—our focus is on whether the other cost-reducing options were included in each assessment, or omitted from analysis.

HOW ADEQUATE ARE U.S. COST ASSESSMENTS?

Our review shows that all the major economic assessments being cited in the U.S. debate on the Kyoto treaty are significantly incomplete (Table 1). Though each major cost-reducing policy option is examined in at least one study, no study examines the joint application of all domestic no-regrets options, or for that matter, the joint application of the domestic no-regrets options and international trading.

Table ES. 1: Policy Analysis Gaps in U.S. Assessments of the Kyoto Protocol

	Scope of policy analysis		
	Market reforms, technology programs	Tax shift reforms	International allowance trading
1998 Energy Information Administration			
Domestic	No	No	
Annex I trading	No	No	YES
Global trading + sinks	No	No	YES
Domestic plus weak double dividend	No	YES	
Annex I trading plus weak double dividend	No	YES	YES
Global trading plus weak double dividend	No	YES	YES
1999 Energy Modeling Forum-16			
No trading	No	No	
Annex I trading	No	No	YES
Global Trading	No	No	YES
1998 White House/Council of Economic Advisors			
"Domestic Only" policy case	No	No	
Annex I trading	No	No	YES
Best case trading	No	No	YES
1997 Interlaboratory Working Group (IWG)			
Non-price policies, moderate	YES	No	No
Non-price policies, strong	YES	No	No
Same plus $50/tC tax	YES	No	No
2000 Clean Energy Futures study (IWG)			
Moderate scenario, no C charge	YES	No	No
Advanced scenario, no C charge	YES	No	No
Advanced scenario including $50/tC charge	YES	No	No

This observation calls into question claims that the U.S. lacks affordable domestic mitigation options, or that the U.S. is heavily dependent on international trading mechanisms and credits for carbon sinks if it is to reduce costs to acceptable levels. The validity of these claims can only be established through an analysis in which all of the major cost-reducing policy options described above are implemented jointly.

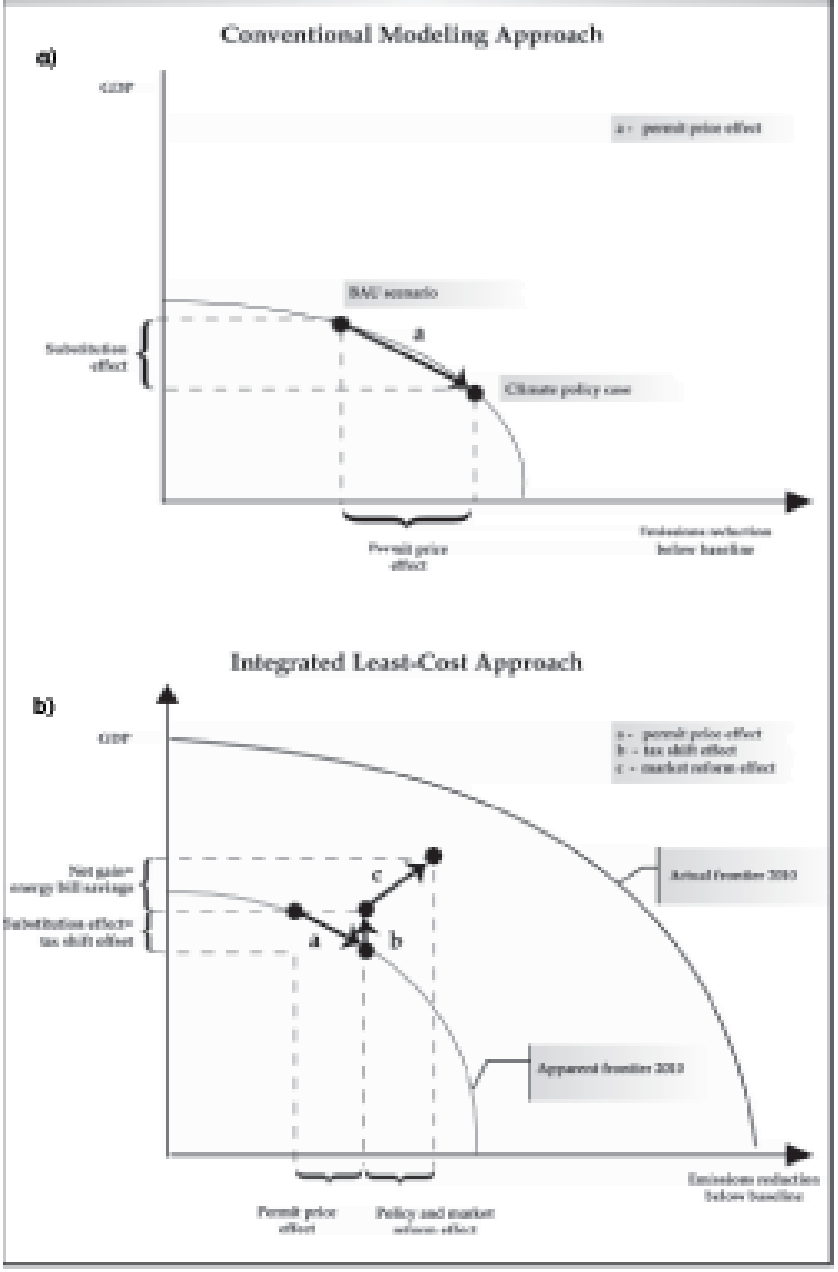
The present report is the first to offer such an integrated least-cost analysis. We reexamine the economics of cutting carbon emissions in the U.S. by calculating what the economic impacts of the Kyoto targets or similar targets would be if the U.S. were to implement its provisions using an integrated least-cost policy approach. In pursuing this analysis, we do not introduce any new models or modeling techniques, but rely on procedures and results that have already been developed and used in the U.S. government's own studies.

METHODOLOGY OF THIS REPORT

An integrated analysis of the above four policy options requires the joint evaluation of carbon charges and market and institutional reforms. A convenient and operational approach to this task has been developed by the U.S. Department of Energy's Interlaboratory Working Group (IWG). It is based on the familiar economic concept of the tradeoff curve between GDP growth and carbon emission reductions. Conventional economic instruments such as carbon taxes or permit auctions move the economy along that curve while cost-effective market reforms and tax shifts move the economy toward the curve or shift the curve itself.

The standard modeling approach is depicted in Figure ES. 1a: a carbon charge is implemented to reduce emissions to their target level. In conventional models the historical tradeoff curve for the economy is described as the production possibilities frontier, i.e., the best the economy can do given available inputs of labor, capital, and technology. As a result, emissions can only be reduced by moving the economy along the tradeoff curve to a point with lower emissions. This movement is brought about by energy price effects from carbon taxes or permit auctions, which lead to adjustments in the mix of energy and non-energy inputs by consumers and businesses. These economic substitution effects somewhat reduce GDP.

Figure ES.1:
Conceptual framework for modeling greenhouse gas mitigation policies



The concept of no-regrets policies rests on the empirical observation that the economy does not operate fully at the frontier of optimal economic and technological efficiency. The tradeoff curve of conventional models is only an apparent frontier. Cost-benefit tested market reforms—such as the utility demand-side management pro-

grams of many States, the appliance efficiency standards of the U.S. Department of Energy, and marketing and information efforts like the U.S. Environmental Protection Agency's Energy Star and Green Lights programs—represent a move toward the actual frontier by eliminating market, organizational, and institutional barriers to cost-effective investments. By increasing energy efficiency and total factor productivity, more GDP can be produced with fewer emissions. Similarly, economically efficient tax shifts reduce dead-weight losses from the tax system. In both cases, the economy's tradeoff curve is shifted outward toward higher GDP/carbon ratios.

When carbon charges and no-regrets policies are implemented jointly (Figure ES. 1b), much of the targeted emissions reduction is provided by market reforms. As a result, required carbon charges are smaller, and so are GDP losses from economic substitution effects. Depending on their design, tax shift reforms can partially or more than fully offset these losses. Assuming that losses are just offset, the net economic impact of carbon mitigation becomes equal to the net change in the total cost of energy services (lighting, heating, cooling, driving, etc.) brought about by market reforms and technology programs.

Figure ES.2a: Effect of a least-cost climate strategy on U.S. energy supply requirements in 2010

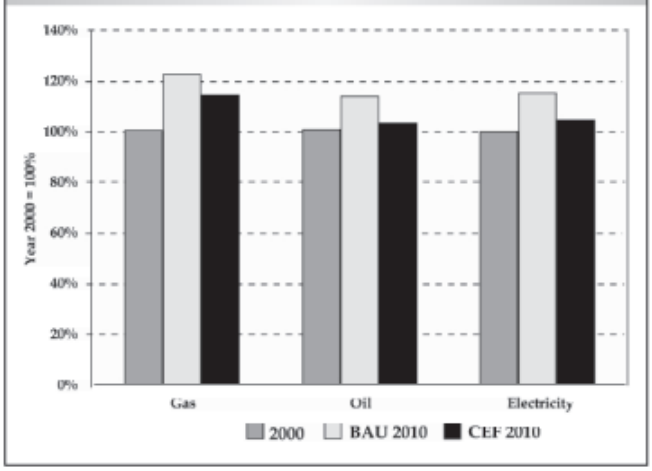
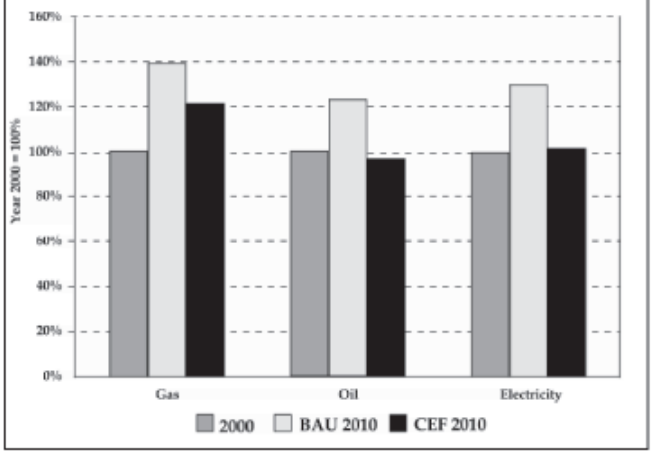


Figure ES.2b: Effect of a least-cost climate strategy on U.S. energy supply requirements in 2020



The present study is the first integrated analysis of these policies and effects. Emissions reductions and economic gains from cost-benefit tested market reforms and technology programs (arrow c in Figure ES. 1b) are derived from the U.S. Department of Energy's Clean Energy Futures study (CEF), which was published in November 2000. This major analysis was conducted by the U.S. DOE's Interlaboratory Working Group, a team of experts from five national laboratories. The CEF

study represents a highly conservative assessment of these non-price policies, and it combines them with domestic permit trading. However, it does not cover tax shifts or international trading, and it analyzes levels of emission reductions that remain well below the Kyoto target for 2010. Other studies have suggested that the U.S. has further options that would permit emission reductions up to and beyond this target at favorable cost.

The impacts of carbon charges (arrow a in Figure ES. 1b) are derived from the work of the Energy Modeling Forum (EMF–16) at Stanford University. The groups participating in this Forum analyzed the economic impacts of the Kyoto Protocol on the basis of standardized runs for a number of different economic models, including the model used by the Clinton Administration's Council of Economic Advisers in its official evaluation of the Kyoto treaty. These studies provide the best available basis for calculating the substitution effects of carbon charges on the U.S. economy. They also analyze international trading and the Kyoto flexibility mechanisms. However, they do not cover market reforms or tax shifts, and they omit the important effects of these domestic no-regrets policies on the international allowance market. Our study derives central (average) estimates from this comparative work (labeled 'EMF–16 Mean' in the accompanying charts and tables).

Gains in GDP from tax shifts (arrow b in Figure ES. 1b) are derived from a number of U.S. Government and academic studies. These studies show that tax shifts can be designed with widely varying effects on GDP, ranging from a partial offset of losses (weak double dividend) to more than a complete offset leading to net gains (strong double dividend). For our central estimates, we assume that tax shifts will just offset the GDP losses from economic substitution effects caused by carbon charges.

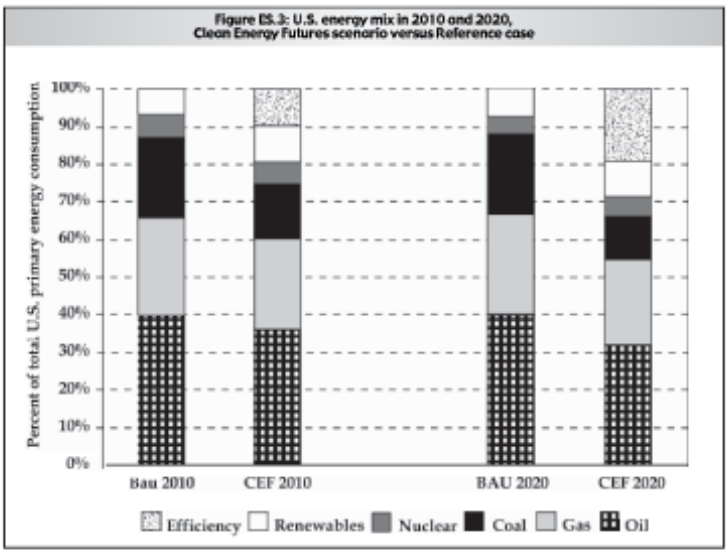
Following the arrows in Figure ES. 1b, the total economic impact of an integrated climate policy is calculated as the sum of these effects. Interactions between carbon charges and net savings in energy service bills are already accounted for in the models used in the above studies. We additionally include the environmental co-benefits associated with lower fossil fuel consumption and, in our global trading analysis, the cost of purchasing international emission allowances. The details of these calculations are documented in the main report.

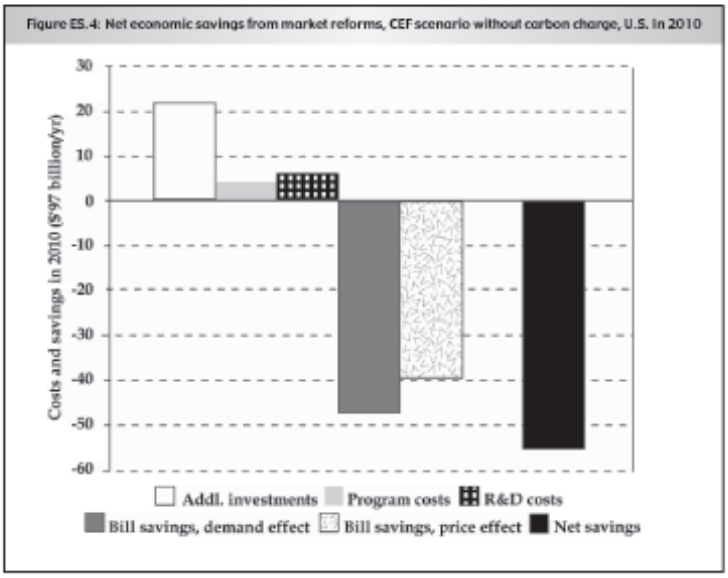
SOLVING TWO PROBLEMS WITH ONE STRATEGY

Conventional wisdom has it that domestic action to reduce carbon emissions in the U.S. is expensive because of a lack of cheap low-carbon technologies. The central proposition—that the U.S. lacks cost-saving opportunities for domestic emission reductions in its energy system—is at odds with the U.S. government's own authoritative studies by the national laboratories. Our review of this and other work shows that a strong overlap exists between a national energy policy aimed at safeguarding the U.S. economy and a least-cost oriented climate policy.

This synergy is clearly demonstrated in the Clean Energy Futures study by the national laboratories. It not only offers a comprehensive analysis of the nation's domestic technological options in fighting climate change; it also illustrates how an integrated least-cost strategy aimed at the climate problem can help the U.S. deal with vulnerability to oil price shocks, disproportionate growth in the consumption of gas, demand and supply imbalances in electricity markets, and resulting volatility in energy prices.

To correctly perceive the national economic interests of the U.S. in the international negotiating process, it is important to understand these interactions. Beginning with the energy supply picture, Figures ES.2a and ES.2b compare the growth in U.S. oil, gas, and electricity requirements in 2010 and 2020 for the CEF reference case (business as usual or BAU scenario), and for the climate policy case (CEF 'Advanced' scenario). The level of demand and the mix of energy supplies in the CEF reference case is based on a widely used forecast issued by the U.S. Energy Information Administration (EIA).





Relative to the baseline projections of the EIA, the CEF climate policy scenario not only reduces the consumption of carbon-intensive coal, but also of oil and gas. Specifically, oil consumption is 10 percent lower in 2010 and 21 percent lower in

2020. Electricity requirements change by the same percentages, and natural gas consumption is lower by 7 percent in 2010 and by 12 percent in 2020.

Indeed, the CEF analysis shows that with certain electricity market improvements, gas-fired cogeneration of heat and power could reduce total U.S. gas requirements even further than shown in Figure ES. 2, at a net cost saving for consumers and firms, while reducing U.S. carbon emissions by 26 and 40 MtC in 2010 and 2020.

These results suggest that a least-cost oriented climate policy does not need to worsen U.S. supply problems in the natural gas or electricity markets. On the contrary, a least-cost approach would help relieve and prevent these problems. Moreover, such relief is not a transient respite but keeps on growing over the next two decades, as is evident from comparing Figures ES.2a and ES.2b.

Unlike with purely supply oriented approaches, this substantial relief of U.S. energy supply problems does not arise from lowered economic activity or reduced energy services (driving, lighting, heating, cooling, etc.). As is evident from comparing Figures ES. 2 and ES. 3, the need for growth in conventional energy sources is alleviated by investments in energy efficiency, and to a secondary degree, in renewable energy sources. In the CEF scenario, the combined contribution of efficiency and renewables to total energy services triples from 7 percent in the reference forecast to about 20 percent by 2010, and quadruples to about 30 percent in 2020.

As the CEF study documents, not only are more efficient demand-side technologies currently available, they also are highly cost-effective. By clearing away the market, organizational, and institutional barriers that currently hamper the rapid diffusion of these technologies, the U.S. can cut its energy bills while simultaneously gaining important breathing space for readying a new generation of cheaper and cleaner energy supply technologies. At the same time, the U.S. can avoid excessive investments in long-lived energy supply facilities that would further lock in yesterday's technologies.

MONEY SAVINGS FROM DOMESTIC MARKET REFORMS

The overlap between a least-cost climate policy and national energy policy extends to the economic realm. The key sources of this synergy are cost-benefit tested market reforms that facilitate cost-effective energy efficiency investments, combined with increased R&D efforts.

The EIA reference case excludes all such market reforms (beyond those already in place or under way in the base year). This assumption reflects past policy trends and considerations of political economy. Though market reforms are economically worthwhile on their own in the absence of climate change, many policymakers hesitate to advocate such government actions unless they also represent a least-cost path for realizing other clearly identified societal objectives. The broader environmental objective of reducing greenhouse gas emissions is operative in the Clean Energy Futures policy scenario but is not considered in the EIA's Annual Energy Outlook forecast, which is a business as usual perspective.

The assumptions used in the CEF scenarios regarding the effectiveness of expanded market reforms are a highly conservative extrapolation of past experience with such programs. Only a portion of all new and replacement investments in energy using equipment is shifted toward higher efficiency technologies compared to the reference case. For example, in the buildings sector, this fraction is about a third in 2010 and half in 2020. Even with these conservative assumptions, market reforms are shown to have powerful economic effects. They include:

(1) Productivity gains from energy efficiency investments;

(2) Accelerated reductions in the costs of current and emerging technologies;

(3) An expanded array of no-regrets efficiency technologies;

(4) Lower (pre-tax) prices for fossil fuels and a relatively cheaper electricity supply mix at lower levels of total demand; and

(5) Avoided pollution damage and control costs.

Figure ES. 4 shows economic results for the CEF scenario when market reforms are implemented without a climate policy component, i.e., without a carbon cap and permit auction system. The annual cost for investments, program delivery, and R&D is about $30 billion/yr. These costs are far exceeded by the roughly $45 billion/yr in reduced expenditures on energy that occur on account of higher energy productivity and reduced demand alone, assuming the same energy prices as in the EIA reference case (demand effect). However, reduced energy demand produces a sizable additional economic benefit from its effect on energy prices, which adds another benefit of close to $40 billion/yr (price effect). Finally, the co-benefits of reduced environmental damages from air pollution and other impacts add a saving of roughly $5 billion/yr.

Net gains—calculated as (demand effect) plus (price effect) plus (avoided pollution damages) minus (investments and program costs)—are $60 billion/yr in 2010. For the sake of simplicity, we refer to these savings as net energy bill savings. More precisely, they are a reduction in the total national cost of energy services (i.e., in the total expenditures on energy carriers plus levelized investments and program and R&D costs, some of which deliver energy services through efficiency improvements rather than energy consumption). These net energy bill savings are 8 percent in 2010, equivalent to 0.5 percent of projected GDP.

By 2020, these figures double to $123 billion/yr (including $12 billion/yr in avoided pollution damages), equivalent to 16 percent of the national energy bill or one percent of GDP. If the EIA reference projections of future U.S. energy prices should turn out to be too low—as would be the case if recent trends persist—the economic benefits of market reforms could be significantly larger still.

As the CEF study shows, the energy productivity savings from no-regrets market reforms are far greater than the funds needed to pay for the accelerated introduction of renewable energy sources or other carbon-reducing technology options.

CUTTING CARBON EMISSIONS AT A PROFIT

With its conservative assumptions, the CEF study's market reforms alone produce about 30 percent of the U.S. Kyoto target in 2010 and about half in 2020. When a $50/tC charge is added, the CEF scenario leads to a roughly 60 percent realization of the Kyoto target in 2010 and 85 percent in 2020.

This roughly doubling of emissions reductions brought about by the carbon charge diminishes net economic savings by only a small fraction. The national cost of energy services rises by only $6 billion/yr in 2010 and $3 billion/yr in 2020, respectively, relative to the no-carbon-charge case. (In this calculation, which adopts a national perspective, the carbon charge payments themselves cancel, since they are merely a transfer payment).

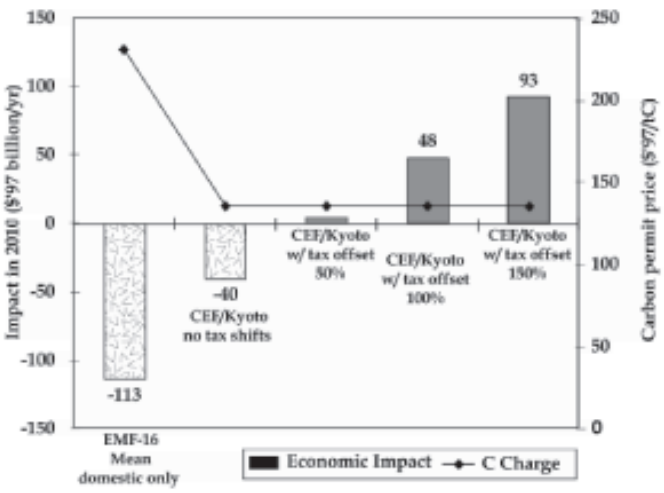
Our report finds that even though the CEF scenarios do not reach the Kyoto target, the U.S. can fully achieve that level of emission reductions at a net economic gain—even if a purely domestic strategy is used. The key to this outcome is a combination of the above-discussed no-regrets market reforms with tax shifts that offset the negative GDP effects of a cap-and-trade permit system or carbon tax, as qualitatively illustrated in Figure ES. 1 above.

Again, the EIA forecast used as the reference case in the CEF study does not include any no-regrets options for implementing carbon charges, i.e., growth-enhancing tax shifts. Though they are economically worthwhile on their own, such tax shifts require new sources of government revenues to offset reductions in existing, more distortionary taxes. Climate policy scenarios do include new revenues from carbon taxes or emissions permit auctions, but no such new source of revenues is available in the EIA reference case.

Figure ES. 5 shows how market reforms and tax shifts play out in the aggregate in 2010. The chart compares the Kyoto analysis of the Energy Modeling Forum with an integrated least-cost approach in which the CEF scenario is extended to reach the Kyoto target. Under a domestic permit trading system alone, a high permit price of $230/tC is required to reach the Kyoto target. The resulting economic losses based on the mean of estimates from the Energy Modeling Forum are of the order of $130 billion/yr. Co-benefits of reduced pollution reduce this figure to about $110 billion, or one percent of projected year 2010 GDP.

When domestic market reforms are added, the permit price required to reach the Kyoto target drops to less than $140/tC. This reduces GDP losses from substitution effects. At the same time, market reforms trigger cost-effective energy productivity investments, which cut the costs per unit of energy service as well as the nation's total bill for energy services. As a result of these savings, economic losses shrink by about two-thirds to $40 billion.

Figure ES.5: Economic Impact in 2010 –
U.S. Kyoto target, domestic strategy with and without market and fiscal reforms



When tax shifts are also included, GDP losses from substitution effects are eliminated entirely. Depending on the extent and effectiveness of tax shifts (we model 50 to 150 percent offset of substitution losses), U.S. economic output in 2010 increases by an amount that ranges from less than 10 to more than $90 billion per year (again including environmental co-benefits of about $20 billion).

For the midpoint level of effectiveness (100 percent offset), tax shifts just compensate for the GDP impacts of the carbon charge. What remains, then, are the reductions in the total cost of energy services from market reforms (simply referred to as net energy bill savings), plus the environmental co-benefits of reduced carbon emissions. With a carbon charge of roughly $140/tC, net savings from market reforms are lower than they would be in the absence of carbon charges, but the co-benefits of avoided pollution compensate much of this effect. The total economic gain is about $50 billion/yr, equivalent to about half a percent of projected GDP in 2010.

EXTENDING THE TIME HORIZON TO 2020

The extension of the above analysis to 2020 is of great importance for the U.S. policy debate and the U.N. negotiations in that it indicates whether emission reductions can be profitably maintained or even increased over the following decade as economic growth continues to push the reference forecasts beyond current emissions levels.

Using the CEF results for 2020, we examine a domestic least-cost strategy, again consisting of permit trading, market reforms, and tax shifts. We analyze two alternative emission reduction targets. In the first case, it is assumed that the U.S. Kyoto target for 2010 (i.e.,1990 emission levels minus 7 percent) will be maintained in the subsequent decade. In the second case, the target is increased to the minus 20 percent level originally proposed at Kyoto by the Alliance of Small Island States (AOSIS), a group of countries most vulnerable to sea level rise.

As expected, the U.S. energy system in 2020 is more responsive to both market reforms and carbon charges. The Kyoto target is reached at $65/tC—roughly half the charge required in 2010. Expanding emission reductions to minus 20 percent of 1990 levels requires only a modest further increase in the carbon price, to $77/tC.

Net economic benefits are roughly $120–125 billion/yr in 2020, equivalent to 0.9 percent of projected GDP. This is more than double the economic gains achieved with the same strategy in 2010. When the year 2020 emission reduction target is extended from minus 7 to minus 20 percent of 1990 levels, net economic gains are somewhat lower but still of the same order of magnitude as for the Kyoto target. The higher carbon charge necessary in 2020 to achieve the minus 20 percent target

does lead to reduced net savings in energy service bills. However, this effect is partially offset by larger environmental co-benefits.

The more than doubling of net benefits between 2010 and 2020 is explained by three factors: (a) money-saving productivity investments are far from saturation in 2010, and are continuing to penetrate the capital stock in the period between 2010 and 2020; (b) capital stock turnover in many important categories of energy-using equipment, and thus the penetration rate of demand-side efficiency programs, is inherently faster than economic growth, on account of short (10–20 year) equipment lifetimes; and (c) the costs of advanced low-carbon technologies decline at an accelerated pace, due to learning curve effects and R&D impacts.

Examining the CEF scenarios for the entire period from now until 2020, it is evident that a domestic no-regrets strategy of permit auctions, tax shifts, and market reforms already becomes significantly profitable within the first couple of years of implementation. From there, it grows more lucrative year by year as the capital stock turns over.

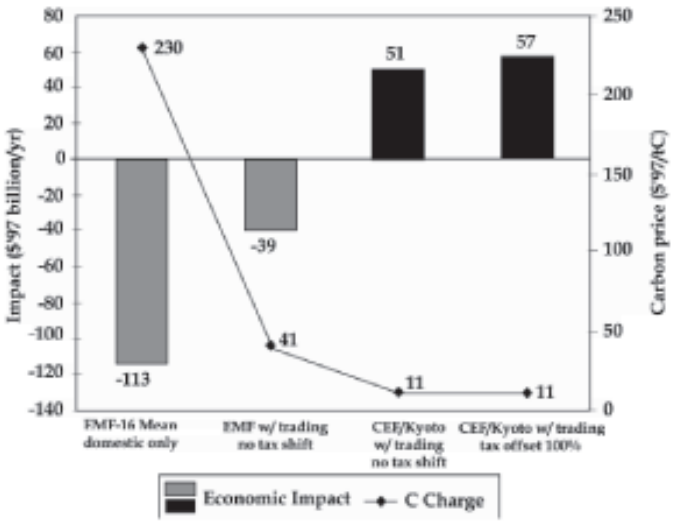
These findings call for a revision of conventional wisdom, which presumes an economic advantage from postponing most emission reductions to later years. Larger emissions reductions do become easier to achieve in later years, as more time is allowed for the adjustment process in the economy. However, because growing levels of emissions reductions below the baseline become profitable even in the early years, foregoing the early reductions implied in the Kyoto target would amount to a significant opportunity cost for U.S. consumers and firms.

INTERNATIONAL IMPLEMENTATION

The positive economic picture found so far further improves when a domestic least-cost strategy is integrated with the Kyoto flexibility mechanisms. Here, we analyze the limiting case of unrestrained global emissions trading. Other scenarios with only a supplementary role for trading are discussed in the subsequent section. Figure ES. 6 compares the international trading case of the EMF–16 analysis with the results for the CEF/Kyoto strategy combining international flexibility with domestic no-regrets action.

As a point of reference, the chart begins with the domestic worst-case policy based on a carbon tax without tax shifts or market reforms. When global trading is incorporated into this policy case, the carbon price drops by more than 80 percent from $230/tC to about $40/tC. Total mitigation costs decline by two thirds or more.

Figure ES.6: Economic Impact in 2010 –
U.S. Kyoto target, domestic permit trading versus global trading versus integrated least-cost strategy

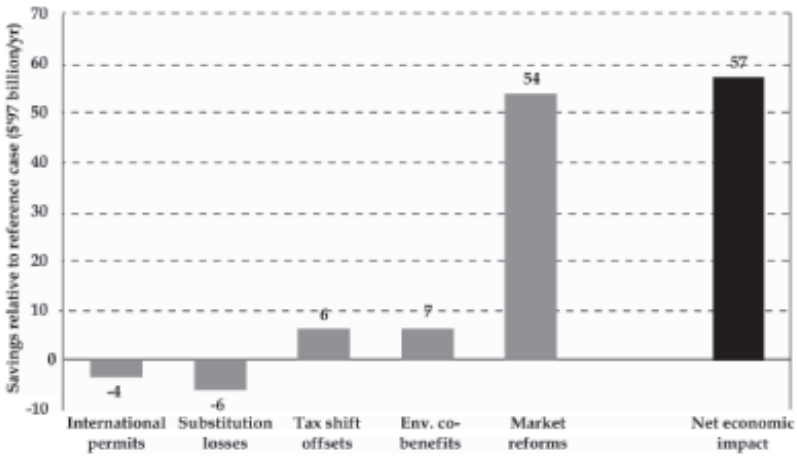


While global trading can reduce U.S. mitigation costs by significant percentages, it alone cannot prevent economic losses. By contrast, domestic market and fiscal re-

forms can produce net benefits on their own. If these gains are enhanced by international allowance trading, the carbon price drops from about $40/tC to $11/tC, due in part to feedback effects of U.S. domestic no-regrets policies on the international allowance market.

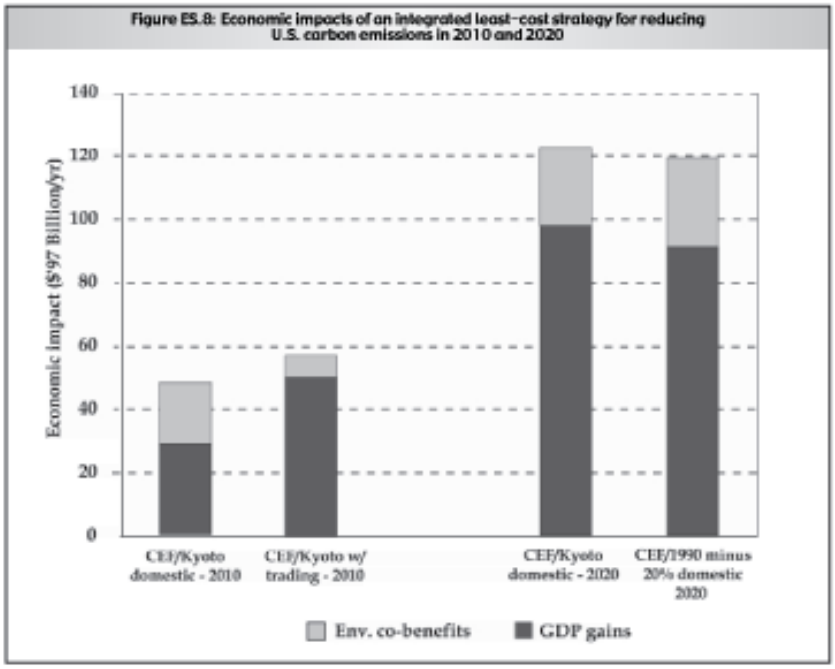
Our analysis shows that a fully integrated 'flexibility with no regrets' strategy yields economic benefits of $57 billion/yr in 2010. Figure ES. 7 shows the individual components of this aggregate result. The graph also shows that tax shifts are of lesser importance in the context of an international strategy: economic substitution losses are diminished on account of the much lower carbon price.

Figure ES.7: Cost and savings components of an 'international flexibility plus domestic no regrets' strategy for the U.S., year 2010



SUMMARY OF RESULTS FOR 2010 AND 2020

The main results of our review are summarized in Figure ES. 8. These results support several conclusions. The first conclusion is that with an integrated least-cost policy mix, the U.S. can meet targets such as those set forth in the Kyoto Protocol at a net economic gain ranging from about 0.5 percent of GDP in 2010 to about 1 percent of GDP in 2020. Insofar as some of the total benefits are from avoided environmental damages (in areas other than climate change), not all of these economic gains may show up in the country's GDP accounts, but they are economic gains nonetheless.



The second conclusion is that postponing carbon mitigation in the U.S., or reducing abatement efforts to less than the U.S. target under the Kyoto Protocol, brings with it significant lost opportunities for the U.S. economy. Such lost opportunities are of the order of $50–60 billion per year in 2010, and about $120 billion per year by 2020.

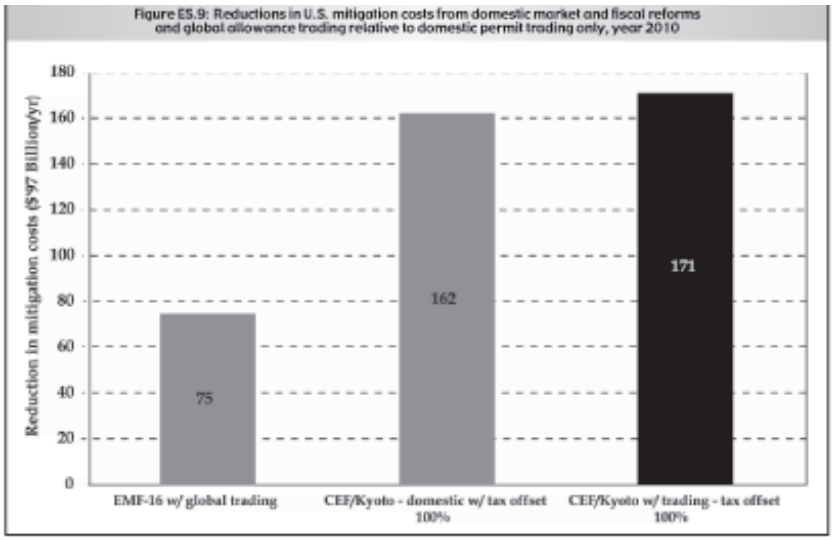
The full opportunity cost of inaction is measured by the sum of foregone annual economic gains in the period between now and 2020. By the end of the first Kyoto commitment period in 2012, U.S. consumers and businesses would forego cumulative economic gains of about $250 billion (net present value of growing annual gains, discounted to the year 2001 at a 5 percent real discount rate, constant 1997 dollars). For the entire period until 2020, this figure rises to more than $600 billion.

The third conclusion is that positive net economic impacts are centrally driven by productivity-enhancing market reforms. A focus on international rather than domestic strategies is misplaced, because GDP losses from carbon charges can be minimized through either domestic tax shifts or international trading. The implication of this finding for the U.N. FCCC negotiations is further discussed below.

HOW IMPORTANT IS EMISSIONS TRADING?

Our analysis shows that the economic significance of international allowance trading has been exaggerated. To measure the significance of trading, the appropriate point of reference is the 'no trading' case examined in the EMF–16 assessments, in which the only policy is a domestic permit trading system or carbon tax. The mean of the EMF–16 estimates of the impact of the U.S. Kyoto target for this policy case is a GDP loss of about $110 billion/yr in 2010.

Relative to our average derived from the EMF–16 global trading case, the domestic least-cost approach of the CEF/Kyoto scenario improves economic results by eliminating all GDP losses and generating a net benefit instead. The economic improvement is roughly $(110+50) = $160 billion/yr in 2010. This figure is far larger than what is achieved in the EMF–16 'global trading' case, which reduces mitigation costs by only about $75 billion (Figure ES. 9).



When the CEF/Kyoto scenario is expanded to incorporate international trading, results improve further to about $170 billion/yr, or by roughly $10 billion/yr. It is this marginal improvement of $10 billion/yr relative to the domestic gain of $160 billion/yr that measures the marginal significance of international trading.

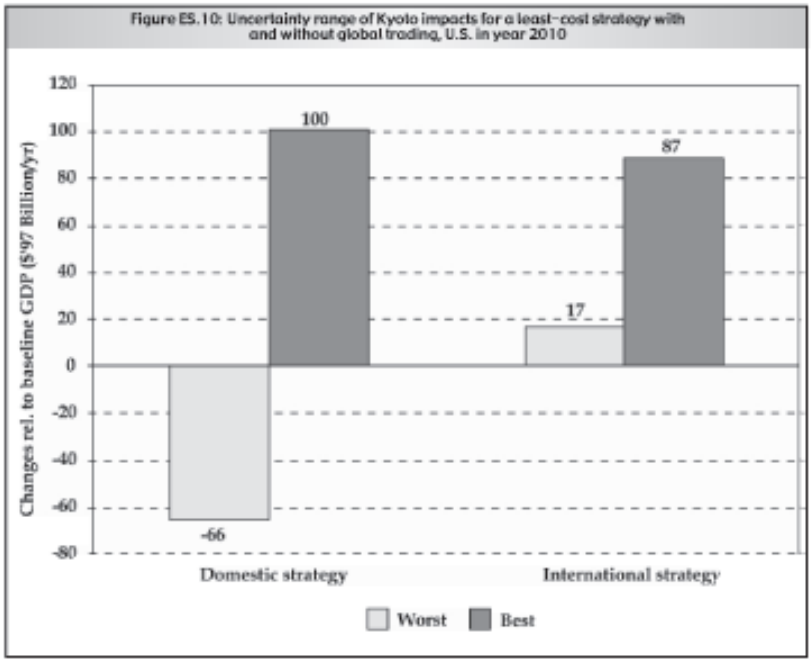
These proportions indicate that trading adds no more than a roughly 5 percent improvement. About 95 percent of theoretically feasible abatement cost reductions can be achieved through domestic market and fiscal reforms alone. While a $10 billion absolute gain could certainly be worth pursuing, the purported major significance of international trading turns out to be an artifact of incomplete modeling analyses of domestic policy options.

Not only that, a one-sided reliance on international trading would be expensive for U.S. consumers and firms. Figure ES. 9 implies that in the absence of domestic market and fiscal reforms, global allowance trading as assumed in the EMF–16 scenario would saddle the U.S. economy with opportunity costs of roughly $(160–75) = $85 billion/yr in 2010.

Rather than obtaining emission reductions at negative net cost from domestic action, U.S. energy users would end up paying for investments abroad that provide carbon reductions at a positive cost. The fact that this cost burden would be lower than in the absence of trading does not change the fact that exclusive reliance on trading (i.e., a lack of domestic action) would result in a sizable economic penalty.

HOW ROBUST ARE THESE FINDINGS?

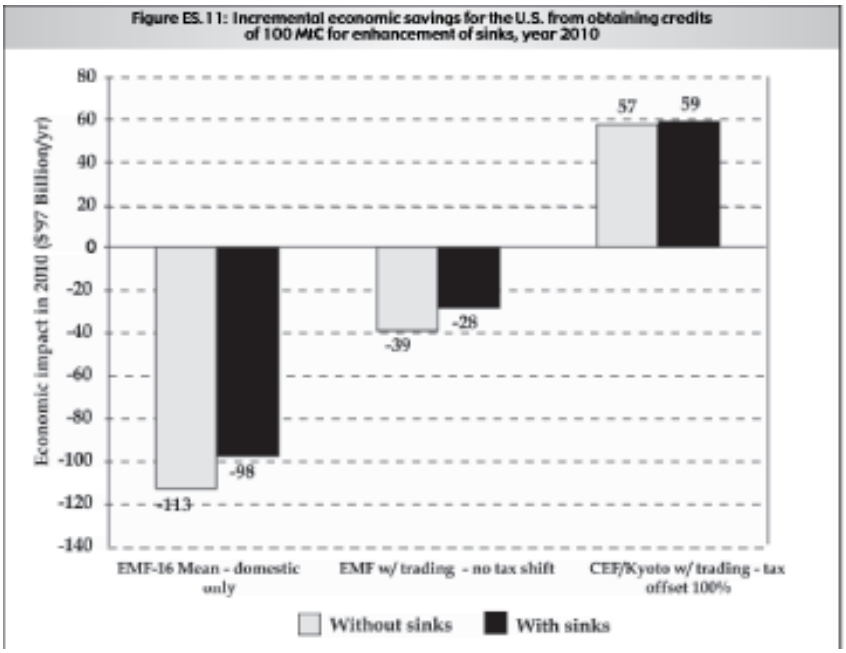
A sensitivity analysis of our results shows that international trading can provide a certain amount of insurance against domestic policy failures, as well as against the large variation in GDP estimates from current economic models. This effect is illustrated in Figure ES. 10, which shows high/low sensitivity ranges for the domestic and international CEF/Kyoto least-cost strategies. Our sensitivity tests include both a fourfold variation in predictions from economic models (highest versus lowest GDP loss for a given carbon price); a range of ancillary benefit estimates; and variations in tax shift offsets and no-regrets emission reductions by plus or minus a third.



As shown in the chart, the uncertainty band under international trading is only half as wide as under the domestic strategy. Equally important, trading shifts the full range of economic outcomes into positive territory. Of course, the workability and reliability of the proposed international flexibility mechanisms is as yet untested and represents a source of uncertainty itself. In practice, something less than full global trading may be implemented initially.

NEGOTIATIONS ON SINKS AND SUPPLEMENTARITY

Just as a least-cost integration of all policy options reduces the marginal significance of international trading, so does it diminish the importance of credits for sinks. Figure ES. 11 shows the savings the U.S. would obtain if it were to gain agreement for 100 MtC in such credits for 2010.

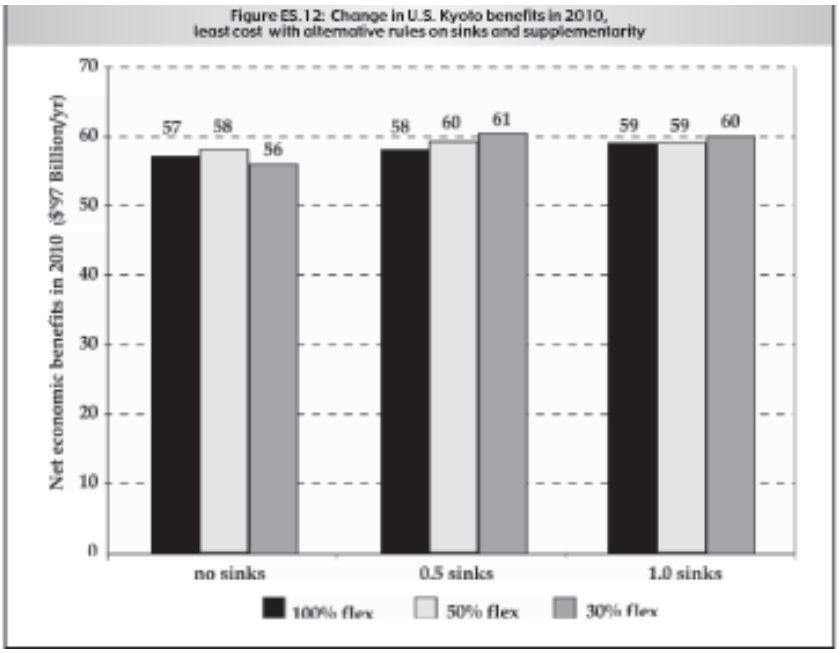


In the context of a least-cost strategy, sinks add savings of $2 billion/yr in 2010. Relative to the roughly $170 billion in savings already obtained by the CEF/Kyoto strategy (see Figure ES. 9 above), sinks represent a mere 1 percent effect.

Similar findings apply to the impact of constraining the Kyoto flexibility mechanisms to a supplementary role. The U.S. negotiating position has strongly emphasized unlimited use of the Kyoto flexibility mechanisms in meeting national targets while the EU has proposed a roughly 50 percent limit that would require countries with targets to undertake most reductions at home. Meanwhile, various studies including analyses in EMF–16 have pointed out that the U.S. would likely be a net beneficiary of moderate flexibility constraints, but have found those constraints detrimental from a global economic efficiency perspective.

From the perspective of an integrated strategy of domestic no-regrets reforms plus international trading, U.S. insistence on unconstrained use of the Kyoto mechanisms turns out to be even more misplaced. First, in a least-cost approach to mitigation, supplementarity constraints are economically insignificant for the U.S. Second, if the U.S. proposal for 100 MtC in credits for sinks is combined with a least-cost mitigation strategy as outlined above, sinks plus domestic no-regrets options already supply about 250 MtC, or just about half of the U.S. Kyoto target.

The least-cost economics of the U.S. position on supplementarity, and of various negotiating outcomes regarding supplementarity and sinks, is shown in Figure ES. 12. It combines three outcomes for sinks (no credits, half credits, full credits = 100 MtC) with three flexibility limits (100 percent = unconstrained, 50 percent limit, and 30 percent limit).



We show the net economic impact of each outcome relative to the EIA baseline projection used in the CEF business as usual case. A least-cost strategy including unconstrained international trading and full sinks (the U.S. negotiating position) results in an absolute economic gain of $59 billion relative to the business-as-usual reference case (see Figures ES. 8 and ES. 11 above).

The marginal effects of alternative outcomes, at less than $3 billion/yr in either direction, are in the 5-percent range—hardly the impact that could justify the collapse of international negotiations.

WHAT ABOUT INDIVIDUAL INDUSTRIES?

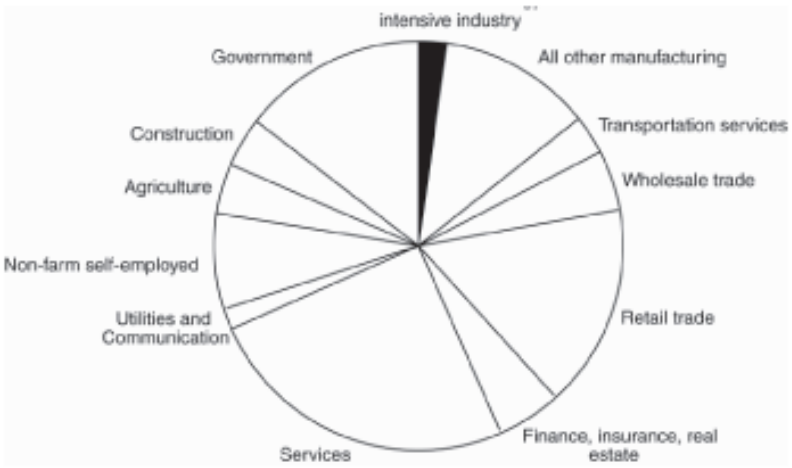
Although the overall economy-wide impacts of a well-designed climate policy are positive, this does not necessarily mean that impacts on some individual sectors of the economy could not be adverse. Even if the U.S. approach to date—emphasizing global trading and credits for sinks rather than no-regrets market, institutional, and fiscal reforms—is economically inefficient for the U.S. economy, might it nevertheless represent a sensible strategy for protecting the competitiveness of important trade-exposed or disproportionately carbon-intensive industries?

Our study finds that the perceived advantages of a global trading strategy for U.S. industries rest on comparisons with ill-designed domestic climate policy scenarios that mainly rely on a carbon charge. Relative to this analytical "straw man," global trading does show significant economic benefits for the U.S., both in terms of aggregate costs and sectoral competitiveness impacts.

However, an integrated analysis of cost-reducing policy options shows that a global trading strategy pursued in isolation not only incurs large opportunity costs for U.S. businesses and consumers in the aggregate, but also is inferior in maintaining the competitiveness of trade-exposed energy-intensive industries.

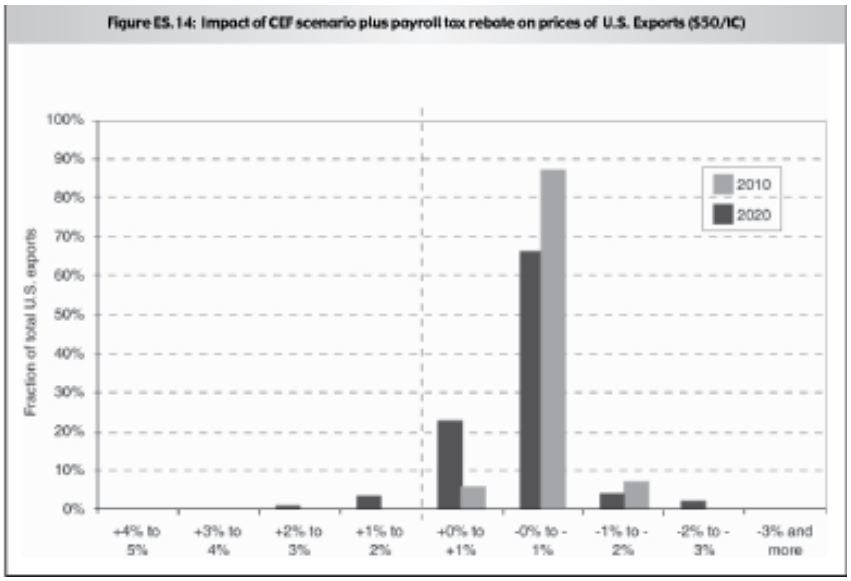
Here, a sense of proportions is helpful. Figure ES. 13 shows that the share of U.S. employment in trade-exposed energy-intensive industries is on the order of 1 percent of total employment. All other industries, including more than 90 percent of U.S. manufacturing employment, is found in industries where energy costs represent less than 3 percent of production costs or—in the case of transportation services—where trade competition is inherently limited. The effect of carbon charges on the competitiveness of these industries necessarily must be minimal.

Figure ES.13: Distribution of U.S. jobs in 1995 (total = 132 million)



In addressing competition from developing countries without carbon charges, U.S. industries including the energy-intensive basic materials industries would be better served by an integrated no-regrets strategy. This is borne out by Figure ES. 14, which shows how a $50/tC carbon charge would affect U.S. export prices if this charge is combined with the market reforms of the CEF scenario, and if revenues are recycled into a payroll tax cut. In 2010, no industry would see export prices rise by more than 3 percent, and only about 5 percent of industries would see price increases of more than 1 percent. Such changes would easily be swamped by ordinary exchange rate fluctuations unrelated to climate policy.

The overwhelming majority of U.S. industries—three quarters in 2010, and about 95 percent in 2020—would see a decline in the prices of their exports. Energy productivity investments and tax rebates have the net effect of reducing production costs despite the application of the $50/tC charge. An integrated least-cost strategy including international allowance trading would further enhance the competitiveness of U.S. industries.



The U.S. has advocated the global trading approach as a way of generating meaningful participation by the developing countries, who would be induced to undertake domestic emission reductions to sell permits. Such global trading has also been viewed as a policy that would relieve pressure on the U.S. coal industry.

Our assessment finds that global emission allowance trading would have some such effect. However, it comes with a large price tag for U.S. consumers and businesses as a whole. Choosing the global trading approach over an integrated least-cost approach for the sake of protecting the U.S. coal industry would save an estimated 10,000 to 20,000 coal mining jobs at an opportunity cost of close to $100 billion/yr, or $5–10 million/yr per job saved. An adjustment fund providing direct assistance to affected coal workers and their communities would be 50 to 100 times cheaper and could be financed with just 3 percent of domestic permit auction revenues.

MEANINGFUL PARTICIPATION BY DEVELOPING COUNTRIES

Some policymakers believe that the current exemption of developing countries from binding emission reduction commitments is providing these nations with an unfair competitive advantage and is undermining the effectiveness of global climate protection efforts. This perceived imbalance along with other cost concerns has led to attempts by the U.S. to rewrite the U.N. climate treaty through the post-Kyoto negotiating process, and more recently, to its outright rejection.

The present analysis suggests that the perception of the Kyoto Protocol as burdensome and unfair is unfounded simply because its implementation could be achieved at a net economic gain for the U.S. while at the same time improving the competitive position of U.S. industries. This finding points to a way out of the present diplomatic stalemate. It also offers a promising way of obtaining the earliest and wholehearted participation of developing countries: self-interested U.S. leadership in implementing the Kyoto target through the full use of no-regrets policy options.

Such leadership would likely set in motion an irresistible economic process. First, energy productivity oriented market reforms would be widely imitated throughout the developing world. Second, domestic market reforms in the U.S. and other OECD countries would not only accelerate technological innovation but also speed the diffusion of more efficient vehicles, appliances, and industrial equipment to developing countries. A principal mechanism would be foreign direct investments by U.S. and other OECD multinationals whose technological priorities continue to be strongly influenced by policies adopted in the U.S.

Conclusions

Flawed and incomplete cost assessments have severely distorted the U.S. policy debate on climate policy and on the Kyoto Protocol. The integration of existing stud-

ies into a coherent least-cost policy framework turns conventional wisdom upside down. It shows that if U.S. climate policies embrace market and fiscal reforms, carbon-cutting investment shifts result in cumulative net economic gains of $250 billion by the end of the first Kyoto commitment period and $600 billion by 2020—before counting the benefits of avoided climate risks and damages.

Our analysis also shows that an energy strategy aimed at mitigating climate change would simultaneously relieve current U.S. energy problems and help safeguard the U.S. economy. Though mitigation will involve significant administrative and political challenges, meeting these challenges offers tangible economic rewards for U.S. consumers and improved competitiveness for U.S. firms. Conversely, inaction and delay carry significant opportunity costs.

In view of these results, objections to emission reduction goals such as the Kyoto target as too costly or unfair must be considered economically uninformed. Likewise, the U.S. insistence in recent international negotiations on certain outcomes regarding sinks and flexibility constraints would seem to be misguided. Given that the U.S. can meet and exceed targets such as those of the Kyoto Protocol at significant economic gains, and given recent evidence of increased global warming risks, it is in the national interest of the U.S. that carbon and other greenhouse gas emissions be speedily curtailed, both domestically and globally. Future U.S. climate policy should be based on improved information regarding the nation's economic and technology options.

STATEMENT OF KALEE KREIDER, GLOBAL WARMING CAMPAIGN DIRECTOR, NATIONAL ENVIRONMENTAL TRUST

The National Environmental Trust appreciates this opportunity to submit testimony for this hearing before the Senate Committee on Environment and Public Works. The National Environmental Trust (NET) is a non-profit public interest group working to protect public health and the environment. The impacts of global warming present one of the most challenging sets of environmental policy issues that we face. NET supports the development and implementation of appropriate, comprehensive domestic and international policies to mitigate global warming. We especially advocate the leadership of the United States, the world's largest emitter of greenhouse gas emissions, in the international arena. In order to fully address the threat of global warming, countries must negotiate a binding treaty that will achieve real, verifiable global reductions of greenhouse gas emissions. In addition, the U.S. must implement strong domestic energy policy to reduce U.S. greenhouse gas emissions and transition our economy away from inefficient, polluting fuels toward clean energy technologies.

It is with great confidence that we state that the science of global warming is no longer disputed. The U.S. National Academy of Sciences determined just last year that global warming is "undoubtedly real," and taking place "at a rate substantially larger than the average warming during the twentieth century." The third and most recent study by the Intergovernmental Panel on Climate Change (IPCC)—a panel comprised of over 1,200 of the world's leading scientists, concluded this year that:

> "In light of the new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations . . . . Emissions of CO_2 due to fossil-fuel burning are virtually certain to be the dominant influence on the trends in atmospheric CO 2 concentration during the 21st Century."

The IPCC also found that unique natural ecosystems such as prairie wetlands, alpine tundra, and cold water ecosystems likely will not be able to adapt to warming, and that sea-level rise would erode coastlines, including along the U.S. Atlantic coast. The incidence of vector-borne diseases such as malaria, dengue fever, and Lyme disease are predicted to occur into Northern latitudes where they were not previously experienced. We are particularly concerned with the projected impacts of global warming on U.S. agriculture.

It is against this backdrop that the environmental community reacted with alarm and grave concern at the abrupt and unilateral actions of the Bush Administration, just months into taking office, on both domestic and international climate change policy. President Bush's decision on March 13, 2001 to abandon his campaign pledge of requiring mandatory reductions of carbon dioxide emissions from power plants dealt a critical blow to a credible domestic policy on climate change. Power plants are responsible for 40 percent of U.S. greenhouse gas emissions (and 10 percent of international greenhouse gas emissions), and policies to address what is perhaps the greatest industrial source of greenhouse gases in this country are imperative to addressing the problem.

Recognizing both the science and the impacts of global warming, senior representatives of the utility industry, in concert with members of the environmental community, were engaged in a dialog about cutting carbon dioxide from power plants, prior to the President's devastating announcement. The utility sector recognizes, as does most of the country, that climate change is a real phenomenon with human causality and profound potential consequences—and that domestic policies must be enacted to begin to deal with climate change now. The utility industry, much of which faces significant capital investments in the near future, is cognizant that policies and directions are needed now to begin to address carbon dioxide emissions over the long term. Utilities were engaged in discussions on this issue because they are looking for the regulatory certainty that multi-pollutant power plant legislation would bring—that is, legislation that seeks reductions in multiple pollutants, at the same time, rather than via piecemeal approaches. This legislation would allow the utility sector to make long-term investment strategies with the knowledge that they would not face new, unexpected, and costly regulatory and investment hurdles down the road.

Because the Administration has chosen not to honor this campaign commitment, and because they are prepared to introduce energy legislation that would continue U.S. dependence upon the dirtiest fossil fuels, we believe it is imperative that the Congress, and this committee specifically, move forward with legislation on a comprehensive, multi-pollutant bill to reduce emissions of the power plant pollutants of mercury, nitrogen oxides, and carbon dioxide.

On the international policy front, we are distressed at the Bush Administration's unilateral decision to abandon the the Kyoto Protocol, an agreement that has been years in the making and that has engendered the cooperative participation of 165 countries in a complex negotiating process. We strongly urge the Administration to carefully consider the hard-fought wins in the Kyoto Protocol—especially the market-based flexible mechanisms in the Kyoto Framework—mechanisms that would keep the costs of compliance and implementation of the treaty as low as possible. These mechanisms are perhaps the most important part of the framework, aside from the binding targets and timetables.

The flexible mechanisms in the Kyoto Treaty include emissions trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI). The common feature of these mechanisms is that they would achieve real emissions reductions in the most cost-effective places and manners. In particular, these mechanisms offer the ability for countries such as the U.S. to export clean technologies that reduce global greenhouse gas emissions but allow share in the 'credits' or benefits.

Joint Implementation would allow industrialized countries to jointly agree to a project undertaken in one country, for which the other takes the initiative, and hence receives credits. This would allow for the sharing of benefits or activities that one country has either the resources or technologies for that another does not, but for which real emissions reductions are achieved. The CDM is similar to JI, but would allow an industrialized country to undertake a project or activity in a developing country, also to result in real emissions reductions, with prearranged agreement as to how the credits would be shared by the two countries. Emissions trading is a mechanism akin to the trading of sulfur dioxide credits under the domestic sulfur dioxide ("acid rain") program. It operates based upon a cap-and-trade premise, whereby an upper level amount, or cap, is established for the amount of pollutants that can be emitted in a certain area (for instance, the entire United States), and entities within that area that emit those pollutants can share or trade pollutant credits. This enables the involved entities to seek the lowest-cost, 'easiest' reductions first, thus keeping the costs down while also 'buying' time for the harder reductions, which will conceivably occur later, but which will have the benefit of new technologies that can be developed in the interim.

In both the domestic and the international arenas, we would also like to point out that voluntary approaches, while they may be useful in some situations to deal with environmental issues, have failed to deal with the problem of climate change. The 1992 United Nations Framework Convention on Climate Change (UNFCCC), unanimously passed by the U.S. Senate and ratified during the first Bush Administration, has failed to cut greenhouse gas emissions. That treaty obligated this country and others to voluntarily reduce our emissions of greenhouse gases to 1990 levels by 2000. Instead, United States emissions' of greenhouse gases were 13 percent above 1990 levels in 2000, and they continue to rise. The Kyoto Protocol was negotiated by the world community in response to the failure of the voluntary approach of the UNFCCC. Binding targets and timetables are essential tools to help this country and other industrialized nations begin to grapple with the choices and policies that will reduce atmospheric concentrations of greenhouse gases to the point where they are stabilized and even reduced.

As evidenced by the testimony of witnesses today, and of many others in the energy sector, there are many tried and true policies that we can enact today to begin to address climate change on a domestic and international basis.

In particular, NET supports the following policies:

- Completion of a binding international agreement to cut emissions of the six major greenhouse gases.
- Advancement of domestic policies to use fossil fuel reserves more efficiently, particularly with regards to electricity generation, transportation, and buildings.
- Passage of a national Renewable Portfolio Standard that would allow consumers to choose the source of their electricity.
- Passage of a comprehensive bill to cut the four major pollutants emitted from coal-fired power plants (NOx, SOx, mercury and carbon dioxide).

In summary, we have watched with great interest and concern the evolution of this topic in the Congress over the past several years. We are gratified that the debate in this arena has moved from one of questioning the science and the collective wisdom of international, multidisciplinary scientists to one where we are seeking real, near-and longer-term solutions to what is probably the greatest environmental issue facing this country, and the world.

STATEMENT OF JOHN W. CLARK, SENIOR VICE PRESIDENT FOR GOVERNMENTAL AND PUBLIC AFFAIRS, CMS ENERGY CORPORATION

Mr. Chairman, I am. John W. Clark, Senior Vice President of CMS Energy. We appreciate being given an opportunity to provide testimony on this important matter. CMS Energy is an integrated energy company with annual sales of $11 billion and assets of about $16 billion throughout the U.S. and in selected foreign markets, with businesses in electric and natural gas utility operations; independent power production; natural gas pipelines, gathering, processing and storage; oil and gas exploration and production; and energy marketing, services and trading.

A quick reading of nearly every major news publication on any given day reveals the extent to which the interplay between U.S. energy security, environmental policy, and the economy at large has risen to the top of the national agenda. CMS Energy commends the Committee for its leadership in examining a particularly critical element of the debate: whether and how voluntary efforts to reduce pollutants and other emissions, including CO_2 emissions, can be effective, and what needs to be done to establish the framework for putting them into place.

We believe CMS Energy is an industry leader and well credentialed in this area through its successful effort to establish one of the world's largest climate change mitigation projects.

That effort, the Atlantic Methanol Production Company (AMPCO) on Bioko Island in Equatorial Guinea just off the coast of West Africa, is particularly innovative. As CMS began drilling and extracting liquids and condensate from its oil and gas operations in Equatorial Guinea, one of the by-products was an extraordinary amount of residue, or excess dry gas for which there was no market. Consequently, and in fill compliance with local laws and environmental regulations, we began to flare that gas in order to ensure its disposal.

That struck the company as both a waste of potentially valuable resources and as unnecessarily harmful to the environment. Determined to find a productive use for the gas, CMS decided to convert the gas into methanol for trading in the world market, thus giving rise to the AMPCO project. At the same time, we knew that there would be substantial benefit to the environment—the gas is flared at a rate of up to 135 million cubic feet per day, or enough to fuel a 500 MW power plant. Since methanol, like any commodity, is subject to price volatility, we began to explore the prospects for gaining recognition for AMPCO's substantial emissions reductions and materializing economic benefit from them, Over time, those reductions could help sustain the project's economics, so there was a clear market-based incentive for us to pursue the effort.

CMS Energy's Experience with the USIJI Program

That effort led the company to initiate a proposal to the U.S. Initiative on Joint Implementation, which is a pilot program established pursuant to the U.N. Framework Convention on Climate Change, or the Rio Treaty. While it is a global program, the USIJI is administered within the United States by an interagency panel, which includes among others the Departments of Energy, State and Commerce and the U.S. Environmental Protection Agency. After nearly a year's worth of discussions and after providing volumes of data and information to the USIJI staff, the AMPCO project was accepted into the program earlier this year. USIJI estimates

that the elimination of the flared gas will result in reductions of nearly 3 million metric tons per year of CO_2-equivalent emissions, or nearly 75 million metric tons throughout the project's estimated 25-year lifespan. These reductions will be verified as the plant goes operational by an independent third party. The volume of reductions is the largest that USIJI has approved for an existing project.

There were significant residual benefits in our effort to gain acceptance for AMPCO into the USIJI program. Equatorial Guinea, which until then had chosen not to accede to the Rio Treaty, was induced to sign the treaty and thus became more filly integrated in the global environmental regime solely because of this project. And as a partner in the project, Equatorial Guinea emerges in a truly win-win position: it gains all of the benefits of the initial investment, it grows its economy, it gains valuable technology and knowledge transfer, and it will share in the economic benefits that will accrue through trading and monetizing emissions reductions.

Policy Implications

CMS Energy believes that its experience with the USIJI program can offer some valuable insights to the Committee's efforts. Applying the knowledge and lessons we've learned from AMPCO's acceptance into the USIJI, we believe that a serious, well designed effort to establish a voluntary emissions reduction program, coupled with a rigorous, market-based emissions trading effort, can provide companies with a sound economic rationale to undertake and sustain substantial reductions of greenhouse gas emissions, including CO_2. For the program to be effective, it would need to have a balanced mix between the types of voluntary commitments that industry would make, and the incentives that would provided in exchange for the implementation of those commitments. It would also need to allow flexibility in the types of mechanisms that companies can use to comply.

CMS Energy believes that there would be multiple benefits to flow from the adoption of such a program. First and foremost, there would be substantial enthusiasm from companies such as CMS to participate, which would result in commensurately high levels of emissions reduced. Second, if properly designed, the program would provide economic incentives in proportion to the commitment that companies undertake to reduce their emissions. Accordingly, as the program succeeds it will induce companies to expand their own commitments, and demonstrate to skeptics the value of participation. Third, the program would demonstrate to America's international partners and allies that there are effective, market-friendly and verifiable ways to reduce emissions that do not require the adoption of a mandatory, command-and-control regime such as the Kyoto Protocol in its present form. Indeed, if a voluntary program succeeds and matures in ways that we believe it is capable of, it could well help to reshape the debate in the international community on how to address collectively climate change issues. Last, the successful implementation of a voluntary, market-based program would accomplish its objective of reducing emissions without inspiring the principal concern that many in the Congress and private sector have expressed about the Kyoto Protocol: that compliance would do irreparable harm to the U.S. economy.

Practical Considerations

Moving for a moment from the theoretical, allow me to offer some practical considerations about how such program would work and what might hinder it. Say for example that CMS Energy committed to a newly established voluntary program. The questions that arise immediately are how to establish a baseline, what volume of reductions to commit to, how to begin implementing that commitment, and how to account for natural growth in demand.

One of the attractive features of the AMPCO project for its acceptance into the USIJI program was the ease with which we could establish the baseline emissions and measure the reductions. It was a relatively simple proposition: the flare was there, and with the project in place it would be extinguished, and the reductions would be calculated on the difference. Calculating the baseline and levels of reductions from other emissions projects can be far more complicated, however, depending on what type of project is under consideration. It can be quite confusing to establish baselines and determine resulting reductions for efforts such as fuel switching, replacing old or inefficient equipment, recovering or reinjecting vented or flared gas, repairing gas leaks, or implementing demand-side management efforts. Efforts such as these are extremely useful and should be recognized in any voluntary program, but clear and specific guidelines will be needed to provide companies with a sufficient level of comfort and assurance that they will be justified in making the expense to implement them.

CMS Energy has undertaken a very preliminary analysis of its current and projected emissions of CO_2 equivalent from 2000 –2005. Specifically, we've looked at two alternative views of the company's future starting from the same point—our current level of CO_2 equivalent emissions. One view shows a fairly sharp growth in emissions based on what would happen if we proceed with business as usual. Another view shows a far more gradual growth of emissions based on what would happen with an aggressive effort to institute a number of improvements, upgrades, and applications of new technologies to a variety of our existing and planned projects. Assuming we had the economic incentive through a voluntary program to implement these efforts, we can obtain significant reductions of CO_2 equivalent reductions by 2005.

An important fact that emerged from our analysis is that both views of our future showed growth in total emissions—with one alternative growing at a sharper rate than the other. This reflects the fact that there will always be natural growth in demand. Accordingly, it is eminently clear that any voluntary program will have to account—and not penalize companies—for normal growth. Without such an allowance, a voluntary program would be predicated on the totally unrealistic assumption that the US economy and resulting electricity demand would remain flat, and would make it more difficult and less attractive for companies to participate.

If companies could be rewarded along the way with a clear set of incentives for implementing commitments, they would have both a road map and an economic justification for achieving substantial amounts of emissions reductions. Moreover, as companies exceed their commitments, they should be able to market their excess reductions to other participating companies that anticipate shortfalls, That creates an additional incentive for companies to cut emissions aggressively, and a disincentive for others to fail to meet their commitments. It also facilitates the development of a robust trading market, which can be expanded to include international projects and purchasers.

A CO_2 emissions trading market is already in its infancy. CMS Energy, for instance, has reached preliminary agreements with a foreign company for the sale of a parcel of AMPCO's emissions reductions, at a price that suggests the potential for real value for the reductions. Our experience is emblematic of an evident willingness of foreign companies to purchase emissions reductions from the United States. But the existing market is illiquid, transactions involve a great deal of risk for both buyers and sellers, and the process is beset with a great deal of uncertainty stemming from the lack of clear rules and definitions. A voluntary emissions reduction program that facilitates and rewards emissions trading, and provides clear rules on baselines, eligibility of projects, measurement of reductions, and flexibility for companies to meet commitments would allow the emerging marketplace to flourish.

Recommendations

The practical considerations that I have mentioned form the basis for CMS Energy's recommendations for a voluntary emissions reduction program. Some of the recommendations are obvious and have been touched upon in my testimony, but I will conclude with a comprehensive list:

- First, the program must be voluntary. Command and control regimes are inefficient, costly, politically untenable, and have the potential to do grave economic harm to the United States.
- Second, the program needs to offer clear guidelines to companies about how to formulate their corporate-wide CO_2 equivalent emissions baselines—what can and cannot be counted in terms of their emissions—as well as project-level baselines for greenhouse gas emissions.
- Third, the program needs to offer precise rules about what projects are eligible and what constitutes and qualifies as a reduction. Companies will be discouraged from making major capital expenditures to upgrade existing operations or reconfigure new ones to obtain greater emissions reductions if they are uncertain the reductions will be recognized. Obviously, to improve prospects for success, as broad a range of acceptable projects and activities as possible should be encouraged. We believe the existing USIJI process and the DOE's 1605(b) program respectively offer a good basis from which to construct a framework for evaluating and implementing international and domestic projects, and for establishing which existing projects should be "grandfathered" into the new program. Both programs, however, would need to be refined dramatically and their rules made more specific and transparent to eliminate uncertainties and bureaucratic inefficiencies. On the other hand, we believe that reforming the USIJI and 1605(b) programs does not require legislation.
- Fourth, in order to be credible the program requires monitoring and verification, which also has the potential to add costs. These costs must be reasonable or the program becomes self-defeating.

- Fifth, in measuring reductions from the baseline, the program must account for growth in demand. There may be several ways to provide such an accounting, such as establishing an allowance for increased demand as companies commit to gross levels of reductions, or by structuring the program so that they commit to a better standard of efficiency like achieving lower CO_2 emissions per kilowatt-hour.
- Sixth, the program should rely on a rigorous, well-defined emissions trading program. The trading effort should be equally clear as the program itself on definitions of acceptable reductions for trades and should establish transparent rules for ownership and/or title to reductions, for allowing transferability (secondary, tertiary, and ongoing trades), for allowing portability (the ability of companies to take their reductions with them as they withdraw from projects, or sell them to new buyers as they enter). To ensure maximum flexibility and effectiveness, the trading effort must permit the use of credits and offsets generated by domestic and overseas projects of American companies and encourage the participation of foreign buyers.
- Lastly, and perhaps most importantly, the incentives must be significant and increase proportionally as companies establish and make progress in implementing their voluntary commitments. Fundamentally, the program must offer an economic rationale to be effective and encourage fill implementation. The list of possible incentives is large and need not be debated here, but for illustrative purposes can include tax relief, reform of the New Source Review rules, protection from further mandatory emissions reductions during the compliance period, and baseline protection or fill credit for past reductions in the event of the adoption of a mandatory regime. Not only will these types of incentives encourage success, they will also create a platform to provide value to the reductions and thereby facilitate an emissions trading regime.

Mr. Chairman, thank you for the opportunity to present these views.

CLEAN AIR ACT OVERSIGHT ISSUES

WEDNESDAY, AUGUST 1, 2001

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 9:01 a.m. in room 406, Senate Dirksen Building, Hon. James M. Jeffords (chairman of the committee) presiding.

IMPACT OF AIR EMISSIONS FROM THE TRANSPORTATION SECTOR

Present: Senators Jeffords, Lieberman, Inhofe, Chafee, Carper, Clinton, Corzine, and Voinovich.

OPENING STATEMENT OF HON. JAMES M. JEFFORDS, U.S. SENATOR FROM THE STATE OF VERMONT

Senator JEFFORDS. The hearing will come to order.

Last week, this committee learned about the impact of power plant emissions on public health and environment. Today, we will take a similar look at the transportation sector and after the recess will take a look at our industrial sources. That will complete a broad survey of the impacts of energy use on society.

Before I start my opening statement, I would like to ask Senators and witnesses to try to keep their opening statements to 5 minutes. I will certainly try to keep that rule. We are covering a sizable topic this morning and will need to keep things moving. Also, several members have committee duties elsewhere, so there may be a fair amount of coming and going. Witnesses shouldn't let that distract them. As usual, any additional written material that Senators or witnesses may have can be entered into the record.

America and its political leaders are committed to clean air. Improved air quality results in healthier, longer lives for our citizens, clean air, ecosystems, more abundant crops and a stronger economy. Transportation is one of the main drivers of that economy. Transportation touches every aspect of our lives. Our transportation system is one of the most advanced in the world and is truly the foundation of our strong economy. Even the most advanced system can be improved. With American ingenuity and technology, and with little additional cost, we can create new engines that are equally as powerful but far less polluting. Our goal today is to ensure that our Federal Government is doing all it can to create a cleaner, more efficient and less polluting transportation system for the nation.

Earlier this week, the National Academy of Sciences released a report on corporate average fuel economy or CAFE standards. The report is helpful but it tells us what we already know, improving fuel efficiency can save consumers money, cut greenhouse gas emissions, and reduce our dependence on oil. That's no surprise.

The report also said that market forces alone aren't going to make these things happen. That is why I believe that the Federal leadership must pull technology in an experimentally sound direction. As many of you know, I am not too pleased with the Administration's policy on climate change. An entirely voluntary and unilateral approach is not the best route. It won't get us far enough, fast enough.

The report also suggests that our current approach with CAFE hasn't been effective. The average fuel efficiency of all the vehicles has remained more or less flat for 15 years. In this same time, greenhouse gas emissions from the sector have risen 12 percent over the 1990 levels. We may need a new approach to fuel economy if we can't fix CAFE and increase these standards substantially. There are just too many negative environmental problems from wasting energy, including global warming.

The Clean Air Act allows carbon dioxide from vehicles to be regulated as a pollutant. Clearly the potential impacts of carbon on the environment and public health are enormous. Perhaps this committee should consider a national cap and trade program for carbon emissions from the transportation sector. That might be a more effective way to stimulate innovation and less carbon intensive fuel inefficiency.

I have tried for many years to encourage cleaner fuels in vehicles. During the debate on the Energy Policy Act of 1992, I offered a successful amendment to require certain levels of alternative fuel production. That amendment came back from conference saying the Department of Energy "may" require alternative fuels production instead of the "shall" that was in my amendment. Had that amendment survived, we might be worrying less about greenhouse gas emissions and other pollution today.

According to EPA's Green Vehicle Guide, while good fuel efficiency does not necessarily mean clean emissions, a car that burns less fuel, generally pollutes less. That would make sense. It could also cost the manufacturers less in the amount of precious metals necessary for catalysts.

We shouldn't just focus on cars. Passenger cars have been getting cleaner and they will get even cleaner as a result of the recent rules on emissions and low sulfur fuel. Trucks and nonroad sources have a long way to go. EPA has moved slowly to set standards for these nonroad sources like airplanes, locomotives, marine diesel and recreational engines. These sources are a growing part of the many areas pollution problem. Approximately 120 million people still live in areas that don't meet the national standards for ozone and carbon monoxide. These pollutants and fine particulates are partly due to emissions from the transportation sector. They are also associated with asthma and other illnesses.

A study published earlier this year in the Journal of the American Medical Association by a group of doctors found something interesting and distressing about the link between pollution and

asthma. The Olympic Committee in Atlanta made great efforts to reduce traffic congestion during the 1996 Games. Increased use of transit and telecommuting cut traffic and emissions significantly. Doctors found a corresponding reduction in the rate of childhood asthma events. The morals of that story are that the cars have to get still cleaner and a better transit system can help prevent pollution.

I want to touch on the subject of toxic air pollutants from mobil sources before I turn to the next speaker. The Clean Air Act amendments of 1990 directed EPA to issue a rule to control toxic air pollutants that most the greatest risk to human health or about which significant uncertainties remain. Last year, EPA finally issued its rule. It simply said these toxics must not increase beyond the averages of 1998–2000 levels, with future regulation to be set in 2004.

In 1998, the entire transportation sector was responsible for emitting 2.3 million tons or 4.6 billion pounds of toxic air pollutants such as benzene and 20 other hazardous chemicals. Some are known as probable carcinogens.

I hope you can see why I think the EPA's rule is not adequate to protect public health. Instead, EPA should have heeded the words of George Perkins Marsh, a great per mater and environmentalist. He said, "We are never justified in assuming a forest to be insignificant because it measures our unknown or even because no physical effect can now be traced to its origin." Marsh believed that we have a responsibility and the ability to help solve the problems we create. We all have to think ahead and shape our society to protect our children and environment from essential harm, even when there isn't perfect proof. We must strengthen CAFE standards, reduce the vehicle contributions of carbon to the atmosphere and cut emissions that undermine human health. I am hopeful that this morning's witnesses will give us some ideas on how to meet these challenges.

Before I recognize the next speaker, I would like to remind all members that we are to have a business meeting today in S–211 in the Capitol after the first vote to consider six pending nominations. I encourage all Senators to attend.

Senator Lieberman?

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. Thanks for convening this series of hearings on the impact of various sectors of our country on public health and the environment. I regret that I could not be at the hearing last week on the emissions from the utility sector but I am pleased to be here for a while this morning.

I know you have been planning this hearing for some time but as I believe you may have indicated, the time could not be better in light of the National Academy of Sciences long awaited report on fuel efficiency standards that was issued on Monday. I've read the accounts of the report with great interest and have been particularly struck by the statement that technologies exist according to the National Academy of Sciences that "could improve fuel efficiency in cars and in light trucks by 20 to 40 percent over the next

10 to 15 years." Once you figure in the fuel savings, this can be done without any real additional cost to the consumers. In addition, I think the report notes memorably that "It is appropriate for the Federal Government to ensure fuel economy levels beyond those expected to result from market forces alone."

This morning, we are going to hear about the environmental consequences of emissions from cars, trucks and other types of gasoline-powered vehicles, much of which would be mitigated if our vehicles didn't guzzle so much gasoline. For instance, in looking over the testimony to be given today, I was particularly impressed by the statements about the health impacts of the mobil source toxics and smog causing pollutants.

If we raise our fuel efficiency standards to 40 miles per gallon by the year 2012, already the standard at which Japan is aiming, we would reduce our nation's emissions by 148 million pounds of toxics and 320 million pounds of smog-causing hydrocarbons and nitrogen oxides. That would represent a 16 percent decrease in each of those emissions. I'm not explicitly proposing that this be our target, but the fact that Japan is looking at it tells us something about its viability.

I think we have to acknowledge also the contribution of these emissions to global warming. That is why I'm particularly pleased that you've convened this series of hearings, Mr. Chairman. Faced with what is now a failure of leadership from the White House on the critical issue of climate change, I think it really becomes Congress' responsibility to get America back in the battle against global warming with a program of credible domestic action.

Fuel efficiency standards are clearly part of such a program because the transportation sector represents about 30 percent of our nation's greenhouse gas emissions and about 8 percent of the world's. America's transportation sector produces about 8 percent of the world's greenhouse gas emissions.

A final word that is related, which that the energy we consume in our automobiles, particularly the gasoline obviously, carries another environmental cost and that is the cost of the increased production that results from increased demand. In the House of Representatives today, there apparently will be a vote on President Bush's proposal to drill for oil in the Arctic National Wildlife Refuge. When many of my colleagues sponsored legislation in the Senate to prevent such drilling and to declare the Refuge the permanent reserve it ought to be, those who opposed this bill stressed the need to bring oil to the market to satisfy the demand of American drivers but doesn't it make more sense to meet that demand with more fuel efficient vehicles than by despoiling one of America's great natural treasures? I think so.

I'm encouraged as I look at the testimony to be delivered today that Mr. Dana of the Automobile Manufacturers Association has endorsed the approach found in the Clear Act, a measure introduced by Senator Hatch, that I co-sponsored, that would create tax incentives for the purchase of alternative fuel and hybrid vehicles. I hope that we can find more and better ways like the Clear Act to shift our automobile fleets in a manner that reduces our emissions.

Again, I thank you for your leadership here. I think you give all of us here in Congress an outside hope that Congress will take the initiative on cleaning up air pollution and in dealing with the problem of climate change. I look forward to the testimony of the excellent group of witnesses we are privileged to have before us today.

Thank you.

Senator JEFFORDS. Thank you very much, Senator.

We now have Mr. Rob Brenner, Acting Assistant Administrator for Air and Radiation, U.S. Environmental Protection Agency here in Washington, DC. Please proceed.

STATEMENT OF ROB BRENNER, ACTING ASSISTANT ADMINISTRATOR, AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. BRENNER. Chairman Jeffords and Senator Lieberman, thank you for this opportunity to discuss one of the cornerstones of EPA's Air Quality Management Program, our work to reduce air pollution from mobil sources. Through initiatives ranging from the first tailpipe standards in the mid–1970's to the voluntary diesel, truck and bus retrofits announced earlier this year, this important program has brought healthier air to millions of Americans across the country. Combined the health benefits of these efforts are enormous.

Our Tier II passenger vehicle standards alone will prevent more than 4,000 premature deaths each year, along with tens of thousands of respiratory illnesses. The benefits from our new diesel standards will be even greater. We have more work ahead of us, however, and I will discuss that during the next few minutes. With your permission, Mr. Chairman, I would also like to submit a longer statement for the record.

Senator JEFFORDS. You certainly can.

Mr. BRENNER. Cars, trucks and buses give Americans the mobility we grave and that has come to define us as a society. These same sources that give us so much freedom also create pollution that poses significant environmental and public health risks. Mobil sources are major contributors of harmful nitrogen oxides, carbon monoxide, volatile organic compounds and particulate matter. We've made tremendous progress in reducing mobil pollution since Congress passed the 1970 Clean Air Act. In 1975, our first automobile tailpipe standards allowed NOx emissions of 3.1 grams per mile.

Today the emissions allowed are less than 140th of that amount, making cars significantly cleaner. New trucks and buses will be more than 90 percent cleaner than current models starting in 2007. Our on highway and mobil source programs will reduce emissions of 21 mobil source toxics from nearly 1 million tons or 40 percent between 1996 and 2007.

We have made this progress by selecting the right combination of tools for each task. For example, we recognize fuels and vehicles operate as a system and that effective regulations must address both components. By requiring significant sulfur reductions in gasoline and diesel fuels, we enable vehicle manufacturers to achieve large reductions in tailpipe emissions. In our recent diesel rule, EPA set performance standards for buses and trucks but we allowed manufacturers to meet those standards using market-based

mechanisms such as banking and trading. At the same time, we recognized it is important to look for ways to reduce harmful emissions from diesel buses and trucks that are on the road today, so we developed a voluntary retrofit program in partnership with business, municipalities and emission control manufacturers. We are already more than halfway toward meeting our goal of retrofitting 100,000 diesel vehicles this year. We anticipate using similar combinations of tools to meet future challenges.

No matter what the task, one goal will remain constant, to continue to reduce pollution from mobil sources and seek energy efficiency while the U.S. population and economy grow and or demand for mobility continues. Our remaining priorities include implementing the new truck and passenger vehicle standards, setting new standards for off-road vehicles and developing initiatives such as the commuter choice program and the green vehicle website to encourage transportation efficiency and reduce congestion. To meet these priorities we will continue to use a variety of tools from performance-based emission standards to partnership-based voluntary programs and will use the valuable lessons we have learned as the mobil source program has evolved.

I remain optimistic that we can continue to work together to accomplish many of our goals. Many of you no doubt remember the heated debates in the early years of automobile tailpipe standards. Each time a new standard was discussed, there was tremendous controversy but this committee continued to support our pollution reduction goals and industry, despite its initial reluctance, used ingenuity to meet them often sooner and at lower cost than originally estimated.

The process of developing those standards has come a long way. As we were developing the Tier II passenger vehicle standard last year, the automobile manufacturers willingly came to the table and worked constructively with EPA, the States and other stakeholders. Although I realize that such cooperative efforts won't always be possible, we value industry's insights. With their help and the continued guidance of this committee, we can continue to reduce mobil source pollution and make great strides in protecting the health of the American public.

Thank you and I'd be happy to answer any questions you might have.

Senator JEFFORDS. Thank you.

I'd like to allow Senator Inhofe to make a statement because I know he has another important commitment.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Thank you, Mr. Chairman.

That is a problem and I know it is one that is difficult to deal with but I want everyone here to know and the members of this committee, every committee and subcommittee hearing we have had in this committee this year has coincided exactly with an Armed Services Committee hearing. It is a difficult thing to deal with, I know. I hope we will be able to do that and I know Senator Lieberman has the same problem I do. We have to be there, we have probably the next Chief of the Air Force and his nomination

hearing is very significant. Senator Smith is not here because he is there. Senator Warner is not here because he is down there.

To me, this hearing is very significant. Having served as Chairman of the Clean Air Committee as well as the Transportation Committee, I feel you really need to be in the middle of this but I wanted to get that in the record. Perhaps we can work together with that committee and figure a way.

Senator JEFFORDS. We will try to do that and I appreciate your being here. Please proceed.

Senator INHOFE. Let me do an opening statement because I won't be able to stay.

In a recent report entitled, "U.S. Downstream, the EPA takes another bite out of America's steel supply," Merrill Lynch concluded that EPA's clean air regulations will clearly have the impact of reducing existing U.S. refinery capacity. The reduction in refinery capacity predicted by Merrill Lynch is the result of poorly thought out and implemented regulations. We had a chart we used at one time that showed this. Congress and the executive branch must also do a better job in understanding how these various layers of regulation impact our industry.

For example, right now, during the time many of these rules came on line, we were at 100 percent refinery capacity. If you're at 100 percent refinery capacity and get hit with a number of regulations, such as Tier II and sulfur, diesel rules, it's going to aggravate that problem and the people who are going to pay for that are the people who can afford it the least. In the near future there will be some real opportunities to rethink how to balance our energy and environment needs, for example, the upcoming Administration review of the heavy duty sulfur-diesel regulation.

I hope the environmental goals of this regulation—I support the environmental goals but have serious concerns about the impacts this regulation will have on rural America and specifically in rural Oklahoma. The Farm Bureau and the Farmers Union were all in town during the consideration of the Farm bill. They consider this to be more significant than many of the other things we talked about.

Let us not forget, when the price of energy rises, it means the less fortunate in our society must make a decision between keeping the heat and lights on and paying for other essential needs. Again, I am supportive of the environmental goals of clean air regulations but we owe the American public a full and fair evaluation of any regulations that will affect fuel supplies as well as the consequences of regulations on meeting the difficult emission standards. As the President has said, "Just as we conduct environmental impact assessments, we must think about assessing the energy impact of regulatory programs."

Finally, on the CAFE standards, in a recent article entitled, "Why Governments Phase Standards for Fuel Efficiency Should Be Repealed, not Increased," Mrs. Charlie Koontz states, "The CAFE Program has failed to accomplish its purposes. Oil imports have not decreased; in fact, they have increased from about 35 percent of supply in the mid–1970's to 56 percent today. Likewise, consumption has not decreased. As fuel efficiency improves, consumers have generally increased their driving offsetting nearly all the

gains in fuel efficiency. Not only has the CAFE Program failed to meet its goals, it has had tragic even if unintended consequences. As vehicles were being made lighter to achieve more miles per gallon and meet the standards, the number of fatalities from crashes rose. We need to carefully examine these issues before going forward with any expansion of the CAFE standards."

As the ranking member of the Transportation Subcommittee I also have concerns about the nexus between environment, energy and transportation policies which I really wanted to get into in the course of this hearing but will not be able to do it because I won't be able to stay.

Thank you, Mr. Chairman, for allowing me to come out of order.

Senator JEFFORDS. You're quite welcome.

Senator Chafee, do you have an opening statement?

OPENING STATEMENT OF HON. LINCOLN CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator CHAFEE. Yes. I would like to thank you for holding this hearing. I do believe examining mobile sources of emissions is an important step for the committee as we identify impediments to our clean air goals. In determining the best methods for reaching these goals, we must consider the impact of automobiles and other mobile sources. I believe this hearing will shed some light on some serious problems and hopefully an equal number of solutions.

It is vital to our nation's environment and economy that America leads the way in a fight to reduce emissions from the transportation sector. I believe if Congress raises CAFE standards, technology will be developed to meet those standards. If Congress provides financial incentives to produce new vehicle technologies and alternative fuels, ingenuity will prevail, and the technology will be developed. Our economy will not suffer and if history repeats itself, the United States will become the leader in the field. Jobs will be created to manufacture the new technologies and will export the new technologies around the world. I believe it will be a potential boon to our economy.

Thank you and I look forward to the testimony.

Senator JEFFORDS. Senator Carper?

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thank you for holding the hearings and to our witnesses, welcome. We are delighted that you are here.

I want to begin by expressing my gratitude for the scheduling later today of votes on a number of nominees for positions within EPA. I know Administrator Whitman appreciates that as well.

I also serve, as some of you, on the Energy Committee and we have been in the throes of a host of hearings on how to conserve energy. Some of you sitting on this panel have authored legislation which is going to be very helpful as we seek to conserve our energy resources in the years to come.

I would observe that today in the United States, over half the oil that we use comes from sources outside the United States, some of it controlled by people who don't like us very much. As we seek to find ways to use less energy, it is imperative that we keep in mind

that over half the oil we consume, we consume in our cars, trucks, vans and SUVs.

I am one who actually believes that part of the solution is producing more energy, natural gas and oil, nuclear, solar, wind and geothermal, hydroelectric but at the same time, it is imperative that we find ways to conserve energy. Since we use so much of it in the vehicles we drive, that is obviously a good place to start.

I am much encouraged by the technology being developed that actually finds its way onto the roads of our country in hybrid vehicles, in the fuel cell vehicles being developed and I would add there is very good technology being used in Europe on diesel, a highly efficient diesel engine that we need to be mindful of to see how we can learn from those works as well.

Again, thanks for holding this hearing and to our witnesses, welcome. We look forward to hearing from you.

Senator JEFFORDS. Senator Corzine?

OPENING STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator CORZINE. Thank you. I will be brief and say that I think this series of hearings you are holding with regard to pollution of a whole series of economic sectors is important. The transportation sector is probably as important as any. We have 18 or 21 counties in the State I represent not meeting the ozone standards. There is an enormous amount of thoughtful work being done with regard to controlling air pollution through auto vehicles and fuel efficiency as a side benefit which I think are absolutely essential for us to deal with. The whole subject of how we utilize mass transit, particularly in the northeast corridor in the most densely populated State in the country without a mass transit system couldn't be a more important issue, both with regard to energy and air pollution.

I think this hearing is a tremendous step in making sure we understand all the various factors. I appreciate the witnesses' help and also the expeditious nature with which you are dealing with the appointments the President has put forward.

I look forward to participating in the hearing. I have a full statement for the record.

Senator JEFFORDS. Full statements will be entered in the record.

[The prepared statement of Senator Corzine follows:]

STATEMENT OF HON. JON S. CORZINE, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Thank you, Mr. Chairman. I want to thank you for holding this hearing on the environmental and health impacts of the transportation sector.

Mr. Chairman, air pollution is a serious problem in New Jersey. Take ground-level ozone, known as smog, for example. As of July 29, nine areas in New Jersey had logged a total of 14 exceedances of the current "1-hour" standard for ozone this year. That number increases to 114 exceedances if you use the "8-hour" standard that will be phased in. So we continue to have a serious problem with smog in New Jersey, to say nothing of airborne toxics and other problems.

Mr. Chairman, although some of our air pollution comes from out of State, much of it is generated within our borders. New Jersey is the most densely populated State in the nation. It is also a major transportation corridor for traffic moving up and down the east coast. Put these factors together, and you have millions of cars and trucks moving along New Jersey roads each day. In 1999, more than 213 million vehicles traveled a total of more than 5 billion miles on the New Jersey Turnpike alone. So it's clear that in spite of the progress we have made in cleaning up

cars, a major part of the solution to New Jersey's air pollution lies in the transportation sector.

And we have made progress, Mr. Chairman. I don't want to minimize that fact. Today's cars are 90 percent cleaner than in 1970. We are poised to make further progress with the phase in of EPA's so-called "Tier 2" standards beginning in 2004. These standards will result in cleaner cars and cleaner fuels, and will close the loophole that currently allows the increasingly popular sports utility vehicles to meet dramatically lower emissions standards than cars.

But in spite of our progress, many challenges remain. Emissions of carcinogenic air toxics, such as benzene, continue to be a problem. Emissions of carbon dioxide have continued to rise over the last 30 years, to the point where the American transportation sector accounts for about 8 percent of the world's greenhouse gas emissions.

So we need to continue to focus on ways to improve the environmental performance of our transportation system. With respect to climate change, I want to echo my colleagues in highlighting the findings released earlier this week by the National Research Council. This report concluded that there are cost-effective ways to increase vehicle fuel economy standards over the next 10 to 15 years without compromising performance or safety. Increasing fuel economy would reduce both greenhouse gases and our dependence on foreign oil. Congress should act on these findings and modify the Corporate Average Fuel Economy standards to require increases in fuel economy.

I think we also need to improve our mass transit systems. In New Jersey, we have two light rail projects that are just getting underway—the Hudson-Bergen rail and the Newark-Elizabeth rail. When these systems come on line, it will take cars off the road and reduce pollution. I think it's essential that we continue to invest in Amtrak.

Looking beyond the technologies of today, I am encouraged by the prospect of next-generation technologies such as fuel cells, that offer the potential for huge gains in energy efficiency and huge reductions in pollution. New Jersey companies are working hard to develop and commercialize these technologies. But I think the Federal Government should do what it can to speed the development of this promising technology.

With that, I conclude my remarks and look forward to the testimony of today's witnesses.

Senator JEFFORDS. Senator Clinton?

OPENING STATEMENT OF HON. HILLARY RODHAM CLINTON, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator CLINTON. I wanted to begin to thank our witnesses. I won't be able to stay for all of the testimony because of another committee but I want to thank Mr. Brenner and I particularly want to welcome Mr. Omar Freilla from the New York City Environmental Justice Alliance. I thank Omar for being here. They have done a lot to try to improve the air quality for New York City residents and to address issues of environmental justice.

You will get to hear about an exciting project they are working on at Hunts Point Market to try to limit the emissions that are particularly prevalent in that area.

Before I conclude and have my statement submitted, I want to say how pleased I am to hear from press reports this morning that Administrator Whitman has decided to move forward with the full clean-up plan for the Hudson River that was originally proposed this past December. We don't have all the details yet but this appears to be a significant environmental victory, not just for New York and New Jersey but for communities around the country that are plagued by contaminated sediments.

I know this is not a final decision. I spoke with the Governor of New York the other evening who has the right to review the decision and to make comments. He certainly supports the full dredging recommendation if that indeed is the final decision. It won't be

officially announced until September but this is very welcome news for people who have been concerned about this issue for 20 years, particularly as it affects our country's largest Superfund site. I wanted to add my words of support to what I hear will be the decision.

Again, Mr. Chairman, I want to thank you for moving this committee along so expeditiously to deal with the real problems that are on New Yorkers' minds and Americans' minds. This issue about how we cut pollution from our transportation sources is absolutely critical and has a big impact on health, something you and I have discussed, that we are having increasing evidence and awareness of. I thank you for making this a priority of the committee.

Senator JEFFORDS. Thank you.

Senator Voinovich?

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Senator VOINOVICH. Thank you. My remarks will be very brief.

I thank you for scheduling this hearing on mobile source emissions. It is a very important issue. Too often I think we concentrate on the stationary sources and lose sight of how much problems are caused by cars and mobile emissions.

As we move forward with the multiple emission strategy for utilities, we need to keep in mind that utility emissions are only a part of the problem. This hearing is very helpful to increasing our understanding of the overall environmental and health impacts of air emissions from all sources. However, as I said last week, the committee also needs to look at the available control technologies for mercury and CO_2 and how we go about crafting a bipartisan approach to those issues.

I know many of my colleagues from the northeast point to Ohio and other midwestern States as the source for most of their quality problems. The fact of the matter is that we could shut down every utility in Ohio and the northeastern States would still not comply with the air quality standards for the most part because of mobile emissions.

Over the last 10 years, my State—I am particularly sensitive to this because a lot of the people we are talking about are in my State—has spent more on emissions reductions than New York, New Jersey, Massachusetts, Connecticut, Vermont, Rhode Island, Maine, New Hampshire, Maryland, Delaware and Washington, DC. combined. By 1995, Ohio had spent $3.7 billion on pollution controls. We reduced air toxins from approximately 381 million pounds in 1987 to 144 million pounds in 1996.

When I began my term as Governor, eight of our cities were in nonattainment for ozone. Currently, all 88 Ohio counties are in attainment of our current national ambient air standards. I am very proud of that. No single State has done more to improve air quality in the last 10 years than Ohio and I reiterate we still have a lot more to do because we are a large industrial State. We have a lot of power plants, we have a lot of emissions and we have a problem we need to keep working on.

Ohio was one of the first States to implement an enhanced INM Program. In fact, we implemented our program before any of the

northeastern States. Mr. Chairman, I know your State of Vermont operates a basic INM Program, although they are in the process of having an enhanced program approved by EPA. Our enhanced INM Program in Ohio was not without controversy. I implemented that program as Governor of Ohio. We started to move it through the State. The legislature came back and passed legislation that did away with the enhanced program. I had to veto that bill. I took all kinds of heat like I have never taken in our State because of what I did. Everywhere I went, I had pickets and so forth.

I notice some representatives here from environmental groups and there wasn't one environmental group that stood up and said anything good about the fact that we were staying at the table and taking the heat and continued that INM Enhanced Emission Program in our State. That was a very, very difficult thing for us to do and I am very proud of it. We could have backed off. For example, the State of Pennsylvania got into the same controversy and they just pulled the plug and moved away from it.

The point I'm making is that we did try very hard to do the job we were being asked to do. During the OTEC process, the ozone transport assessment group, again, some of the other States dropped out of it. We stayed in it, participated in it, even voting for the report based on 65 percent reductions. Unfortunately, the EPA opted for the more stringent 85 percent level which was not supported by the modeling data.

The data show that the biggest threat to air quality in the northeast, in addition to their coal and oil fired utilities, is the emissions from their cars. Their problem is compounded by their population density and the resulting traffic congestion—big problem.

According to testimony by Taylor Bolden of the American Highway User Alliance at our subcommittee hearing in April of this year, "Improving the traffic flow at our nation's 167 bottlenecks which comprise only a few hundred of the nearly 4 million miles of U.S. roads would reduce gasoline and diesel consumption by almost 20 billion gallons over the next 20 years. This would go a long way toward reducing air pollution, particularly in areas which need it the most"—of course that is our urban cities.

In addition, this committee needs to look closely a renewable fuels requirement. If we were to use more ethanol nationwide, our air quality would improve and we would decrease our dependence on foreign oil. For example, in my State, 40 percent of the gasoline has an ethanol portion in it, about 10 percent ethanol.

I look forward to working with you on this issue. We need to understand mobile sources better and the ways in which to deal with that problem. I look forward to the testimony of the witnesses.

Senator JEFFORDS. Thank you.

Mr. Brenner, sorry we interrupted your statement. You have made an excellent statement. As I mentioned in my opening statement, EPA's Green Vehicle Guide says that "While good fuel efficiency does not necessarily mean clean emissions, a car that burns less fuel generally pollutes less." Could you tell us how much increase in fuel efficiency might reduce transportation emissions other than carbon dioxide?

Mr. BRENNER. When you have more fuel efficient vehicles, one of the advantages is that there is less fuel needed in the overall sup-

ply system because the vehicles overall will not need as much gasoline or diesel fuel to power them. That means all through the system where you produce the gasoline at refineries, where it travels through pipelines and you can get evaporative emissions from the pipelines, where you get evaporative emissions from gasoline stations, at all those steps there is less fuel working its way through the system and therefore fewer emissions all around the country. That's the added advantage besides the green house gas advantages you mentioned.

Senator JEFFORDS. As you know, EPA collects and estimates data on greenhouse gas emissions from vehicles and stationary sources on a regular basis. Would the agency be capable of developing a greenhouse gas emissions registry like the one used in the Toxic Release Inventory Program?

Mr. BRENNER. I believe we would be capable of doing that. We'd have to think about how to deal with some of the more difficult sources of greenhouse gases, some of the sources of methane or some of the other gases where we don't know quite as much as we do with CO_2. I think we could at least make a good start on a registry and then try to build on that over time.

Senator JEFFORDS. As you know, in May several environmental groups submitted a petition asking EPA to regulate greenhouse gas emissions from new motor vehicles. Can you give the committee a general idea of how the agency will be responding and when?

Mr. BRENNER. Yes, Mr. Jeffords. The petition came in to us a couple of years ago and we went through an evaluation of the set of legal issues and then decided what we could do was propose it for comment. We received something on the order of 6,000 comments on that petition. The comment period closed I believe last May.

We are now in the process of evaluating those comments and then we will be issuing a determination as soon as we can work our way through all those comments and come to a decision.

Senator JEFFORDS. Why didn't the EPA take strong action to require new reductions in the mobile source toxics rule?

Mr. BRENNER. I'm glad you asked about that because I think here has been a good deal of misunderstanding about that rulemaking.

We developed that rule and we looked at the future projects for air toxics. What we saw was one of the numbers I mentioned in my opening statement, that from the period 1996 to 2007, toxic emissions are going to decline by a million tons from the mobile source sector. We are going to continue to make tremendous progress on toxic emissions. Even after 2007, as you know there are additional standards such as the diesel standards that we will be phasing in.

We believe that you need to look at that rulemaking in the context of all the other activities we have underway that are reducing toxics. One of the reasons that we decided to take a small additional set of reductions, benzene from gasoline, early on was that we were concerned about some of the issues that Senator Inhofe raised, that refiners are facing a set of difficult challenges for producing fuels and we didn't want to load additional challenges on them right away. We wanted to be able to phase it in with the

other work underway. That is why we will do a review in 2004 of mobile source air toxics to see if additional controls are necessary.

Senator JEFFORDS. Senator Lieberman?

Senator LIEBERMAN. Thanks, Mr. Brenner, for some excellent testimony.

I was struck in your testimony by your description of the record that EPA has in establishing standards for emissions control that have really driven technology and improved public health enormously. In talking about the Tier 2 program standards which will go into effect in 2004, you cite some standards that frankly are the kinds we usually hear only from the public health organizations but we should be hearing from EPA.

That is that Tier 2 will prevent 4,300 premature deaths annually. That is quite remarkable, not to mention the 2 million tons of NOx emissions avoided per year by 2020. Then you add also the tens of thousands of respiratory illnesses prevented, but 4,300 premature deaths annually prevented by the Tier 2 standards I think we should see the real danger and impact the emissions have on peoples' health but also feel some pride and gratitude at the projected results. I thank you for pointing that out.

It does seem to me that in view of the NAS report on CAFE standards that came out earlier this week that we should be looking to increase the efficiency of our vehicle fleet even more because this would reduce emissions as you indicated in answer to Senator Jeffords. I wonder if there is any particular estimate that you have or you can obtain and submit for the record of the health and environmental benefits that would result from increases in fuel efficiency?

Mr. BRENNER. We can make an effort to submit that for the record. It is a bit difficult because as I said, these are mostly fugitive emissions prevented throughout the system and it is harder for us to estimate those types of emissions than tailpipe emissions but we should be able to at least come up with a rough estimate and will be happy to submit that for the record.

Senator LIEBERMAN. Good. I'll look forward to that.

Regarding the diesel/sulfur rule, I appreciated Administrator Whitman's recent response to Chairman Jeffords in which she stated that "The technology review under the diesel/sulfur rule would be conducted by the Clean Air Act Advisory Committee pursuant to the requirements of the Federal Advisory Committee Act." Can you provide us with anymore details regarding plans for that review?

Mr. BRENNER. The plans are not completely firmed up yet but I can give you a sense of what our plans are. What we want to do is have EPA do the biennial review that is called for in the rulemaking of both engine technologies and fuel supply and then in addition to EPA's review, we want to create a Federal advisory committee of technical experts and stakeholder representatives to present us with their own assessment of these two sets of issues, the fuel supply issues and engine technology issues. We want to include representatives with expertise from the refining industry, the marketing industry, from the public health community and the States and make sure that we are able to tap into the expertise that exists outside of EPA, and do it in an open process under the

Federal Advisory Committee Act. The plan would be to start this and complete it next year.

Senator LIEBERMAN. I appreciate the answer and we look forward to monitoring progress on that.

Regarding the petition that's been filed to regulate CO_2 from new vehicles, I wonder what standard you are going to use to evaluate that petition and when you would anticipate a decision on that?

Mr. BRENNER. I'm not able to give you as clear an answer as I would like on what standard we will use. The petition raises some difficult legal issues for us. There are some significant questions that have been raised regarding our legal authority to proceed with that type of regulation.

One of the things our attorneys are doing is sorting through the comments which raise both sides of the legal issue and trying to sort out what our view would be as to the standard we would use for evaluating the petition and the process we would use for setting a standard if we decide it is appropriate to set one.

Senator LIEBERMAN. My time is up. Thank you.

Senator JEFFORDS. Senator Chafee?

For the interest of the members, I do it on the early bird system, so as you come in time you will be ordered as to when you get to ask questions.

Senator CHAFEE. In your testimony, you said that since 1975, the average auto fuel economy measured in miles per gallon has doubled but that has entirely occurred before 1987, and in the past 14 years, new car fuel economy has been roughly unchanged, kind of falling off the wagon since 1987.

You also say that the average fuel economy of the new passenger vehicle fleet in the 2001 model year is 2 miles per gallon below the 1988 peak. We certainly have a lot of work in front of us.

What are the mechanics? How is this going to happen? Is it going to come from EPA, from Congress, from the Department of Transportation? What exactly are the mechanics of moving forward?

Mr. BRENNER. The manufacturers have been responding to consumer demands. There is also some good news. There are continuing developments in these technologies such as improved aerodynamics, less rolling resistance of tires and other types of actions that have enabled Ford and other manufacturers to commit to make some significant improvements in fuel economy, especially for their sport utility vehicles. They are talking on the order of 25 percent over the next few years. That is one mechanism that will be underway as far as actions the auto manufacturers have already undertaken.

The next potential mechanism is that the National Academy of Sciences did a very good job of laying out the issues that public policymakers will need to consider in deciding whether to change the CAFE standards or use other mechanisms for improving fuel economy. On the one hand, they mentioned there are the environmental benefits that some of the other Senators mentioned this morning but there are also cost issues, potential safety issues, technology availability issues and there are consumer preferences. We now have those issues all laid before us. The Administration committed in the National Energy Plan to take the NAS study, with the Department of Transportation in the lead, and come up with some

recommendations for appropriate next steps with respect to fuel economy. It sounds like the Senate will be doing the same thing.

Senator CHAFEE. You think the Department of Transportation will take the lead?

Mr. BRENNER. Yes, they are the lead agency for this and we will work closely with them.

Senator JEFFORDS. Senator Clinton?

Senator CLINTON. I'm still a little confused about the independent review of the diesel sulfur rule. I know the EPA has classified diesel exhaust as a likely carcinogen, is that right?

Mr. BRENNER. It's either a likely or probable carcinogen.

Senator CLINTON. I know earlier this year the Natural Resources Defense Council released a report showing that children who ride to school in a diesel school bus are exposed to excess exhaust on the bus at levels 23 to 46 times higher than the levels already considered to be likely or probable cancer risks by EPA. I have also seen enough of these yellow buses sitting there idle with the diesel exhaust going into the air further causing potential health problems.

The latest statistics I have show that overall, the transportation sector emitted approximately 2.3 million tons of air toxics in 1996, including benzene, toluene and benzopyrene and 18 other compounds known or suspected to cause cancer, birth and developmental defects as well as other potential adverse health effects.

I am very pleased by the effort to try to regulate diesel emissions. I know EPA has engaged in a retrofit program that I think holds great promise. We have a lot of companies in New York that are on the cutting edge of technology like Corning and Air Flow Catalyst Systems in Rochester that are manufacturing emission control equipment that could be used to help retrofit existing vehicles. I think this is an area on which we ought to put a lot of emphasis. Even if we do move forward on new fuel and emission standards, we still have a lot of vehicles on the road that are not going to be up to speed.

I guess I want to parse a bit of what Senator Lieberman was asking so I can understand. I know earlier this week Governor Whitman sent a letter to Chairman Jeffords regarding a number of clean air related regulatory issues. One that was touched on was the emission standards for diesel trucks and buses. The rule went through the usual review process, including public comment. I guess I don't understand why do we need an additional new, independent review process?

Mr. BRENNER. The concept behind the independent review process is to focus on progress and implementation, not on the basic rule itself. As you noted, we went through a rulemaking process and there is a record for the rule which is being litigated now, so it's being examined by the courts.

What we said when we issued the rule was, we wanted to make sure implementation was working smoothly, that new technologies were being developed for engine controls, that fuel supply was going to not be a problem as we moved into the years when the rule actually is implemented, 2006, and forward. The purpose of the review is to focus on implementation, to make sure that is working smoothly and if there are some adjustments in the imple-

mentation of the rules needed to make any necessary adjustments to ensure we have adequate fuel supply.

Senator CLINTON. I thought already within the promulgated rule was a biennial review process that would look at technology and related issues. If there is already a review process within the rule, why is there an independent new process started?

Mr. BRENNER. There is a process in the rule that EPA will be conducting but we also felt that it would be valuable to be able to obtain outside expertise from the kinds of technical experts I mentioned. This would be done, although the details haven't been worked out, under the framework of our Clean Air Act Advisory Committee. That is something we typically use and they have advised us in other areas on the implementation of rules. It's one of the reasons I think we've been successful in implementing the Clean Air Act. We've been able to take advantage of some very capable people, including Corning, in implementing our rules.

Senator CLINTON. I'm safe in concluding that there is not any change in the substance of the rule, only perhaps some fine-tuning as to expedited implementation?

Mr. BRENNER. Our plan is to focus on the implementation, that's right, and ensure we are doing implementation in a way that will ensure fuel distribution and adequate new engine technologies.

Senator CLINTON. Thank you.

Senator JEFFORDS. Senator Voinovich?

Senator VOINOVICH. You talked about the fact that the EPA had learned valuable lessons from the I&M Program and you've been more flexible in letting the States decide how to go forward with their I&M Program. One real concern is are you familiar with the 126 petitions?

Mr. BRENNER. Yes, I am.

Senator VOINOVICH. And the NOx SIP call?

Mr. BRENNER. I am.

Senator VOINOVICH. As you know, the 126 petitions are kind of an enforcement provision that deals specifically with some of the same things in the NOx SIP call. One thing that has been very difficult is originally the NOx SIP call was supposed to be done in 2004 and the court ruled it should be in 2004. The 126 petitions are coming in 2003. Many of us have wondered why the EPA is insisting we go forward with the 126 petitions prior to the 2004 NOx SIP call where one gives the utilities more flexibility and the other is very specific about you must do this in order to get the job done. We believe we could get the job done even better if we had more time and also satisfy the concerns of those who filed the 126 petitions and give the utilities more flexibility instead of the specificity. Is there any possibility that could be revisited so?

Also, from a practical point of view, on some of the things being required, if you come out to our State, finding people to do some of the things that are being required is enormous. I think this committee is going to find out the availability of the boilermaker skilled trades people that you need to do some of the things that are required. Some of them are just not there. I'd be interested in your reaction to what I've just said.

Mr. BRENNER. First, let me start by talking about the implementation issue you just raised. We have been doing some assessments

because we wanted to make sure we track the ability of the pollution control industry and the power plants to install the NOx control equipment both for 2003, the 126 rule, and for the 2004, 110 rule. If you would like us to provide you or staffing with a briefing on what we are seeing, we'd be happy to do that.

The problem in coordinating the two dates in the way you described is that once the EPA makes a finding, which we did with respect to 126, it starts a 3-year period which does end in 2003. We have a difficult time legally in moving away from 2003. The other, more significant issue is a number of the northeast States were also involved in the rulemaking.

Senator VOINOVICH. They filed the petition.

Mr. BRENNER. They filed petitions and once we made a positive decision on those petitions, we approved them and that gave them the assurance there would be controls in 2003 which they are looking for as part of their air quality plans. To change the date would require some agreement on the part of the northeast States. I know they have expressed concerns whether some of the midwest States are serious about proceeding to control either under 126 or 110 because having seen the air quality plans in place from some of the States, they have heard some continuing concerns as to whether the States intend to meet even the 110 requirement.

I think there would be some work to do between all the stakeholders before we could reach an agreement that would harmonize those two dates.

Senator VOINOVICH. I'd be interested in a briefing on it and see who the players are.

Senator JEFFORDS. Senator Lieberman.

Senator LIEBERMAN. I was intrigued by something that Mr. Dana of the Automobile Manufacturers Alliance says in his testimony expressing some pride in the record of the automobile industry at reducing hydrocarbons, carbon monoxide and nitrogen oxide. It makes some fascinating comparisons to other emission sources—"Using a chain saw for 1 hour emits the same amount of hydrocarbons as driving 600 miles in a typical car, the distance from Washington, DC. to Atlanta; using a snow blower for 1 hour emits the same amount of carbon monoxide as driving a typical car 305 miles from Phoenix to Las Vegas; a jet ski emits more in only 7 hours of use than a new car does in traveling 100,000 miles which is the average mileage accrued for a decade of driving."

I am sure some will wince at this question but is EPA considering regulating or taking any actions to reduce emissions from those sources? I presume they are less than automobiles, there are more automobiles than jet skies, snowblowers or chainsaws. It still sounds like they are causing a problem.

Mr. BRENNER. We already have done some regulations and there are others underway. You're right that when we looked at the sector, we were very surprised at how large the emissions were especially because they tend to use the 2-stroke engines which produce far more pollution than the more modern 4-stroke engines. We have set standards for chainsaws, for snowblowers and other handheld equipment. We are also about to propose standards for things like snow mobiles, forklifts and some of the other smaller engines that have been 2-stroke engines. We are hoping over time many

will move toward adopting 4-stroke technology. It is a significant factor.

Also, some things like yard equipment tend to be used during the summer at times when you are particularly concerned about ozone pollution. Those standards can be fairly important.

Senator LIEBERMAN. Again, it's a question of the standards driving technology where it otherwise wouldn't go in the normal course if EPA wasn't there to say this is contributing to the problem.

Mr. BRENNER. It's also an example of many of the companies that produce this equipment are small business with difficult problems with respect to raising capital. It's very important that we work closely with the companies and understand their problems. We've gone through small business review sessions to make sure we are sensitive to their concerns in developing the standards.

If you would indulge me, I'd like to jump from that issue of small business concerns to pick up on the diesel rule?

Senator LIEBERMAN. It's OK with me if it's OK with the chairman.

Mr. BRENNER. Several questions have come up with implementation of the diesel rule and I didn't want to leave without mentioning when we designed the rule, we tried to be very careful to ensure there was an adequate phase-in, especially for small refiners.

There is a 3-year period during which the diesel fuel requirements are phased in. There is an opportunity for a small refiner, small or large, to get a hardship exemption if it turns out they need more time to be able to produce the fuel and some of the refiners in the Rocky Mountain area were given the option of extending the time line for producing low sulfur fuel because they had a particular set of problems.

Taken altogether, many of the refiners, almost half, have the ability to delay their investment by up to 4 years in producing low sulfur diesel fuel. I wanted to mention that although we are going to be doing the review of implementation, we also took a number of steps up front to try to implement this rulemaking as smooth as possible.

Senator JEFFORDS. Thank you, Mr. Brenner.

I would alert the members that we also have an executive session this morning for the nominees of the President. I would hope you all make sure you are there. We also have another panel here, so we will have to proceed expeditiously.

Thank you, Mr. Brenner, for very helpful testimony.

Our second panel consists of: Mr. Jason Mark, Clean Vehicles Program Director, Union of Concerned Scientists; Greg Dana, Vice President, Environmental Alliance of Automobile Manufacturers; Mr. Dan Greenbaum, President, Health Effects Institute, Cambridge, Massachusetts; Mr. Omar Freilla, New York City Environmental Justice Alliance; and Mr. Jeff Saitas, Executive Director, Texas Natural Resource Conservation Commission in Austin, Texas.

Mr. Mark, if you would proceed. We will have everyone give opening statements and then we will have questions from the members.

STATEMENT OF JASON MARK, CLEAN VEHICLES PROGRAM DIRECTOR, UNION OF CONCERNED SCIENTISTS

Mr. MARK. Thank you for the opportunity to testify today. My name is Jason Mark, a mechanical engineer and Director of the Clean Vehicles Program at the Union of Concerned Scientists. UCS is a nonprofit partnership of scientific citizens working at the intersection of science and policy for over 30 years.

I will speak to you today about our continuing struggle to achieve clean air and in particular, the importance of improving transportation efficiency in addressing air pollution and global warming. Despite years of progress, 108 million Americans still live in areas that don't meet Federal health standards. Transportation accounts for more than half of precursors to ground level ozone or smog, and in urban areas, motor vehicles are typically the dominant polluter. Over 90 percent of the cancer risks from polluted air in the Los Angeles region is estimated to come from cars and trucks. So even as vehicles are getting clean air, arriving travel is undoing the progress we are making to date.

Even as tighter tailpipe standards come into effect we continue to be plagued by emissions that are released offboard the vehicle. Refining and distributing each gallon of gasoline results in over 6 grams of smog-forming pollution and nearly 3 grams of toxic pollutants. These are emissions that are the direct result of driving even though they don't come from vehicle tailpipes because as we use more fuel, we create more pollution to make that fuel.

The best strategy for reducing gasoline-related emissions is to reduce gasoline use altogether. This approach prevents air emissions before they are created and has the added benefit of addressing one of the most significant environmental challenges facing our country and this planet and that's global warming. Each gallon of gasoline yields 24 pounds of greenhouse gas emissions that result in climate change and U.S. cars and trucks emit more global warming pollution than every country in the world releases from all of its sources combined.

Scientists worldwide agree that humans are having a measurable impact on the climate and the potential economic and environmental consequences are severe. Higher temperatures can also increase air pollution. There is a direct feedback. Smog which forms in the presence of heat and sunlight increases with even small temperature changes. One recent study by the Lawrence Berkley National Laboratory suggests that temperature increases in the Los Angeles region for the next half century could create nearly three million cars worth of added pollution. We believe there is a strong case for giving EPA the authority to regulate greenhouse gas emissions under the Clean Air Act.

Fortunately, technology exists that can address fuel use and global warming pollution from vehicles. The Union of Concerned Scientists and the Center for Auto Safety recently published an analysis outlining a safe and economically sound path to boosting automotive efficiency using existing technologies such as variable valve engines being introduced on over 60 percent of Honda vehicles today; multispeed transmissions and weight savings. We estimate that passenger vehicles could reach an average of 40 miles per gallon over the next 10 years up from today's average of 24

miles per gallon. The greenhouse gas savings would be the equivalent of taking nearly 60 million cars off the road by 2012 and by using less fuel, we'd reduce refinery pollution. We estimate 440 million pounds of smog forming pollutants annually by 2012 and 200 million pounds of toxics annually from refining and distribution of gasoline.

The National Academy of Sciences recently completed its much anticipated evaluation of fuel economy. Their results confirm that technology can cost effectively boost fuel economy of vehicles. Using a subset of technologies we evaluated, the NAS estimates cars could cost effectively and cost effectively reach 34 to 37 miles per gallon and light trucks could reach 28 to 30 miles per gallon.

We believe with an additional investment of several hundred dollars per vehicle and using weight saving technologies that improve fleet safety, cars and trucks could reach an average of over 40 miles per gallon while still saving consumers money.

One final point about the role of policies in achieving environmental goals. UCS strongly supports incentives that encourage industry to deliver clean, more efficient vehicles. We work closely with several automakers to develop tax credits for advanced vehicles embodied in the Clean Air Act that several members of this committee support. As the Senate takes up this important legislation, we urge you to maintain the environmental provisions that guaranteed credits will flow to vehicles that are both efficient and clean. We also urge you to consider incentives for cleaner trucks and buses like the legislation recently introduced in the House that would provide Federal grants to school districts who buy cleaner buses to protect children's health.

Incentives only work within a framework where firm standards guarantee environmental gains. Virtually all the progress we have made to date with respect to motor vehicles and air pollution has been the result of government action. Despite repeated industry warnings that environmental rules will have dire consequences, the evidence demonstrates that past regulatory programs have been highly cost effective. Over the last 15 years, every major motor vehicle regulation the State of California and EPA have introduced has cost on average less than a $1 per pound of ozone precursor. That cost has continued to stay constant, even though standards have gotten tighter.

We're making important progress but your continued support for key air quality programs such as passenger vehicle tailpipe standards, diesel engine rules and accompany local sulfur fuel requirements.

The next step in improving environmental performance of vehicles is boosting the fuel economy of our fleet which will reduce emissions from gasoline production and distribution while lowering greenhouse gas emissions. The technology exists to cost effectively bring SUVs, pickups and mini-vans up to the fuel economy standards, cars and then boost the entire fleet to 4 miles per gallon over the next 10 years. If this policy passes, it makes sense for consumers' pocketbooks and it is good for the environment.

Thanks for the opportunity to testify.

Senator JEFFORDS. Thank you very much.

Our next witness is Mr. Greg Dana, Vice President, Environment, Alliance of Automobile Manufacturers. Please proceed.

STATEMENT OF GREG DANA, VICE PRESIDENT, ENVIRONMENT, ALLIANCE OF AUTOMOBILE MANUFACTURERS

Mr. DANA. On behalf of the 13 members of the Alliance of Automobile Manufacturers, it is a pleasure to be here today to provide the committee with our views on the impact of air emissions from the transportation sector on public health and the environment.

Today, I'd like to make three basis points. First, the auto industry had done a tremendous job reducing emissions of criteria pollutants from motor vehicles as of today. Second, more reductions are on the way as we implement the Federal Tier 2 emission requirements beginning in the 2004 model year. Under these requirements, light trucks will be required to meet the same emission standards as passenger cars. Third, zero emission vehicles are in the foreseeable future, not the battery electric vehicles that California has mandated but fuel cell vehicles which are being developed competitively by the industry without the need for further regulation. However these will require another 10–15 years of development. Let me expand on these points.

We are a mobil society. Historically, cars and light trucks have been responsible for over 50 percent of the VOC and NOx emissions in major cities. This picture is changing very quickly across the United States. Even in Los Angeles, a city heavily dependent on motor vehicles, cars and light trucks represented only 29 percent of VOC and NOx emissions in 2000. This will shrink to just 10 percent in 2020. The new emission requirements for 2004 and later reduce emissions 80 percent further from today's clean vehicles. Attached to my written statement you have some color charts that show the progress we have made reducing emissions from the early days to the 2004 standards.

One of the most important aspects of the Tier 2 rulemaking is that it will require cars and light trucks to meet the same emission standards including the larger sport utility vehicles. This will address the concerns of many of these vehicles that are replacing cars for everyday transportation needs. The rule also requires that emission standards be met for a longer useful life 120,000 miles rather than today's 100,000 mile requirement, which means more durable emission controls.

Another important aspect of this rule is to control sulfur levels in gasoline. Both improved fuel quality and technological improvements are needed to significantly reduce emissions. Cleaner gasoline with sulfur approaching near zero levels, capping distillation index at 1,200 or 1,150 and adopting other limits as recommended by the world's automakers in the worldwide fuel charter is absolutely critical to ensure the lowest possible emissions and to enable new fuel efficient gasoline lean burn technologies.

EPA has also finalized a rule to significantly control emissions for heavy duty engines for 2007 and later model year trucks. As part of this rulemaking, EPA is reducing the sulfur content of diesel fuel to 15 ppm. This lower sulfur diesel fuel is critical to the light duty industry as it offers the hope of being able to meet the Tier 2 standards with light duty diesel engines. These new diesel

engines are one of the many tools in the manufacturer's toolbox for increasing the fuel efficiency of the fleet. As noted in the NAS report released yesterday, the Tier 2 standards represent a significant challenge for advanced diesels and lean burn technologies.

Automakers are working to increase fuel efficiency. Automakers have consistently increased the fuel efficiency of their models since the 1970's. According to EPA data, fuel efficiency has increased steadily at nearly 2 percent a year on average from 1975 to 2001 for both cars and light trucks but it is important to understand this does not translate into CAFE increases because CAFE is a program which relies on the sales of cars that consumers must make choices for.

In surveys, consumers indicate they want greater fuel economy but in their purchases, they don't want to sacrifice size, safety, cargo room, acceleration or other vehicle attributes to get it. Today, manufacturers offer more than 50 models with fuel economy ratings above 30 miles per gallon. We also offer vehicles that achieve 40 miles per gallon or greater but these highly fuel efficient vehicles account for less than 2 percent of sales.

We support the tax credit provisions in S. 760, the clean, efficient automobiles resulting from advanced car technologies or the CLEAR Act of 2001 introduced by Senators Hatch, Jeffords and others. The CLEAR Act would provide tax incentives for fuel cells, hybrid electric vehicles, battery electric vehicles and dedicated alternative fuel vehicles along with alternative fuel and alternative fuel infrastructure tax credits. We are working on slight modifications to the hybrid electric tax credits and would like to see tax credits for the introduction of advanced lean burn technology.

It is the advancement in the development of the fuel cell vehicles that is most exciting. If this technology can be brought to market at a competitive price, it will result in vehicles with twice the mileage of conventional vehicles and zero tailpipe emissions. However, this technology is 10 to 15 years away from the commercial market and a new fuel infrastructure will be required for it.

In conclusion, the auto industry is tremendously proud of the achievements we have made but we will not rest until zero emissions are a reality. I appreciate Rob Brenner's words today about our cooperation on Tier 2 because we are willing to work cooperatively with regulators to achieve these goals. We are committed to the introduction of advanced technology vehicles. Tax credits that are being considered in this Congress will accelerate the market penetration of cleaner and highly fuel efficient vehicles that consumers will want to buy.

Thank you.

Senator JEFFORDS. Our next witness is Dan Greenbaum, President, Health Effects Institute, Cambridge, Massachusetts. Please proceed.

STATEMENT OF DAN GREENBAUM, PRESIDENT, HEALTH EFFECTS INSTITUTE

Mr. GREENBAUM. I appreciate the opportunity to testify before you today.

I am the President of the Health Effects Institute. We are a nonprofit, research institute funded jointly and equally by the USEPA

and the worldwide motor vehicle industry. We provide high quality, impartial science on the health effects of emissions from transportation and other sources.

I might add that my introduction to environment and transportation came 30 years ago as a graduate student at MIT when I was asked to do a study of the environmental impacts of travel over Route 4 in the Ottauquechee Valley in Vermont, so I have been on this case for quite a while.

Since the early 1970's as vehicle travel has grown dramatically, there have been concerns about air pollution health effects from transport. There has also been substantial progress in reducing the emissions from individual vehicles but travel volume has grown substantially offsetting much of the improvements achieved.

Scientific knowledge has increased identifying health effects from emissions from motor vehicles at lower levels of exposure. Vehicles produce a number of emissions of potentially harmful substances. These emissions come from both the tailpipe and evaporation and result from a combination of the engine design and the fuel characteristics, an important component in thinking about control strategies.

The emissions from motor vehicles come in two primary forms: major gaseous and particulate air pollutants, such as carbon monoxide and ozone to which cars contribute which can be found in relatively high amounts in the atmosphere and air toxics such as benzene, butadiene and the aldehydes which usually are found in lower amounts in the atmosphere but can have important health effects.

To date, most of our attention has been focused on on-road transport for cars and heavy duty vehicles but increasingly we have understood that nonroad sources, the construction equipment, locomotives, airplanes and ships are also significant contributors.

Importantly, all of the emissions from motor vehicles also come from other sources such as industrial processes, electric power generation and home heating. As a result, in most cases, motor vehicles contribute between 25 and 40 percent of the ambient levels, although for a few pollutants such as carbon monoxide, motor vehicle contributions are noticeably higher.

There are also certain circumstances in which motor vehicles can contribute a substantially higher amount to personal exposure. In urban centers, mobile sources can contribute 2 to 10 times background levels. This can have important implications for the potential acute health effects from exposure to these pollutants, especially for the elderly, low income and other urban populations.

Research over several decades has found a variety of health effects from different pollutants including effects on the lungs, heart and nervous system and the promotion of several different types of cancer. Overall, these effects on public health tend to be relatively small in comparison with some things we know about like smoking but because of the very large number of people exposed, the effects as a whole are of sufficient magnitude to be of significant public concern.

Although we are still learning about these effects, there is much we already know. We know that ozone reduces the lung function of some individuals and studies have found evidence of increased

asthma attacks and hospitalization. Mr. Chairman, you noted a study the CDC conducted in Atlanta around the Olympics earlier this year which was a recent example of this data.

We know that PM_{10} and $PM_{2.5}$ are emitted directly from both diesel and gasoline vehicles and also other sources and are also formed in the atmosphere. As you are aware, recent studies have found associations of PM with increased mortality and morbidity at ambient levels.

While we still have more to learn about PM, the health data on PM effects have strengthened substantially over the last 5 years with work by my institute and others.

The air toxics which you have talked about have also gained attention due to a variety of characteristics and effects, most notably some being known carcinogens, such as benzene, and others such as butadiene and aldehydes being probable human carcinogens.

Given these health effects, action has been taken and continues to be taken. However, continued growth in travel is expected to offset a portion of these reductions. As a result, continued attention to reducing emissions is likely in the future. Continued tightening of fuel and emission standards for gasoline and diesel vehicles, especially for the nonroad vehicles, introduction of the new technologies that my fellow testifiers have mentioned as well, and the need for attempts to encourage reduced growth in personal auto use, a potentially important future direction but as all of you know, an especially challenging one.

In conclusion, the emissions of a variety of pollutants from vehicles account for some 25 to 40 percent of what we see in the atmosphere and in some cases, more. These have measurable effects on public health. As a result, a long term trend has been toward reducing these emissions and that trend is likely to continue in the future.

However, as we continue to drive more, continue to use transport, some of those benefits are going to be offset and we are going to need to pay attention as time progresses to how we can continue to come back and address these important health effects on a regular basis.

Thank you.

Senator JEFFORDS. Mr. Freilla?

STATEMENT OF OMAR FREILLA, NEW YORK CITY ENVIRONMENTAL JUSTICE ALLIANCE

Mr. FREILLA. Good morning.

I am here today representing the New York City Environmental Justice Alliance. We are an alliance of community-based organizations fighting the continued presence of racism and classism in environmental protection. Our groups all represent communities of color that are largely poor and working class. They are in neighborhoods that bear a disproportionate amount of environmental hazards receiving all of the burdens and none of the benefits.

There are many in this room, including myself, trying to convince each of you that the Federal Government must do everything in its power to slash air pollution levels and dramatically improve the quality of the air we breathe. There is an immense amount of evidence to back up that call to action.

The overwhelming consensus of public health studies in this area all demonstrate that more air pollution equals more asthma attacks and more deaths but I am sure that is no surprise to anyone here, so I am not going to try to convince you of the obvious. What concerns me more is whether or not you care.

I live in the South Bronx in the neighborhood known as Hunts Point. My neighborhood is a magnet for trucks, approximately 11,000 trucks enter and exit each day. They head for one of the world's largest regional food distribution centers as well as 26 waste transfer stations. We are home to a sewage treatment plant and a sludge processing plant.

In an adjacent neighborhood, four partially diesel fuel powered turbines went on line last month. From my window, I can see the three giant smokestacks of a power plant right on the water front in Queens, just two football fields away from the water front of my neighborhood, a waterfront that is almost completely inaccessible without trespassing.

As if all that were not enough, the city plans to relocate the Fulton Fish Market, the world's largest fish market, to my neighborhood, complete with its 1,000 trucks a day.

On an adjacent lot, developers are seeking to build a 5,200 megawatt power plant. Whenever I walk to the subway or anyplace outside of my neighborhood I have to cross a 10-lane road under an elevated highway that carries 130,000 vehicles a day. My community is completely surrounded by pollution sources of particulate matter and toxics and no one in the neighborhood sees it as a mere coincidence.

I've noticed no matter what I do I cannot keep my apartment clean because of the dust from outside that settles near the windows. I never had the problem in an apartment until last year when I moved into the neighborhood. It is a common complaint of people in my community as is asthma. It is of no surprise to anyone that we have one of the highest rates of hospitalization for asthma in the country, six times the national average. When I go to the laundromat, I hear mothers trading asthma remedies as if they were dinner recipes. Thirty-percent of the children in my neighborhood suffer from asthma. It is a disease that has reached epidemic proportions in similar communities throughout New York as well as communities across the country.

Time and time again community groups who are members of the New York City Environmental Justice Alliance have fought with city, State and Federal agencies that do not seem to value the lives of people of color and poor people. How else do you explain lax environmental reviews in communities of color on the one hand, and strict enforcement in white communities on the other?

Our communities have been turned into sacrifice zones where any and all forms of environmental abuse are allowed to take place. You will not scratch the surface of air quality issues as long as you fail to focus attention on overburdened communities such as Hunts Point.

With all this in mind, I urge the members of the Senate to act in three key areas of transportation. The first is to promote cleaner fuels. Diesel trucks and buses are the worst polluters in commu-

nities such as ours. They produce the bulk of particulate emissions that trigger asthma attacks in New York City.

Our Alliance has been at the forefront of effort to promote cleaner fuels in New York. We have worked closely with the U.S. Department of Energy over the past few years in focusing attention on the most overburdened communities by co-hosting clean fuel forums in the South Bronx, Harlem and South Brooklyn with a citywide summit planned in September. Next week, EPA Administrator Christine Todd Whitman will come to my community to meet with environmental justice groups and help unveil a pollution control device that promises to cut emissions by up to 90 percent from idling trucks in the neighborhood.

We are very excited by these developments and see measures such as these and the 2007 standards for diesel as vital to reducing air pollution in our neighborhoods. But while we support the need for stricter diesel standards, it must be pointed out that the proposed standard will not bring cities into compliance with air quality standards as long as existing fleets and nonroad engines such as construction equipment are not addressed.

The second issue is to include local impacts in all air quality analyses. There seems to be no end in sight to the horrible proposals for noxious facilities that want to site in communities such as mine. Current practice ignores a project's impact on local air quality. Any increase in air emissions is added to the total emissions for the region as a whole. The result is that while a transportation project may not produce enough emissions to be noticeable on the regional level, at the local level, it could have dramatic consequences, especially when we're talking about levels of particulate matter and air toxics.

The highest concentrations of particulates are found within the first quarter to a half mile of a street or highway. The absence of local impacts is a failure of both the Clean Air Act and the EPA's willingness to establish a procedure for accounting for local impacts.

The third and last area is improving rail freight infrastructure. Almost 90 percent of goods entering New York City from the West travel by truck. While rail freight has the potential to take trucks off the road and dramatically improve air quality, rail lines in New York City are in such poor condition due to decades of neglect that they have become almost useless. The improvement of rail lines and the development of intermodal distribution centers would completely alter the current patterns of goods movement that results in clogged streets and noxious air.

To effectively deal with emissions from motor vehicles requires you to emphasize the places where they are concentrated, cities, but ever since the era of highway building and loss of urban manufacturing encouraged whites to flee to suburbs, cities have not received much attention on Capitol Hill. For communities of color like ours, lack of attention has created a situation where many of our neighbors are the noxious facilities that wealthy and white communities neither desire nor receive. I urge you to take these issues to heart and begin to rectify past practices that have turned low income communities and communities of color into sacrifice zones.

By addressing these issues, you will be addressing the need of our communities for cleaner air and environmental justice.

Thank you.

Senator JEFFORDS. That is most disturbing testimony. I appreciate your bringing it to us.

Mr. Saitas?

STATEMENT OF JEFF SAITAS, EXECUTIVE DIRECTOR, TEXAS NATURAL RESOURCES CONSERVATION COMMISSION

Mr. SAITAS. My name is Jeff Saitas, Executive Director of the Texas Natural Resources Conservation Commission. We are the State environmental protection agency.

We are an agency of about 3,000 employees, 16 satellite offices across the State and continue to have clean air issues right at the top of our priority list.

I wish to make one point today. The point is an issue of shared responsibility and an issue of fairness. Many of you know we have been working very hard to clean up the air in the Houston-Galveston area. It has been given wide attention over the past few years and there really is an air quality problem and it does need to be fixed.

We are finding the science to fix it is requiring us to reduce the nitrogen oxide emissions on the order of 75 percent. The point I want to make today is the State only has control over 64 percent of the emissions, so we are in the position of trying to clean the air which science says we need to cut by three-quarters but only have the authority to address two-thirds from a State perspective. That remaining third, actually 36 percent, is preempted from State control. Let me touch on the kinds of sources we are talking about.

We are talking about locomotive engines, airplane engines, commercial marine, oceangoing vessels, construction equipment, agricultural equipment, forklift type equipment, small commercial equipment, automobiles as well as trucks.

The Federal law says we are required to clean up the air in Houston, Texas by November 15, 2007. We are prepared to do so but addressing these preempted sources is not being done on the same timeline. That is critically important to the issue of shared responsibility and fairness. A lot of regulations are being put in place, some have already been promulgated, some will be adopted sometime very soon but a number of them will not be fully implemented until well past that 2007 date and the reductions won't be fully realized until many years down the road because many of those regulations only focus on replacement. When you buy a new engine, put the new, clean one in. When you talk about locomotives, that could be 30 or 40 years from now.

The States are put in the position to clean the air by 2007 from the sources we have under our control; we have to carry the load of what should have been done by the Federal sources. That is not fair. I don't think from where we are today that much can be done with respect to 2007 as Congress and the nation implement an 8 hour ozone standard and a fine particulate matter standard. I would plead with the committee to please require that the Federal sources reduce their emissions on exactly the same timeline as you are asking the States to develop plans to clean the air.

That is the only point I want to leave with you today, the point of fairness and shared responsibility. I will conclude a minute and a half ahead of schedule.

Senator JEFFORDS. Thank you and that's a good challenge to us.

We have a meeting in another room, S–211 in the Capitol, at 11 a.m. in order to take action on the nominees of the President for EPA.

Mr. Mark, how do you envision tax credits for cleaner vehicle technologies interplaying with tighter fuel economy standards or emission regulations?

Mr. MARK. I think tax incentives have a critical role to play in encouraging and accelerating the introduction of new technologies such as those described by Mr. Dana into the marketplace but I don't see them as a substitute for strong fuel economy standards that would be necessary to lock in some of the environmental gains that these new technologies have to offer. The incentives help the process along but you really need those standards to ensure we get those environmental gains.

Senator JEFFORDS. Mr. Dana, when do you think the industry will be able to achieve the 20 to 40 percent efficiency improvements outlined as possible in the new Academy of Sciences report?

Mr. DANA. The Academy report said something like 10 to 15 years. There are a number of technologies discussed in that report. Let me select one item, what has been talked about in a number of reports, some that Jason's group has done, something called integrated starter technology, some of these variable valve timing issues. A lot of this is dependent on what we call 42 volt technology. We are going from a 12 volt battery in cars today to a higher voltage battery.

We started working on that as an industry in 1999. It takes a long time to set a standard for a new power source of an automobile and we don't expect to see cars coming out with that until at the earliest one or two vehicles maybe in 2005. It probably won't come in across the fleet until later in the decade.

All these technologies that are using electricity or electrical power to power devices in cars that used to run by belts or cams are dependent upon the higher voltage technology. So many of these can phase in slowly over time but each has their own timeframe if you're working the technology through the process.

We have been increasing efficiency 2 percent per year exactly like this. We've been putting new technology on every time we develop it for the marketplace and it gets enough development time to get in place. I think we will continue to make those kinds of improvements over time.

Senator JEFFORDS. Cars are clearly getting cleaner for some pollutants, though trucks have a long way to go. The national fleet continues to grow and people are driving more all the time. How can we keep overall emissions from growing?

Mr. DANA. That is a problem but the good news is in spite of the tremendous VNT increases we have seen in the country, we have reduced overall pollution from automobiles because we have been successful in developing new technology and with the cleaner fuel available for 2004 and later, we will do even more to improve emissions from vehicles.

It is a challenge. As Dan said, one of the problems we face is the fact that people do drive more and that puts a bigger burden on us to reduce the emissions of the vehicles.

Senator JEFFORDS. Mr. Greenbaum, how many people do you think become seriously ill or die every year due to exposure to fine particulate matter?

Mr. GREENBAUM. There have been a number of estimates made of this. In fact, they are mostly based on a national study done by the American Cancer Society of some 550,000 individuals in the United States, looking at people who have lived in more and less polluted areas.

The total estimates of mortality range in the United States from something around 15,000 premature deaths to as high as 60,000 although I think most scientists would ask some questions about the 60,000 number. That's for all particulate matter air pollution. Within that, motor vehicles as I suggest in my testimony, on average contribute somewhere between 25 to 40 percent of what we're looking at in terms of particulate matter. So you might make some estimates that would give you some idea within those numbers of what kinds of premature mortality is.

Hospitalization, asthma hospitalizations and other things would be considerably higher, in the thousands and millions of people affected by asthma. I want to clarify that we are not talking here necessarily about the air pollution from cars causing the person to have asthma in the first place but as Mr. Freilla has said, we have seen a dramatic increase particularly in low income communities of asthma for a variety of reasons which science doesn't fully understand yet, so we have more people in the communities who will be sensitive to exposure to air pollution.

Senator JEFFORDS. Are we on track with developing an adequate scientific basis for controlling fine particulate matter emissions from the transportation sector?

Mr. GREENBAUM. I think we've learned a tremendous amount. I think we know a lot more today than we knew 5 years ago about the connections between air pollution in general, motor vehicles more specifically, and in health. I sit on a National Academy panel that is overseeing the research program. There are a couple of areas where we can improve that. One is we don't do a very good job in this country of tracking our health status over time. We actually don't have a good account of how many people have asthma in the country and what the trends are. We have estimates, certain areas of the country where we have done that but we can't track that over time.

The second is there are different components of emissions from vehicles that may contribute more or less to air pollution effects. There are ultra fine particles, there are some metals that may show up, there are different components of diesel exhaust and we have underway a number of studies trying to see if we can further target which of the things to go after to make sure we get rid of those that are most toxic.

These are areas that don't say, "Until we have the answer, we shouldn't do anything," but they are areas that say we do need to continue to understand these questions over the next 5, 10, 15 and

20 years because we will be with this for a while, we can make better and better decisions about how to target our reductions.

Senator JEFFORDS. Mr. Freilla, your work and your group are very impressive, what you have done and been able to establish. I am glad you were able to come here and testify this morning. Sometimes people in Washington forget the real people are affected by the decisions we make here.

Can you suggest ways that Members of Congress can be regularly reminded of the local impacts? Shall we have you here every month, every week?

Mr. FREILLA. I think a better suggestion would perhaps be to require a month-long stay of each Member of Congress in communities such as Hunts Point. I am more than willing to open my home to Members of Congress who are willing to do so.

Senator JEFFORDS. Good answer. You have made us all deeply concerned about the ramifications that we don't really concentrate on, so thank you very much for being here and letting us know what the real world is like in your area.

Mr. Saitas, thank you for coming to testify before the committee again. You face quite an air quality challenge in several parts of Texas. I agree that the EPA needs to be taking much more aggressive steps on these non-road sources, especially in major, nonattainment areas.

Have the States come together in any kind of a united proposal to ask EPA to expedite the necessary rules?

Mr. SAITAS. We are fortunate to have one of our commissions who is working on a committee, I believe chairing a committee for the Environmental Council of States, so we are participating through that organization and that process to try to bring these issues forward.

We will continue to do so working through our Region 6 administration of EPA and I'd have to take a moment to commend them. Despite the fact there hasn't been aggressive advancement on some of these nationwide rules, we have been able to forge, to the credit of the Region 6 EPA staff as well as some of the key organizations—for example, in Houston and in Dallas/Ft. Worth, American Airlines, Continental Airlines, Delta Airlines and Southwest Airlines entered in voluntary agreements to reduce emissions of their ground support equipment. We are very thankful for them.

Railroad organizations did so as well, so we entered a memorandum of agreement to reduce emissions with them. We did the same thing with some of the tug organizations in the Port of Houston.

We are using every avenue we can to work out some voluntary agreement so we can reduce emissions from those preempted categories. Nevertheless, there are still greater challenges in some of the other sources like construction equipment that is long overdue in terms of reducing their fair share toward the clean air goals.

We will continue to work through the national organizations, to work with EPA through our regional office, to work with those industries that are contributing to part of the problem to help find these solutions.

Senator JEFFORDS. We will be submitting to each of you additional questions in writing so that you may respond. As I say, our

time schedule this morning makes it impossible for us to go much longer.

Senator Voinovich?

Senator VOINOVICH. Mr. Freilla, I wonder do you have any monitors in your neighborhood, pollution monitors?

Mr. FREILLA. Up to about a year and a half ago, because of community calls for an air monitor, there was none near my community, though there is no existing air monitor in Hunts Point. The closest one is in an adjacent community called Longwood which was installed about a year and a half ago. Prior to that, the nearest air monitor was in the Botanical Gardens which certainly doesn't emulate the conditions in the South Bronx.

Senator JEFFORDS. Senator, I have to go to another committee to establish a quorum.

Senator VOINOVICH. I'd be glad to hold the fort, finish my questions and adjourn the meeting.

Senator JEFFORDS. You're in control.

Senator VOINOVICH (PRESIDING). I think it might be a good idea if we looked at that issue. I know they are installing monitors for particulate matter all over the country in order to measure the real impact of particulate matter when we consider this new ambient air standard. That might be something you might talk to the Administrator about. She might locate a monitor in your neighborhood so you have some baseline to look at how things are going.

The other thing you might mention to her is that there is a company in Ohio that had an emulsion that you put in diesel fuel which reduces pollution by about 40 percent. The Environmental Protection Agency is dragging their feet on it. If you're having a lot of trucks in your neighborhood powered by diesel fuel, I think your brothers and sisters would be interested in that. You might mention the Senator from Ohio indicated there is something that would help reduce diesel fuel emissions.

Currently it's being used in Europe. In fact, Europe is encouraging people to use it. There are several areas in California that want to use it. It impacts you more than a lot of others because of all the trucks that come into your area.

I'd like to ask all of you why don't we use more diesel fuel in the United States. Europe is into diesel for almost everything and we don't use it in this country. I'd be interested in knowing why.

Mr. DANA. You're speaking about light duty market more than heavy duty market, I assume? People don't seem to like diesel in this country maybe because of some experience with it in the past. It's hard to say exactly why. We haven't had pressure on fuel economy in this country.

When we look at surveys we do with consumers on what they feel is important in a vehicle, fuel economy is 25th on the list. Diesel is driven by fuel economy desires. The reason they are in Europe is because their fuel prices are much higher than they are in this country. I think the average in Europe is about 25 percent dieselization and it's going higher as part of an agreement with manufacturers in Europe. I think that is an option we have to improve and increase fuel economy.

As we look to the future with the Tier 2 rules, those rules will make it a challenge to bring diesels into the market here. We have

to look at that very carefully because it is difficult to make a commitment to building new engines in 2001 if you're not sure about where they are going in 2004–2005.

Senator VOINOVICH. Do you think that ought to be looked at? I know I had a demonstration, kind of a contest between universities to take a General Motors SUV and do some things to it to increase the gas mileage. It was a combination of two things, a hybrid, an electric engine in it and they were using converted diesel fuel. There was a dramatic reduction in the pollution, emissions. I just thought, why aren't we using more diesel fuel if that's going to help the situation.

The other thing I'd like you to comment is the issue of the alternative fuels. My colleagues say you don't have to worry about gasoline supply because we have the fuel cells, hybrid autos and so on.

I visited a facility with the Secretary of Transportation in Cleveland that is trying to reduce the cost of the gizmo they use in a hybrid automobile. I asked when is this technology going to be marketable and they said 5 or 6 years. When I talk with people about fuel cells, they talk to me about 10 to 15 years. In fact, the new President of General Motors stopped in to see me a couple of months ago and I asked him about it.

The point I'm making is, and if you disagree, tell me, we're going to continue to be using oil for a long time to power our automobiles in this country. In my opinion, the real challenge is to deal with the issue as we have it today understanding that technology is coming down the pike somewhere and how do we deal with the current situation today and do a better job of getting more mileage and less emissions?

Mr. DANA. Fuel has gotten cleaner, cars have gotten a lot cleaner running on the gasoline. We are looking at alternative fuel vehicles, we have those available today. They don't always make sense because they are sufficiently different than gasoline for the consumer market. There is not a widespread infrastructure to fuel cars on either ethanol, methanol or CNG, compressed natural gas.

We do look down the road to fuel cell vehicles many years from now which to be absolutely clean require hydrogen as a fuel. There is no hydrogen infrastructure in the country and we have to get there somehow. That is going to be a big challenge. In the meantime, you may see people converting gasoline or converting methanol or converting CNG to hydrogen to run on fuel cells because those fuels do exist in the marketplace, there is an infrastructure out there for them.

We're going to be going through a fairly major transitional time as we look at alternate fuels and look at other types of technologies coming in the marketplace in the next 5, 10 or 15 years.

Mr. MARK. If I could add a comment, I think you're absolutely right, we need to move as quickly as possible to deliver on the existing gasoline and diesel technologies today. We need to ask more of them.

I also think we need to make this transition to alternative fuels which we are already seeing in some important markets for example, in transit buses, one out of five transit buses on order is going to be powered by natural gas which delivers in the real world a savings of for example ten times in terms of particulate emissions.

That is critical to some of the communities that Mr. Freilla discussed in terms of delivering air quality benefits today.

Regarding diesel emissions and diesel vehicles and the opportunities there, I think the challenge in the United States has been diesel technology continues to lag behind gasoline technology in terms of meeting emission standards. As we continually ask for tighter standards so that we can get more of the 108 million Americans currently breathing unhealthy air to be breathing healthy air, the paramount technical challenge for diesel is to deliver on the promise of getting to cleaner air.

We think that is a very difficult challenge and that there are technologies available today in gasoline vehicles that don't make this tradeoff between fuel economy and clean air.

Mr. FREILLA. I'd like to add a comment. With respect to this issue, we've been working for the past two to 3 years on promoting clean fuels, alternative fuels in New York City and we've spoken with many businesses, diesel truck fleets in the area as well as government agencies when we have tried to pressure them to promote cleaner alternative fuels. We found too major obstacles, one of which is the lack of infrastructure that was referred to earlier, though that is something that can be remedied on the State level in terms of incentives and funding for constructing those kinds of facilities. There are companies that do construction and maintenance of alternative fuel infrastructure fueling stations for companies and diesel truck fleets.

The second and most important obstacle is the desire to do so. I'm in New York City and we have one of the largest transit fleets on the planet but we have had many battles with the agency when it comes to implementing alternative fuels and doing something like natural gas. The facilities are there and in places like New York and cities across the country where you have truck fleets that are either buses or short range delivery vehicles, there is the opportunity for doing something like implementing natural gas. The question is, is there an incentive for companies?

There are currently no real incentives when we're talking about monetary incentives, either tax incentives or credits for any of those types of measures. Currently, if a company wants to switch over, it is pretty much at their own cost. It either comes out to be about the same cost in the ideal circumstance but there is no incentive on their part. They are not saving anything.

With respect to the issue you asked about earlier, diesel, we've been opposed for a long time to extending the life of diesel simply because of the health effects. We see diesel as currently the most polluting form of fuel that is available on the market. We are trying to move away from that, though there have been questions raised about fuel cells and the need for fueling them with hydrogen. We are talking about natural gas, the infrastructure for natural gas is the same infrastructure that would be required for hydrogen fuel cells. If we move in that direction, that type of infrastructure would make that possible.

Senator VOINOVICH. One of the things we have to do is deal in the real world in terms of technology. Somehow the Europeans have reconciled and are they are getting a lot more gas mileage out

of diesel apparently. Your unanimous opinion would be they sacrificed in terms of the environment because of that.

I understand there have been some tremendous improvements made in diesel fuel in terms of its emissions?

Mr. GREENBAUM. My institute actually does research on health both in Europe and the United States, so we are quite familiar with the situation over there. I think as Greg Dana said, one of the issues there has been the difference in fuel prices. They also have had differential air pollution standards for diesel vehicles. So they have allowed diesel vehicles to have higher pollution levels than gasoline vehicles over time. They are moving as we have moved with Tier 2 toward bringing those together.

They have some places, particularly in Sweden, where they moved much sooner than anyone else here in Europe to get to cleaner diesel fuel so you could get emissions down. I also think because the technology originated there, they also moved toward higher performance versions of light duty diesel vehicles faster. We had one disaster of production in this country where people couldn't drive their car the way they were used to and as a result, that has changed.

One of the hopes one would have for this is diesel does offer not just in the vehicle but in the whole production chain some opportunities for significant benefits in terms of climate change, in terms of greenhouse gas emissions. Whatever you want to say about Kyoto, there are questions about trying to reduce those and is there a way to keep diesel actively in the marketplace here, cleaner diesels so you're getting diesels to be cleaner for ambient air pollutants and they are in turn pushing the gasoline vehicles and other vehicles to be more fuel efficient, back and forth.

I think there is an opportunity, a challenge here because the Tier 2 standards have now said, understandably, that all air pollution levels out of any car, whether diesel or gas, have to be the same, so the diesel manufacturer is going to have to come up with the technologies. They are hard at work doing this to try and meet those.

Senator VOINOVICH. You think it's something we ought to look at. If you can extend your gas mileage and cut back on the use of gasoline which is something we all want to do, become more oil independent in this nation and less reliant on foreign oil, and at the same time, you can do as well as or better than gasoline, it seems it is a "two-fer."

You mentioned you thought diesel in terms of greenhouse gases was less.

Mr. GREENBAUM. I think there are two ways in which we deal with diesel as a country and it's important to understand both. One is the one you're talking about which is looking forward, can we develop diesel technologies that are clean, very fuel efficient for cars and also for trucks.

However, if you ask the average person on the street their view of diesel, it is not shaped by what the new technology is going to be, it is shaped as is the case in neighborhoods like Mr. Freilla's by the existing diesel fleet on the street, highly polluting, very old and never controlled. In urban areas, you tend to get even the old-

est trucks because the newest technology tends to go for long distance transport first.

If we are going to deal with diesel in a serious way I think we have to come up with some way much more systematically of supporting the kinds of things going on in the South Bronx and other places to say, "What do we do about the existing diesels," which are by any measure a substantial health risk.

Senator VOINOVICH. Remember the days when you'd see smoke coming out. They have cleaned that up.

I want to say to you, please talk to the Administrator about this emulsion because it costs money but it does bring down the pollution of diesel vehicles. It applies to not only the new ones but the old ones.

I'd like to thank all of you for being here this morning. I apologize that more people aren't here to ask questions. I'm sure several will be submitting questions to you in writing.

Without objection, the statement from Senator Reid will be included in the record.

Senator VOINOVICH. Thank you very much for being here.

[Whereupon, at 11:02 a.m., the committee was adjourned, to reconvene at the call of the chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. HARRY REID, U.S. SENATOR FROM THE STATE OF NEVADA

Mr. Chairman, thank you for holding this important hearing. As the second in a series of hearings designed to assess the impacts that air pollution has on public health and the environment, I look forward to hearing from today's witnesses.

As you know Mr. Chairman, and as I said at the hearing on powerplant emissions last week, every day we learn more about the linkage between polluted air and diseases such as asthma and lung cancer. The damage to the environment from air pollution regardless of the source should concern us all.

I applaud your desire to better understand and address the impacts that the transportation sector has on human health and the environment. I am particularly appreciative that you are looking at all sources of air pollution rather than only a single component of the problem.

With that in mind Mr. Chairman, I hope you will look broadly within the transportation sector to ensure that all new vehicles help contribute to cleaning our air.

In particular, I hope you will consider the impacts of off-road vehicles on air quality. Off-road vehicles represent an important component of American recreation but they should not get a free pass on air pollution. It is unfair to regulate the efficiency and emissions of passenger vehicles but allow off-road vehicles to pump pollutants into the air unchecked.

Mr. Chairman, I am particularly concerned about the impact that snowmobiles have had at Yellowstone National Park. Yellowstone Park has been out of compliance with the Clean Air Act at times because of emissions from snowmobiles. It is unbelievable to me that this amazing symbol of the American park system cannot meet the standards of our environmental laws due to emissions from snowmobiles.

I have ridden snowmobiles in the Lake Tahoe basin. Riding snowmobiles is fun. However, nobody wants to degrade the environment they are busy enjoying by operating an inefficient machine.

Mr. Chairman, I hope we can take a careful look at entire transportation sector and evaluate where our laws are adequate and how they might be modified to protect the environment in a more efficient, effective, and equitable manner.

STATEMENT OF ROBERT D. BRENNER, ACTING ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY

Thank you, Mr. Chairman and members of the committee, for the invitation to appear here today. I appreciate the opportunity to discuss the programs this country has put in place to control air pollution caused by the transportation sector. I will first present an overview of the significant accomplishments which have been made

in reducing harmful air pollution from transportation sources. Then I will discuss additional programs that will be considered to further address the remaining air pollution problems that are experienced by millions of Americans. Finally, I will conclude by briefly discussing the energy impacts of the transportation sector and its relationship to environmental concerns.

Last week, Administrator Whitman testified before this committee on other air pollution matters. I would like to begin by re-stating her opening words. The United States should take great pride in the progress we have made in reducing pollution at the same time that we have had impressive economic growth. Over the last 30 years, we have reduced emissions of six key air pollutants by over 30 percent, at the same time that the gross domestic product has increased almost 150 percent, vehicle miles traveled have increased 150 percent, and energy consumption has increased over 40 percent. This success story was made possible by American ingenuity spurred in large part by legislation that recognized the importance of a clean environment.

In general, transportation sources contribute roughly half of the remaining overall pollution in our air. The contribution, however, can vary significantly among individual pollutants and from one city to another. Note that when I refer to transportation sources I mean all highway motor vehicles as well as mobile off-road sources. They are major sources of four pollutants, contributing 56 percent of the total U.S. emissions of oxides of nitrogen (NOx), 77 percent of the carbon monoxide (CO), 47 percent of the volatile organic compounds (VOCs), and 25 percent of the particulate matter (PM_{10}).

What Has Been Accomplished

CLEAN VEHICLES

Let me begin by discussing motor vehicles. Cars being built today are well over 90 percent cleaner than cars built in 1970. This is a result of a series of emission control programs, in many cases authorized by Congress, and fully implemented by EPA through nationally applicable regulations. Since the first tailpipe standards took effect in the 1970's, there have been increasingly more stringent standards; most recently Tier 1 in the mid–90's; NLEV, which is in effect today; and Tier 2 standards set to take effect beginning with the 2004 model year.

Today, the auto industry is supportive of the Tier 2 standards which are about 90 percent cleaner than Tier 1. This is a good example of how EPA's relationship with the auto industry has changed over the past decade from largely confrontational to cooperation and support. We are pleased with this development and hope to foster an even better relationship with the auto industry as we seek solutions to challenging environmental problems in the future. We are also working hard to build a similar sense of constructive cooperation with other transportation-related industries, particularly the fuels industry.

Let me highlight a few additional points about the Tier 2 program. Tier 2 will take a major step toward reconciling passenger vehicles with clean air. For the first time it holds SUVs, minivans and pick-up trucks to the same emission requirements as autos. Previously, light trucks had a less stringent standard, because it was recognized that some were used for commercial purposes. Tier 2 is also fuel neutral, which means that gasoline, diesel and alternative fueled vehicles all must meet the same set of standards. Tier 2 is cost effective and its benefits to public health are large over two million tons of NOx emissions avoided per year by 2020, 4,300 premature deaths prevented annually and tens of thousands of respiratory illnesses prevented.

In addition to reducing tailpipe pollutants, EPA has set tight limits on the amount of gasoline vapors which may be emitted when vehicles are operating, being refueled or parked on a summer day. Another system in place on 1996 and later vehicles utilizes the onboard computer and a series of sensors to monitor the operation of a vehicle's emission control equipment. Called onboard diagnostics, or OBD, this self-diagnostic system illuminates a dashboard light when a problem occurs.

All of the programs I have just described impose requirements on auto companies to improve the emissions performance of new cars and light trucks. Of course, motorists share responsibility to properly maintain their vehicles and not tamper with emission control equipment. Inspection and maintenance (I/M) programs, currently operating in 56 metropolitan areas, are meant to identify polluting vehicles and require their repair. Although EPA has established performance requirements for I/M programs, States are responsible for adopting and implementing the programs. States have a great deal of flexibility in designing these programs.

A recent report from the National Research Council makes two points about I/M programs. First, the review committee states that "it's important to emphasize that

these programs are absolutely necessary to reduce harmful auto emissions and achieve better air quality." Second, they find the programs are not as successful as EPA and States have estimated. We generally agree with the findings of the report and have already taken actions to adopt many of the NRC recommendations. The primary reason that I/M programs may not be as effective as EPA and the States had originally projected is that emissions control systems of late model cars deteriorate less than those on older cars. The auto companies are building more durable vehicles and that is good environmental news. We have also learned an important lesson from our efforts to implement a program such as I/M which so directly affects the public. We now know that the best approach for programs that are not national in scope is to allow State and local governments broad flexibility in meeting environmental goals. Trying a one-size-fits-all approach, for example, by forcing all States to adopt centralized I/M programs, was not the way to go. We have learned a valuable lesson from this experience and will use that knowledge in designing future programs.

Most large trucks and buses are powered by diesel engines. They can emit high levels of NOx and PM. Although cars were regulated first, diesel truck and bus manufacturers have had to comply with a series of increasingly more stringent standards beginning in the late 1980's. A major new program has just been established that will protect public health and the environment while ensuring that diesel trucks and buses remain a viable and important part of the nation's economy. This program was affirmed by the new Administration in February. Beginning in 2007, the makers of diesel engines will for the first time install devices like catalytic converters on new trucks and buses to meet the emission performance standards. When fully in place in 2030 the environmental benefits are substantial 2.6 million tons of NOx emissions will be avoided every year, 8,300 premature deaths prevented annually, and 23,000 cases of bronchitis and 360,000 asthma attacks. These health benefits far outweigh the cost to produce the cleaner engines and fuels. CLEAN FUELS

Let me now switch from cleaner vehicles to cleaner fuels. The first effort to address an environmental problem linked to fuel was the multi-year effort to phase down and eventually eliminate lead in gasoline. That successful action was followed by other programs to require oil refiners to produce cleaner gasoline. In the late 1980's refiners began to reduce the evaporation rate of gasoline nationwide during the summer months. Included in the 1990 amendments to the Clean Air Act were several new clean fuel programs required by Congress. One required a modest reduction in the amount of sulfur in highway diesel fuel. Another required all gasoline sold in CO nonattainment areas to contain an oxygenated additive during winter months. This has proven successful in reducing CO tailpipe emissions, particularly in older vehicles. Most of the wintertime oxygenated fuels programs that remain today use ethanol as the additive.

In the 1990 amendments Congress also established the reformulated gasoline (RFG) program. The RFG program was designed to serve several goals. These include improving air quality and extending the gasoline supply through the use of oxygenates. Congress established the overall requirements of the RFG program by identifying the specific cities in which the fuel would be required, the specific performance standards, and the oxygenate requirement. Today, roughly 35 percent of this country's gasoline consumption is cleaner-burning RFG. Neither the Clean Air Act nor EPA requires the use of any specific oxygenate in RFG. Both ethanol and MTBE are used in the RFG program, with fuel providers choosing to use MTBE in about 87 percent of the RFG. Ethanol is used in 100 percent of RFG in Chicago and Milwaukee, which are closer to major ethanol production centers.

Ambient monitoring data from the first year of the RFG program (1995) indicated that RFG had a positive impact on reducing toxic emissions. RFG areas showed significant decreases in vehicle-related tailpipe emissions. One of the air toxics controlled by RFG is benzene, a known human carcinogen. The benzene level at air monitors in 1995, in RFG areas, showed the most dramatic declines, with a median reduction of 38 percent from the previous year. The emission reductions which can be attributed to the RFG program are equivalent to taking 16 million cars off the road.

The RFG program with an oxygenate additive has been a successful air pollution control program. An unintended consequence, however, has been the contamination of numerous groundwater and drinking water supplies. I will address this issue later in my testimony.

In two of the programs I mentioned earlier, Tier 2 and the 2007 diesel program, EPA recognized the efficiencies of addressing vehicles and fuels as a system when establishing an emissions control program. Thus, in addition to setting strict exhaust emission standards for the vehicles and engines, we also required that clean-

er, low sulfur gasoline and diesel fuel be available to enable those emission standards to be achieved. Sulfur is similar to lead in that it degrades the effectiveness of a catalytic converter. The Tier 2 and diesel regulations provide sufficient time for refiners to make the necessary modifications to their facilities before the low sulfur fuel is required. EPA has included a number of provisions that provide additional flexibility to refiners, particularly small refiners.

OFF-ROAD ENGINES

As emissions from highway vehicles are reduced, the potential for reductions from other sources must be evaluated. Therefore, in 1990 Congress instructed EPA to study the contribution of all categories of off-road engines and equipment to urban air pollution. Congress also gave EPA for the new authority to set emission limits for these sources. As a result of our findings that certain categories of off-road engines contribute to air pollution in nonattainment areas, EPA has put in place emission control programs for the following off-road equipment: locomotives, large diesel engines used in construction and agricultural equipment, marine vessels, outboard recreational boats, and small gasoline engines used in lawn and garden equipment.

In September of this year EPA will propose rules for public review and comment on other categories of off-road engines, including large gasoline and gaseous-fueled engines used in industrial equipment, such as forklifts. It will also address several types of recreational vehicles, such as all terrain vehicles, snowmobiles and off-road motorcycles. Finally, it will seek comment on whether EPA should tighten the emission standards for highway motorcycles, which have been unchanged since 1978.

Virtually all of the control programs I have discussed thus far not only reduce emissions that cause nonattainment with the NAAQS but also significantly reduce toxic air pollutants. For example, compared to 1990 levels, the programs we have in place today for highway vehicles, including Tier 2 and the 2007 diesel rule, will reduce emissions of four gaseous toxic pollutants by about 350,000 tons by 2020, a 75 percent reduction. Diesel PM from highway vehicles will be reduced by 220,000 tons over the same timeframe, for a 94 percent reduction. To further address the growing concern of public exposure to toxic air pollution, EPA recently identified 21 chemicals as mobile source air toxics. These include various compounds that are emitted from mobile sources, including several volatile organic compounds (VOCs) and metals, as well as diesel particulate matter plus diesel emission organic gases. We also completed a regulation which controls the toxic emissions from gasoline.

One of the points I want to make in summarizing the accomplishments of our motor vehicle emissions reduction program is an acknowledgment of the success of our industry partners in meeting these requirements. Many of these programs set challenging performance standards but, almost across the board, to date auto makers, oil refiners, engine and equipment manufacturers and other businesses have met the challenge, in some cases sooner and cheaper than anyone had anticipated.

Over the past 30 years EPA has become smarter and has changed its way of doing business. We now have:

- more and earlier involvement of stakeholders;
- incentives for early reductions;
- flexibility for implementation, for example, through phase-in rather than forcing all models to meet a new standard in one model year, and allowing banking and trading of emission credits;
- special provisions for small businesses, for example, we have convened 4 small business advocacy review panels under the Small Business Regulatory Enforcement Fairness Act and incorporated a number of panel recommendations in our final regulations;
- a new sensitivity to the market impacts of our programs.

Our goal is to use the lessons we have learned over the years to make our programs even more effective in the future. Equally important, we plan to utilize these new approaches to tackle the challenges we have facing us today. I will talk about those now.

What Remains to be Done

HEALTH EFFECTS FROM AIR POLLUTION

Pollutants which are directly emitted by transportation sources are NOx, VOCs, fine particulate matter ($PM_{2.5}$), and CO. In the presence of sunlight, NOx and VOCs react photochemically to produce ozone. NOx can be transported long distances and contribute to ozone many hundreds of miles from its source. More than 97 million people live in areas that do not yet meet the health-based 1-hour ozone standard (based on 1997–1999 data). The number would be even higher for the new 8-hour

ozone standard. Reducing ozone levels will result in fewer hospitalizations, emergency room and doctors visits for asthmatics, significantly fewer incidents of lung inflammation for at-risk populations, and significantly fewer incidents of moderate to severe respiratory symptoms in children.

Not only will reducing ozone provide public health benefits, but it will avoid damage to ecosystems and vegetation. Ozone causes decreased agricultural and commercial forest yields, increased mortality and reduced growth of tree seedlings, and increased plant susceptibility to disease, pests, and environmental stresses (e.g., harsh weather). Since NOx emissions result in formation of ground-level ozone, reducing NOx emissions will reduce ozone levels and thus reduce the deleterious effects of ozone on human health and ecosystems.

All particulate matter emitted from the transportation sector is "fine" particulate, which means it is be deposited deep in the lungs when breathed in the ambient air. A substantial body of published scientific literature recognizes a correlation between elevated fine particulate matter and increased incidence of illness and premature mortality. The health impacts include aggravation of chronic bronchitis, hospitalizations due to cardio-respiratory symptoms, emergency room visits due to aggravated asthma symptoms, and acute respiratory symptoms. Based on these findings, EPA and others estimate that attaining the fine particle standards would avoid up to tens of thousands of premature deaths annually.

The significant expansion in scientific research in recent years has enhanced our understanding of the effects of particles on health. EPA is summarizing all new information in the ongoing review of the particulate matter standard in a "criteria document" that will undergo extensive peer and public review.

EPA PRIORITIES

The first priority of EPA is to assure smooth implementation of programs whose regulations are set but are not yet in effect. Tier 2 is one such program, but even here we are very pleased that auto companies have certified four vehicle models to Tier 2 standards more than 2 years ahead of schedule. Additionally, some oil companies are already selling cleaner, low sulfur gasoline in cities around the country. The 2007 diesel program is another example in which some companies are moving ahead to introduce cleaner diesel engines and fuel, even though the core program requirements do not take effect for five or more years. EPA will conduct its own biennial assessment of progress being made toward implementation. In addition, EPA will request an independent review, which will monitor the progress of the engine manufacturers and the fuels industry in meeting the program requirements. This independent review will begin next year. The independent review will be conducted in an open, public process that will follow the requirements of the Federal Advisory Committee Act. A third example is our ongoing efforts to work with State officials who manage I/M programs and auto companies to efficiently incorporate the diagnostic capabilities of OBD systems into State I/M programs.

Another major environmental priority that must be addressed is whether or not MTBE will be a component of our nation's future gasoline supply. As I mentioned previously, there is significant concern about contamination of drinking water in many areas of the country. Current data on MTBE in ground and surface waters indicate widespread and numerous detections of MTBE at low levels. Accordingly, EPA published last year an Advance Notice of Proposed Rulemaking requesting comments on a phase down or phaseout of MTBE from gasoline under Section 6 of the Toxic Substances Control Act (TSCA). EPA believes that TSCA is the best regulatory process available for limiting or eliminating the use of MTBE. Eleven States have banned MTBE, one as early as the end of 2002. At least a dozen more States are considering similar bans.

The Clean Air Act authorizes States to regulate fuels through State Implementation Plans if EPA finds such regulations necessary to achieve a national air quality standard. States often use this authority to adopt clean fuel programs that provide significant air pollution reduction benefits. This has resulted in a number of different formulations being required by States which are often referred to as boutique fuels. Actions taken by a growing number of States to ban the use of MTBE as a gasoline additive is the single biggest factor that threatens to proliferate boutique fuel requirements around the country. EPA understands the challenge that State and local "boutique fuel" requirements place on the production and distribution of gasoline in the U.S. These State fuel programs could limit flexibility in the fuel distribution system, particularly if a disruption occurs. If the number of special fuels were limited, while maintaining needed air quality benefits, greater fungibility within the distribution system could possibly result.

The National Energy Policy report issued on May 17, 2001 includes a recommendation that directs EPA to study opportunities, in consultation with DOE, USDA and other agencies, to maintain or improve the environmental benefits of State and local "boutique" fuel programs while exploring ways to increase the flexibility and fungibility of the fuels distribution infrastructure, and provide added gasoline market liquidity. We have begun our boutique fuel assessment; we are consulting various stakeholders, including the States, and expect to make recommendations later this year.

The issues surrounding boutique fuels and the future of MTBE are both related to the statutory requirement that an oxygenate must be added to RFG. As I have mentioned, Congress established the oxygen requirement in 1990 to meet multiple goals: improve air quality, enhance energy security, and encourage the use of renewable fuels. We now know that some refiners can produce clean fuels without the use of oxygenates. Thus, there may be better ways to achieve these goals. EPA strongly supports the use of renewable fuels, such as ethanol, and a great deal of research in this area is being done by others in the Federal Government.

As emissions from automobiles and trucks are significantly reduced in the future as a result of the Tier 2 and the 2007 heavy duty emission standards, in combination with the lower fuel sulfur levels, the next major category of mobile source emissions to be addressed is large diesel engines used in construction and agricultural equipment. Even though modest emission requirements are in place for this equipment, by 2020 the category will contribute over 10 percent of the total NOx emissions inventory in a typical metropolitan area and 8 percent of the PM emissions.

Our current plans in regard to these large, off-road diesel engines are to conduct an initial assessment of the environmental impacts and the feasibility and costs of future control technology in an EPA White Paper which we would release for public review by the end of this year. One of the major issues that needs to be considered is the potential need to lower the sulfur levels in off-road diesel fuel to enable new exhaust control technology to be utilized on future engines. As we found with highway vehicles, this approach of comprehensively looking at the engines and fuel as a system is appropriate here as well. Our plan would be to incorporate the information we receive from the public review of the White Paper into a formal, proposed rulemaking to be published sometime next year.

The programs I have discussed for reducing emissions from diesel engines affect newly produced engines only. But there are millions of older diesel trucks, buses and off-road equipment in use today, many of which spew noxious, black soot from their exhaust pipes. The hazards of diesel exhaust have been the subject of extensive medical research. At the end of last year, EPA's independent science advisory committee concluded that diesel exhaust is a likely human carcinogen. EPA has therefore initiated, in cooperation with manufacturers of diesel emission control systems, a major new initiative to install cost effective emission control equipment on older diesels. Called the Diesel Retrofit Program, the Agency's goal in this calendar year is to obtain commitment from businesses and municipalities that own fleets of trucks or buses to retrofit 100,000 vehicles with devices that will reduce exhaust emissions. I am pleased to report that we are already well over half way toward meeting this goal.

Here is one such commitment. Just 3 weeks ago, Administrator Whitman traveled to Seattle to participate in an event announcing a public-private partnership to clean up the existing fleet of diesel engines in the Seattle area through engine retrofits and the early introduction of ultra low sulfur fuels. Partners with EPA in the program include: the Puget Sound Clean Air Agency; the city of Seattle; King County; the Boeing Company; Tosco Refining; the Manufacturers of Emission Control Association; and the Diesel Technology Forum. Seattle's Diesel Solutions Partnership will deliver more than a 90 percent reduction in particulate matter and reduce air toxics in the fleet of retrofitted engines. As a result of this program, 25 percent of the 100 school bus fleet in Everett, Washington, will be low polluting, as well as a fleet of garbage and recycling trucks operating in Seattle neighborhoods.

To improve the analytical capabilities of air pollution control planners, the Agency has recently embarked on an effort to develop the New Generation Mobile Source Emissions Model. The objective is to develop a comprehensive modeling system for the estimation of mobile source emissions (both on and off-road). The system will estimate emissions in conjunction with the appropriate activity data for criteria pollutants, particulate matter, air toxics, and greenhouse gases. The modeling system will be developed in coordination with stakeholders and users and will incorporate peer review processes throughout its development.

Another important area of future work is the completion of a Technical Analysis Plan for possible further control of toxic air pollutants from transportation sources. This Plan, which EPA announced in December 2000, describes our continued re-

search and analysis on mobile source air toxics. Based on the results of that research, EPA will conduct a future rulemaking to be completed by July 1, 2004, to promulgate any additional vehicle and fuel toxic controls that EPA determines are appropriate under the Act, including off-road sources.

Let me now turn to an approach to reducing transportation-related emissions that is quite different from EPA's traditional methods of setting regulatory requirements on vehicles, engines and fuels. This approach addresses the impact our transportation infrastructure has on air quality and explores voluntary actions to reduce vehicle travel. First, let me mention a concept that was include by Congress in the 1977 Clean Air Act Amendments and was significantly strengthened in 1990 transportation conformity. Simply stated, the transportation conformity provision of the Act requires that transportation planners coordinate with air quality planners to assure that new roads or expansions of existing roads will not worsen air quality. Although the goal is straightforward, the analytical and administrative procedures that must be followed to demonstrate that transportation plans "conform" to air quality plans in a given city or region are not so simple. EPA, in close partnership with our colleagues at the Department of Transportation, have worked closely with State, local and regional planners over the last several years to streamline the conformity regulations and reduce administrative burdens. The conformity program has been successful in getting transportation planners to work with air quality planners when highway projects are in the design stage, and in a number of cities around the country it has resulted in better projects that improve the transportation infrastructure while assuring no adverse impacts on air quality.

Now let me describe an exciting new initiative EPA is undertaking to address the growth in number of miles driven by American motorists as our economy continues to grow. In 1970 vehicle miles traveled, or VMT, was 1 trillion miles. By the late 1990's VMT had risen to 2.5 trillion miles, as more vehicles are driven more miles every year. The implication of this growth is that even as the emissions on a single car are dramatically reduced through new technology, the aggregate emissions from the entire U.S. fleet do not show a similar reduction simply because the number of cars on the road is continually growing. Directly related to that is the worsening traffic congestion in many of our metropolitan areas, with traffic jams becoming a fact of life, even in smaller towns. All of us are well aware of the increasing public concern with this problem. In response, we have initiated the Commuter Choice Leadership Initiative. This program promotes employer-provided commuting benefits by giving recognition, resources, tools and information to employers that meet a national standard of excellence in the commuting benefits they offer their employees. It is also a program that may potentially be used to achieve the goals of the conformity requirements I have just described.

Initially, EPA and DOT worked with a core group of employers (including Intel, Disney, Kaiser Permanente, and the city of Fort Worth) to develop the criteria for the national standard of excellence the keystone of this voluntary program. In mid-April, members of the Federal team began outreach to employers, local, regional and State governments, transportation service providers and others, regarding the Commuter Choice Leadership Initiative program goals and requirements. To date, over 70 employers have joined the partnership with over 120,000 employees enjoying commuting benefits that meet the national standard of excellence. This number is constantly rising: every day new organizations join and our goal is to have 300 employers signed up by 2002. The Commuter Choice Leadership Initiative provides incentives for changing the standard American commuting pattern driving alone to work. The benefits that accrue especially reduced traffic congestion, improved air quality and reduced fuel consumption will enhance quality of life in communities across the nation.

Energy Issues Related to Environmental Programs

I would like to spend a few moments talking about vehicle fuel economy and EPA's role in this area. The transportation sector accounts for almost 70 percent of the U.S. oil consumption. This fact not only has implications on national energy policy, but also means that the transportation sector contributes almost one-third of the total U.S. greenhouse gas emissions, primarily in the form of CO_2.

EPA has a significant role in the assessment of vehicle fuel economy. Our National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan, is the world's premier test center not only for emissions but also for fuel economy. Our engineers are involved in the development of advanced technologies to achieve cleaner, more fuel efficient motor vehicles. They also assess new technologies developed by the auto industry and other research facilities. In addition, EPA performs fuel economy testing on new models and reports this to the public at the start of each model year. EPA and DOE have created a website that provides consumers with easy access to

fuel economy data. In addition, EPA has created the Green Vehicle Guide, a website which provides consumers who may be considering a new vehicle purchase with relative rankings of models by tailpipe emissions and gas mileage. The EPA mileage figures are also used on new car window stickers. EPA maintains the fuel economy data base that provides data to the Department of Transportation about Corporate Average Fuel Efficiency compliance and identifies gas guzzler models to the Treasury Department for application of the gas guzzler tax.

Since the 1970's, EPA has also published the annual Fuel Economy Trends Report. Our latest report finds that, since 1975, the average auto fuel economy measured in miles per gallon (mpg) has doubled. This doubling, however, occurred entirely before 1987. For the past 14 years, new car fuel economy has been roughly unchanged. The average fuel economy of the new passenger vehicle fleet in 2001 model year is about 2 mpg below the 1988 peak. The primary cause of this declining trend is the increasing popularity of light trucks, a category that includes minivans, sport utility vehicles, and pick-up trucks. Because light trucks have to meet a less stringent fuel economy standard than other passenger vehicles, their growing numbers pull down the average of the entire fleet. However, within the past 12 months Ford has made a voluntary commitment to raise its average SUV fuel economy by 25 percent by 2005, and General Motors and DaimlerChrysler have said they would do better than Ford on light truck fuel economy.

Our most recent Trends Report notes that there appear to be advanced technologies that promise substantial increases in fuel economy. Hybrid power vehicles, which combine an internal combustion engine with an electric motor, have been introduced into the market by Honda and Toyota, while GM, Ford, and DaimlerChrysler have announced plans to introduce hybrids over the next several years. In the longer term, fuel cells offer tremendous potential to not only improve fuel economy but also reduce tailpipe pollutants, depending on the fuel that is used.

Summary

I have attempted to present a brief overview of the accomplishments of our national effort to improve the quality of the air we all breathe. This testimony has been focused on the transportation sector, which is a major part of the air pollution problem in this country, but which also has made tremendous advancements in reconciling transportation sources with environmental concerns. As I have mentioned, our work is not finished. Difficult air pollution problems remain and they will challenge the ingenuity of our industrial partners, our colleagues working for State and local governments, environmental and public health organizations and, most importantly, the continued support of the American public.

Mr. Chairman, that concludes my testimony. Thank you for the opportunity to make these remarks. I would be pleased to answer any questions the committee members may have.

STATEMENT JASON MARK, DIRECTOR, CLEAN VEHICLES PROGRAM, UNION OF CONCERNED SCIENTISTS

Mr. Chairman and members of the committee, thank you for the opportunity to testify before you today. My name is Jason Mark, and I direct the Clean Vehicles Program at the Union of Concerned Scientists. UCS is a nonprofit partnership of scientists and citizens that has been working at the intersection of science and policy for over 30 years.

I am going to speak to you today about our continuing struggle to achieve clean air and, in particular, the importance of improving transportation efficiency in addressing air pollution and global warming.

The State of Transportation-Related Air Quality

Despite years of progress, we are far from solving the transportation-related air quality problem in the United States. 108 million Americans still live in areas that do not meet Federal clean air standards,[1] and vehicles are a major cause. According to the Environmental Protection Agency, transportation accounts for roughly half of all emissions that contribute to ground-level ozone, or smog.[2] In urban areas, motor vehicles are typically the dominant polluter. For example, one recent government

[1]Population of U.S. regions that are out of attainment for meeting the current 1-hour ozone standard as of January 29, 2001. Source: http://www.epa.gov/oar/oaqps/greenbk/onsum.html.

[2]Hydrocarbons (HC) and nitrogen oxides (NOx) are the key precursors to ground-level ozone.

study estimates that over 90 percent of the cancer risk from polluted air in the Los Angeles region comes from cars and trucks.[3]

Rising vehicle travel, a changing vehicle fleet, and the realities of vehicle performance in the real world all pose key hurdles to achieving acceptable levels of air quality.

- Rising Travel. There are now more vehicles in the United States than licensed drivers. Combined with increasing travel rates per vehicle, the number of miles that Americans are driving continues to rise. Vehicle travel is expected to increase nearly 50 percent over the next 20 years,[4] a trend that will undo the progress we are currently making to achieve clean air.
- Shifting Markets. SUVs and other light trucks are allowed to emit up to 2.5 times more smog-forming pollutants than cars under current tailpipe standards. While this loophole will be phased out by 2009 under EPA's Tier 2 regulations, the fact that light trucks have historically been held to more lax standards has resulted in the average light truck on the road today emitting 47 percent more smog-forming pollutants than the average car.[5] nationwide, these loopholes have added 41 million cars worth of smog-forming pollution in recent years.[6]
- Real World Emissions. While emissions from vehicles are reaching very low levels as measured over government tests, real world emissions are typically several times higher. For example, today's average gasoline car emits smog-forming pollution at more than twice the rate measured during certification testing.[7] Thus, while the auto industry often claims that their vehicles are over 96 percent cleaner than three decades ago, the evidence in the field does not quite bear this out. Similarly, a $1 billion clean air settlement in 1998 between diesel engine makers and the EPA—one resulting from engine makers selling engines that are estimated to have emitted 28 million cars worth of smog-forming pollution[8]—reminds us that our big rigs have some distance to travel in staying clean over their million-mile lifetimes.

Fortunately, new technologies are available that will take cars and trucks the next step toward cleaning the air. Gasoline powered vehicles are beginning to enter the market that are 10 times cleaner than the average. Diesel technology is emerging in response to new Federal standards that will cut pollution from heavy vehicles ten-fold.

Even cleaner options are moving onto the road. Electric-drive vehicles, such as battery, hybrid, and fuel cell cars and trucks, promise zero or near-zero emissions. New fuels, such as natural gas, are cutting toxic soot pollution from transit and school buses. Together, this combination of cleaner fuels and advanced technology will be essential if we are to protect public health in the 21st century.

The Role of Fuel Consumption

But even as we move to cleaner vehicles, we will continue to be plagued by emissions associated with the production and delivery of fuels. For example, the refining and distribution of each gallon of gasoline results in over 6 grams of smog-forming pollution and nearly 3 grams of toxic pollutants.[9] These emissions are a direct result of driving—even though they do not come from vehicle tailpipes—because as we use more fuel, more pollution is created to make the fuel. As new regulations cleanup tailpipes, these so-called upstream emissions will become the dominant source of vehicle pollution.

The best strategy for reducing gasoline-related emissions, of course, is to reduce gasoline use itself. This approach prevents air emissions before they are created and has the added benefit of addressing one of the most significant environmental challenges facing the planet: global warming.

Each gallon of gasoline yields 24 pounds of the greenhouse gases that result in climate change.[10] Scientists worldwide agree that humans are having a measurable impact on our climate. The potential economic and environmental consequences are

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[3]South Coast Air Quality Management District. Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES-II). Diamond Bar, CA: SCAQMD. September 2000.

[4]Energy Information Administration. Annual Energy Outlook 2001. Washington, DC: U.S. Department of Energy. December 2000.

[5]Mark, J. Greener SUVs: A Blueprint for Cleaner, More Efficient Light Trucks. Cambridge, MA: UCS. July 1999.

[6]Ibid.

[7]Hwang, R.J. "Getting to Zero: Comments on the Zero-Emission Vehicle Program," presented at the California Air Resources Board Hearing on the 2000 Zero Emission Vehicle Program Biennial Review. Sacramento, CA. September 7–8, 2000.

[8]Mark, J. and C. Morey. Rolling Smokestacks: Cleaning Up America's Trucks & Buses. Cambridge, MA: UCS. October 2000.

[9]Friedman, D., J. Mark, P. Monahan, C. Nash, and C. Ditlow. Drilling in Detroit: Tapping Automaker Ingenuity to Build Safe and Efficient Automobiles. Cambridge, MA: UCS. June 2001.

[10]Ibid.

severe. Higher temperatures can also increase air pollution. Smog, which forms in the presence of heat and sunlight, increases with even small temperature changes. For example, one recent study from the Lawrence Berkeley National Laboratory suggests that temperature increases in the Los Angeles region over the next half-century could create 2.7 million cars-worth of pollution.[11] We believe there is a strong policy case, then, for giving EPA the authority to regulate greenhouse gas emissions under the Clean Air Act.

Of course, climate change is a global issue, since emissions anywhere in the world have an impact on our climate. But U.S. cars and trucks alone emit more global warming pollution than all but three countries in the world[12]—so any global effort to reduce the threat of climate change must address vehicles on American roads.

Technological Opportunities

Fortunately, technologies exist that can address fuel use from the vehicle fleet. The Union of Concerned Scientists and the Center for Auto Safety recently published an analysis outlining a safe and economically sound path to boosting automotive efficiency.[13] Using existing technologies—such as variable-valve engines, multi-speed or continuously variable transmissions, and weight savings—we estimate that passenger vehicles could reach an average of 40 miles per gallon over the next 10 years, up from today's average of 24 mpg. The greenhouse gas savings would be equivalent to taking nearly 60 million cars off the road by 2012. By using less fuel, we would save 440 million pounds of smog-forming pollution and 200 million pounds of toxics annually from refining and distributing gasoline.

Boosting fuel economy to 40 mpg is also the environmentally responsible strategy to addressing our oil dependence. In 10 years, we would save more oil than is economically recoverable from the Arctic National Wildlife Refuge in over 50 years. Consumers would save $16 billion per year by 2012 through lower costs at the pump.

The National Academy of Sciences recently completed its much-anticipated evaluation of fuel economy technology. Their results confirm that technology can cost-effectively boost the fuel economy of our vehicles. Using a subset of the technologies that we have evaluated, the NAS estimates that light trucks could reach 28–30 mpg at a cost of $1,200–1,300, and cars 34–37 mpg at a cost of $600–650. We believe that, for an additional investment of $600–700 per vehicle, we could reach a fleet average of 40 mpg while saving drivers $3,000–5,000 at the pump over the life of their vehicle.

Policy Priorities

I want to make one final point about the role of policies in achieving environmental goals. UCS strongly supports incentives programs that encourage industry to deliver cleaner, more efficient vehicles. We have worked closely with several automakers to develop tax credits for advanced vehicles, embodied in the CLEAR Act that several members of this committee have supported. As the Senate takes up this important legislation, we urge you to maintain the environmental provisions that guarantee credits will flow to vehicles that are both efficient and clean. We also urge you to consider incentives for cleaner trucks and buses, such as legislation recently introduced in the House that would provide Federal grants to school districts that replace their dirtiest, least safe diesel buses with commercially available clean buses that protect children's health.

But incentives only work within a framework where firm standards guarantee environmental gains. Virtually all of the progress we have made to date with respect to motor vehicles and air pollution has been the result of government action. The evidence suggests that past regulatory programs have been highly effective. For example, the cost effectiveness of nearly every major vehicle emissions regulation aimed at reducing smog precursors over the past 15 years has been less than $1 per pound,[14] even as emissions requirements have become ever more stringent. We have a history of overestimating costs of environmental programs and making dire predictions over the impact of new rules.

Nearly 30 years ago, Federal regulators enacted new rules to require the first catalytic converters on passenger vehicles. The industry sued for a delay. In a 1973 hearing, GM's vice president for environmental affairs said: "[I]f GM is forced to in-

[11]Taha, H. Potential Impacts of Climate Change on Tropospheric Ozone in California: A Preliminary Episodic Modeling Assessment of the Los Angeles Basin and Sacramento Valley. Berkeley, CA: Lawrence Berkeley National Laboratory. January 2001.

[12]Friedman et al. 2001, op cit.

[13]Ibid.

[14]Personal communication. Tom Cackette, Chief Deputy Executive Officer, California Air Resources Board.

troduce catalytic converter systems across the board on 1975 models, the prospect of unreasonable risk of business catastrophe and massive difficulties with these vehicles in the hands of the public may be faced. It is conceivable that complete stoppage of the entire production could occur, with the obvious tremendous loss to the company, shareholders, employees, suppliers, and communities."[15] GM won a delay in the rule but went on to introduce catalytic converters on all of its models beginning in 1975.[16]

As we struggle to address transportation-related air quality and climate change, I urge you to consider strong standards that set aggressive, yet achievable, goals for industry's engineers. We will make important progress through your continued support for key air quality programs such as the Tier 2 tailpipe standards and accompanying low-sulfur fuel requirements. The next step in improving the environmental performance of vehicles is boosting the fuel economy of our fleet. This is an issue that Congress has not addressed for over a decade, yet we believe the technical, economic, and environmental case for action is clear. The technology exists to cost-effectively bring SUVs, pickups, and minivans up to the fuel economy standards of cars and then boost the entire fleet to over 40 miles per gallon over the next 10 years. It is a policy path that is good for consumers' pocketbooks and good for the environment.

Thank you for the opportunity to testify before the committee today. I would be happy to answer any questions you may have.

STATEMENT OF GREGORY DANA, VICE PRESIDENT FOR ENVIRONMENTAL AFFAIRS, ALLIANCE OF AUTOMOBILE MANUFACTURERS

Mr. Chairman, Thank you for the opportunity to testify before your committee regarding the impact of air emissions from the transportation sector on public health and the environment. My name is Gregory Dana and I am Vice President, Environmental Affairs of the Alliance of Automobile Manufacturers, a trade association of 13 car and light-truck manufacturers. Our member companies include BMW of North America, Inc., DaimlerChrysler Corporation, Fiat, Ford Motor Company, General Motors Corporation, Isuzu Motors of America, Mazda, Mitsubishi, Nissan North America, Porsche, Toyota Motor North America, Volkswagen of America, and Volvo.

Alliance member companies have more than 620,000 employees in the United States, with more than 250 manufacturing facilities in 35 States. Overall, a recent University of Michigan study found that the entire automobile industry creates more than 6.6 million direct and spin-off jobs in all 50 States and produces almost $243 billion in payroll compensation annually.

The Alliance member companies are proud of the record they have achieved in reducing tailpipe emissions of hydrocarbons, carbon monoxide, and nitrogen oxides from motor vehicles. Cars being sold today are 96 percent cleaner than uncontrolled vehicles from over 30 years ago. Compared to other emission sources:

- Using a chain saw for 1 hour emits the same amount of hydrocarbons as driving 600 miles in a typical car the distance from Washington, DC to Atlanta.
- Using a snowblower for 1 hour emits the same amount of carbon monoxide as driving a typical car 305 miles the distance from Phoenix to Las Vegas.
- A Jet Ski emits more in only 7 hours of use than a new car does in traveling 100,000 miles the average mileage accrued over a decade of driving.

With the adoption of EPA's Tier 2 rulemaking (65 FR 6698, February 10, 2000), which will begin to be phased in with the 2004 model year (the fall of 2003), emissions from cars and light trucks will be reduced another 80 percent from today's clean vehicles. While recognizing that it is a tough challenge for our engineers, the Alliance accepted this EPA rulemaking. This rulemaking requires that:

Cars and light trucks meet the same emission standards for the heaviest light trucks, this means that emissions of nitrogen oxides must be reduced from 1.53 grams per mile (gpm) to an average of 0.07 gpm.

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[15]Applications for Suspension of 1975 Motor Vehicle Emission Standards, Decision of the Administrator on Remand from the United States Court of Appeals, District of Columbia Circuit, April 11, 1973, hearing transcript, at 29–30, cited in Clarence Ditlow, "Federal Regulation of Motor Vehicle Emissions under the Clean Air Act Amendments of 1970," Ecological Law Journal. 1975, pp. 495–504; and "EPA—Auto Emission Standards," congressional Quarterly, March 17, 1973, p. 600.

[16]Doyle, J. Taken for a Ride: Detroit's Big Three and the Politics of Pollution. New York, NY: Four Walls Eight Windows. April 2000.

All cars and light trucks must meet an increased useful life of 120,000 miles from today's requirement of 100,000 miles (this increases the durability of the emission control system).

Evaporative hydrocarbon emissions (from the fuel tank and lines) are cut in half over today's levels.

Diesel-powered vehicles will have to meet the same standards as gasoline-powered vehicles.

This rulemaking also reduces the amount of sulfur in gasoline from recent high levels up to 1000 parts per million (ppm) to a cap of 80 ppm in 2006. Cleaner fuel is a critical part of our ability to achieve these very stringent emission standards. Sulfur poisons the catalyst, and the newer catalysts that are being developed for Tier 2 vehicles are extremely sensitive to it. With the extremely low levels of emissions that are required under Tier 2, the catalyst must be extremely efficient for the entire useful life of the vehicle. Even cleaner gasoline than required by Tier 2 with sulfur approaching near-zero levels, capping the distillation index at 1200 and adopting other limits as recommended by the world's automakers in the World-Wide Fuel Charter is absolutely critical to ensure the lowest possible emissions in conventional vehicle technology and to enable new fuel efficient gasoline lean-burn technologies.

What is most impressive about removing sulfur from fuel is that all vehicles equipped with catalysts (which were first installed in 1975 models) will become cleaner due to this change in the fuel. This is because the catalysts in these vehicles will now function more efficiently than before. So the emission reductions due to the removal of sulfur from gasoline are huge.

While we support EPA's rulemaking, we also believe that more should be done to clean up motor vehicle fuel, including reducing sulfur levels even further. The Alliance supports the goals of the World Wide Fuel Charter, which calls for "near-zero" sulfur (levels below 5–10 ppm), capping the distillation index at 1200 F and other changes in motor vehicle fuel. We note that the European Union is well on its way toward making such cleaner fuel available.

The Alliance also strongly supports the EPA's recently finalized rulemaking to control the emissions of heavy-duty engines and diesel fuel sulfur. The reduction of sulfur levels in diesel fuel to a maximum of 15 ppm is critical for helping to enable tighter control of emissions for both heavy-duty engines and light-duty diesel applications. With advanced diesel engines and clean fuel, we believe that diesels will be able to meet the more stringent Tier 2 standards by using after treatment emission control devices for the first time. Diesel engines are one of the tools the industry has to achieve higher fuel efficiency along with other technologies that are mentioned later in my statement. The new, advanced technology diesel engines are nothing like the diesels from the past. These new engines are smooth and quiet and don't emit black smoke commonly associated with diesels. They are proving very popular today in Europe and are part Europe's strategy for reducing greenhouse gas emissions. If clean enough fuel is widely available, they will also be very clean, meeting the same Tier 2 emission standards that gasoline-powered vehicles have to meet.

There is also good news on air toxics. EPA finalized its motor vehicle air toxics rulemaking in March (66 FR 17230, March 29, 2001). EPA found that the emission reductions resulting from the Tier 2 rulemaking has the additional benefit of reducing toxic air emissions to a level such that no further control is needed.

Our efforts to reduce environmental pollutants also extends to our production facilities:

- Automakers have reduced toxic chemical use, and reformulated paints and solvents for lower emissions at auto production facilities.
- Automakers have developed effective waste reduction methods, such as reusable shipping containers for parts and recycling.
- Automakers are also working with suppliers to minimize the environmental impact of operation and production, such as award-winning Brownfields redevelopment.

Moreover, the Alliance supports efforts to create an effective energy policy based on broad, market-oriented principles. Policies that promote research and development and help deploy advanced technologies by providing customer based incentives to accelerate demand of these advanced technologies, set the foundation. This focus on bringing advanced technologies to market leverages the intense competition of the automobile manufacturers worldwide. Incentives will help consumers overcome the initial cost barriers of advanced technologies during early market introduction and increase demand, bringing more energy efficient vehicles into the marketplace.

Congress needs to consider new approaches for the 21st century. The Alliance and its 13 member companies believe that the best approach for improved fuel efficiency is to aggressively promote the development of advanced technologies through cooperative, public/private research programs and competitive development and incentives to help pull the technologies into the marketplace as rapidly as possible. We know that advanced technologies with the potential for major fuel economy gains are possible. As a nation, we need to get these technologies on the road as soon as possible in an effort to reach the national energy goals as fast and as efficiently as we can.

Senate legislation that has been crafted to spur the sale of advanced technology fuel-efficient vehicles is included in S. 389, introduced by Senator Murkowski. This legislation would (1) provide tax credits for the purchase of alternative fuel and hybrid vehicles, (2) modify the existing tax credit for electric vehicles, (3) extend the dual fuel CAFE credit, (4) provide a business tax credit for alternative fuels sold at retail, (5) extend for 3 years the tax deduction for alternative fuel refueling property and add a new deduction for this property, (6) allow States to open HOV lanes to alternative fuel vehicles, (7) allow DOE to provide equivalent alternative fuel vehicle credits to fleets or persons that invest in alternative fuel refueling infrastructure, (8) establish a Federal grant program for local governments addressing the incremental cots of qualified alternative fuel vehicles, and (9) require Federal agencies to increase the fuel efficiency of newly purchased Federal vehicles.

Many of the provisions in S. 389 are included in S. 760 introduced by Senator Hatch, Senator Jeffords and others. The Alliance is in general support of S. 760, but would like to see some minor, technical changes made to the hybrid-electric vehicle section of the bill and would also support the inclusion of tax credits for advanced lean burn technology. The Alliance believes that the overall concepts and provisions found in S. 760 are the right approach and would benefit American consumers.

The bill would ensure that advanced technology is used to improve fuel economy. Performance incentives, tied to improved fuel economy, are incorporated into the legislation in order for a vehicle to be eligible for the tax credits. These performance incentives are added to a base credit that is provided for introducing the technologies into the marketplace.

Specifically, S. 760 has a number of important provisions addressing various types of advanced technologies.

Fuel Cell Vehicles

The most promising long-term technology offers breakthrough fuel economy improvements and zero emissions. Over the very long term, it may enable a shift away from petroleum-based fuels, assuming alternative fuel infrastructures can be developed. A $4,000 base credit is included along with performance based fuel economy incentives of up to an additional $4,000. The credit is available for 10 years to accelerate introduction extremely low volume production is expected to begin in the 2005–2007 timeframe.

Hybrid Vehicles

Electronics that integrate electric drive with an internal combustion engine offer near term improvements in fuel economy. A credit of up to $1,000 for the amount of electric drive power is included along with up to $3,000 depending upon fuel economy performance. The credit is available for 6 years to accelerate consumer demand as these vehicles become available in the market and set the stage for sustainable growth. To be eligible for the credit, hybrid vehicles must meet or beat the average emission level for light duty vehicles.

Dedicated Alternative Fuel Vehicles

Vehicles capable of running solely on alternative fuels, such as natural gas, LPG, and LNG, promote energy diversity. Many alternative fuel technologies also offer reduced emissions compared to conventional vehicle technology. A base credit of up to $2,500 is included with an additional $1,500 for vehicles certified to "Super Ultra Low Emission Vehicle" standards (SULEV).

Battery Electric Vehicles

Vehicles that utilize stored energy from "plug-in" rechargeable batteries offer zero emissions. A base credit of $4,000 is included (similar to the fuel cell—both have full electric drive systems) and an incremental $2,000 is available for vehicles with extended range or payload capabilities.

Alternative Fuel Infrastructure Incentives

Alternative fuels such as natural gas, LNG, LPG, hydrogen, B100 (biomass) and methanol are primarily used in alternative fueled vehicles and fuel cell vehicles. To

encourage the installation of distribution points to support these vehicle applications, a credit of $0.50 for every gallon of gas equivalent is provided to the retail distributor. This credit is available for 6 years and will support the distribution of these fuels as vehicle volume grows and may be passed on to the consumer by the retail outlet. Note that ethanol is not included in these provisions due to the existing ethanol credit.

Complementary to the credit for the fuel itself, the existing $100,000 tax deduction for infrastructure is extended for 10 years and a credit for actual costs up to $30,000 for the installation cost of alternative fuel sites available to the public is included. One of the key hurdles to overcome in commercializing alternative fuel vehicles is the lack of fueling infrastructure. For nearly a century, infrastructure has focused primarily on gasoline and diesel products. These proposed infrastructure and fuel incentives will help the distributors overcome the costs to establish the alternative fuel outlets, especially during initial lower sales volumes, before the number of alternative fuel vehicles increases to commercially sustainable levels.

To reiterate, the way to improve vehicle and fleet fuel economy, one that is in tune with consumer preferences, is to encourage the development and purchase of advanced technology vehicles (ATVs). Consumers are in the driver's seat and most independent surveys show that Americans place a high priority on performance, safety, space and other issues with fuel economy ranking much lower even with today's gas prices. ATVs hold great promise for increases in fuel efficiency without sacrificing the other vehicle attributes consumers desire. Just as important, the technology is transparent to the customer.

Member companies of the Alliance have invested billions of dollars in research and development of cleaner, more fuel-efficient vehicles. Automobile companies around the globe have dedicated substantial resources to bringing cutting-edge technologies electric, fuel cell, and hybrid electric vehicles as well as alternative fuel vehicles and powertrain improvements to the marketplace. These investments will play a huge role in meeting our nation's energy and environmental goals.

These advanced technology vehicles are more expensive than their gasoline counterparts during early market introduction, and they may also face psychological barriers to widespread introduction. As I mentioned earlier, the Alliance is supportive of congressional legislation that would provide for personal and business end-user tax incentives for the purchase of advanced technology and alternative fuel vehicles. Make no mistake: across the board, tax credits will not completely cover the incremental costs of new advanced technology. However, they will make consumers more comfortable with accepting the technology enough to change purchasing behavior. In short, tax credits will help bridge the gap toward winning broad acceptance among the public leading to greater volume and sales figures throughout the entire vehicle fleet. This type of incentive will help "jump start" market penetration and support broad energy efficiency and diversity goals.

Some of the discussion today has centered on the vehicles of the automobile manufacturers. But it is important not to forget about a vital component for any vehicle the fuel upon which it operates. As automakers looking at the competing regulatory challenges for our products—fuel efficiency, safety and emissions—and attempting to move forward with advanced technologies, we must have the best possible and cleanest fuels. EPA has begun to address gasoline quality but it needs to get even cleaner. This is important because gasoline will remain the prevalent fuel for years to come and may eventually be used for fuel cell technology.

Beyond gasoline, the auto industry is working with a variety of suppliers of alternative fuels. In fact, the industry already offers more than 25 vehicles powered by alternative fuels. More than 1 million of these vehicles are on the road today and more are coming. Today, we find vehicles that use:

Natural gas, which reduces carbon monoxide emissions by 65 to 90 percent; Ethanol, which produces fewer organic and toxic emissions than gasoline with the longer term potential to substantially reduce greenhouse gases; Liquefied petroleum gas (propane), the most prevalent of the alternative fuels, which saves about 60 percent VOC emissions; and For the future, hydrogen, which has the potential to emit nearly zero pollutants.

The Alliance has submitted comments to the DOT in support of an extension of the dual fuel vehicle incentives through 2008. Current law provides CAFE credits up to 1.2 mpg for manufacturers that produce vehicles with dual fuel capability. These vehicles can operate on either gasoline or domestically produced alternative and renewable fuels, such as ethanol. However, the dual fuel credits end in model year 2004 unless extended via rulemaking by the National Highway Traffic Safety Administration. The Alliance believes an extension is important so that these vehi-

cles continue to be produced in high volume to help encourage the expansion of the refueling infrastructure and giving consumers an alternative to gasoline.

In addition to alternative fuels, companies are constantly evaluating fuel-efficient technologies used in other countries to see if they can be made to comply with regulatory requirements in the United States. One such technology is diesel engines, using lean-burn technology, which have gained wide acceptance in Europe and other countries. Automakers have been developing a new generation of highly fuel-efficient clean diesel vehicles using turbocharged direct injection engines as a way to significantly increase fuel economy and reduce greenhouse gas emissions. However, their use in the U.S. must be enabled by significantly cleaner diesel fuel.

As you can tell, the automobile companies from the top executives to the lab engineers are constantly competing for the next breakthrough innovation. If I can leave one message with the committee today, it is to stress that all manufacturers have advanced technology programs to improve vehicle fuel efficiency, lower emissions, and increase motor vehicle safety. These are not "pie in the sky" concepts on a drawing board. In fact, many companies have advanced technology vehicles in the marketplace right now or have announced production plans for the near future.

Thank you for the opportunity to testify before the committee today. I would be happy to answer any questions you may have.

STATEMENT OF OMAR F. FREILLA, NYC ENVIRONMENTAL JUSTICE ALLIANCE

Good morning, my name is Omar Freilla and I am here today representing the New York City Environmental Justice Alliance. We are an alliance of community-based organizations fighting the continued presence of racism and classism in environmental protection. Our groups all represent communities of color that are largely poor and working class. They are in neighborhoods that bear a disproportionate amount of environmental hazards, receiving all of the burdens and none of the benefits. We are the first to breathe the dirtiest air and the last to see a green tree.

There are lots of people in this room, including myself, trying to convince each of you that the Federal Government must do everything in its power to slash air pollution levels and dramatically improve the quality of the air we breathe. There is a mountain of evidence to back up that call to action. The overwhelming consensus of public health studies in this area all come down on the side of more air pollution equals more asthma attacks and more deaths. But it would seem to me that that should be of no surprise to anyone. No one needs a Ph.D. to figure out that large cities with major traffic congestion like New York have the dirtiest air on the planet. Anyone with a lung and half a brain should be able to realize that dirty air will make you sick. So I'm not going to try to convince you of the obvious. What concerns me more is whether or not you care.

To effectively deal with emissions from motor vehicles requires you to emphasize the places where they are concentrated—cities. But ever since the era of highway building and the loss of urban manufacturing encouraged whites to flee to the suburbs, cities have not received much attention on capital hill. For communities of color like ours the apathy is blatantly obvious. That's because many of our neighbors are the noxious facilities that wealthier and whiter communities neither desire nor receive.

I live in the South Bronx, in a neighborhood known as Hunts Point. My neighborhood is a magnet for trucks. Approximately 11,000 diesel trucks enter and exit each day. They head for one of the world's largest regional food distribution centers and 26 waste transfer stations. We are home to a sewage treatment plant and a sludge processing plant. In an adjacent neighborhood four partially diesel-fueled power turbines went online last month. From my window I can see the three giant smokestacks of a power plant right on the waterfront in Queens, just two football fields away from the waterfront of my neighborhood—a waterfront that is almost completely inaccessible without trespassing. As if all that were not enough, the city plans to relocate the Fulton Fish Market—the world's largest fish market—to my neighborhood, complete with its almost 1,000 trucks a day. On an adjacent lot developers are seeking to build a 5,200-megawatt power plant. Whenever I walk to the subway, or anyplace outside of my neighborhood for that matter, I have to cross a ten-lane road underneath an elevated highway that carries 130,000 vehicles a day. My community is completely surrounded by pollution and no one in the neighborhood sees it as mere coincidence.

I've noticed that no matter what I do I cannot keep my apartment clean because of the dust from outside that settles near the windows. I never had that problem in an apartment until last year when I moved into the neighborhood. It's a common complaint of people in my neighborhood. So is asthma. It is of no surprise to anyone

in my community that we've got one of the highest rates of hospitalization for asthma in the country—six times the national average. When I go to the Laundromat I hear mothers trading asthma remedies as if they were dinner recipes. Thirty percent of the children in my neighborhood suffer from asthma. It is a disease that has reached epidemic proportions in similar communities throughout New York City and across the country.

Time and time again the community groups that are members of the New York City Environmental Justice Alliance have fought with city, State, and Federal agencies that do not seem to value the lives of people of color and poor people. How else do you explain lax environmental reviews in communities of color on the one hand and strict enforcement in white communities on the other? Our communities have been turned into sacrifice zones where any and all forms of environmental abuse are allowed to take place. You will not even scratch the surface of air quality issues as long as you fail to focus attention on overburdened communities like Hunts Point. The reason is that as long as polluting facilities have access to a community where environmental enforcement is lax they will continue to pollute. This includes dirty-diesel dependent facilities.

With all this in mind I urge the members of the Senate to act in three key areas of transportation:

1.Promote cleaner fuels—Diesel trucks and buses are the worst polluters in communities like mine, they produce the bulk of particulate emissions that trigger asthma attacks in New York City. Our alliance has been at the forefront of efforts to promote cleaner fuels in New York City. We have worked closely with the U.S. Department of Energy over the past 2 years in focusing attention on the most overburdened communities by co-hosting clean fuel forums in the South Bronx, Harlem, and South Brooklyn with a citywide summit planned for September. Next week EPA Administrator Christine Todd Whitman will come to my neighborhood in Hunts Point to meet with environmental justice groups and help unveil a pollution control device that promises to cut emissions by up to 90 percent from idling trucks in my community. We are very excited by these developments and see measures such as these and the 2007 standards for diesel as vital to reducing pollution in our communities. But while we support the need for stricter diesel standards it must be pointed out that the proposed standard will not bring cities into compliance with air quality standards as long as existing fleets and non-road engines such as construction equipment are not addressed.

2.Include local impacts in all air quality analyses—There seems to be no end in sight to the horrible proposals for noxious facilities that want to site in communities like mine. Current practice ignores a project's impact on local air quality. Any increase in air emissions is added to the total emissions for the region as a whole. The result is that while a transportation project may not produce enough emissions to be noticeable on the regional level its effect at a local could have have dramatic effects. The highest concentrations of particulate matter are found within the first quarter to a half-mile of a street or highway. The absence of local impacts is a failure of both the Clean Air Act and the EPA's willingness to establish a procedure for accounting for local impacts.

3.Improve Rail Freight Infrastructure—Almost 90 percent of goods entering New York City from the West travel by truck. While rail freight has the potential to take trucks off the road and dramatically improve air quality rail lines in New York City are in such poor condition due to decades of neglect that they have become almost useless. The improvement of rail lines and the development of intermodal distribution centers would completely alter the current patterns of goods movement that result in clogged streets and noxious air.

I urge you to take these issues to heart and begin to rectify past practices that turned low-income communities and communities of color into sacrifice zones. By addressing air quality issues in this manner you will be addressing the need of our communities for environmental justice.

STATEMENT OF DANIEL S. GREENBAUM, PRESIDENT, HEALTH EFFECTS INSTITUTE

Chairman Jeffords, and members of the committee, thank you for the opportunity to testify before you today on the health effects of air emissions from the transportation sector. I come before you as the President of the Health Effects Institute, a non-profit, independent research institute funded jointly and equally by the U.S. EPA and the worldwide motor vehicle industry to provide high-quality, impartial science on the health effects of emission from transportation and other sources in the environment. For over two decades, we have conducted targeted research on the full range of emissions and health effects, and I am pleased to summarize our un-

derstanding for you today. For the record, I have also submitted a more detailed paper that describes these effects and trends.

Since the early 1970's, as vehicle travel has grown dramatically, there have been concerns about air pollution from transport and its impacts on human health. There has been substantial progress to reduce the emissions from individual vehicles, and more recently improvements in the quality of fuel, resulting in reductions of some emissions by greater than 90 percent. At the same time, traffic volume has grown substantially, offsetting much of the improvement achieved. Also, scientific knowledge has increased, identifying health effects from emissions from motor vehicles at lower levels of exposure. Thus there continues today to be significant attention to understanding the health effects of, and reducing the emissions from, vehicles and fuels.

Emissions

The combustion of gasoline and diesel fuel in vehicle engines produces a number of emissions of potentially harmful substances. These emissions are not solely the result of the combustion process, nor do they come only from the tailpipe of the vehicle. Rather, such emissions result from a combination of the engine design and the fuel characteristics. Evaporative emissions—from refueling, spills on to heated engine parts, etc.—can equal emissions from the tailpipe.

The emissions from motor vehicles come in two primary forms: major gaseous and particulate air pollutants which can be found in relatively high amounts in the atmosphere, and air toxics which usually are found in lower amounts in the atmosphere but can have important health impacts. The gaseous and particulate pollutants to which motor vehicles contribute include carbon monoxide, ozone (through its atmospheric precursors volatile organic compounds (VOCs) and nitrogen oxides (NOx)), fine particulate matter PM_{10} and $PM_{2.5}$ (particles smaller than 10 and 2.5 microns in aerodynamic diameter respectively), and nitrogen dioxide. The air toxics emitted from motor vehicles include aldehydes (acetaldehyde, formaldehyde, and others), benzene, 1,3-butadiene, and a large number of substances known as polycyclic organic matter (including polycyclic aromatic hydrocarbons, or PAHs).

All of the emissions from motor vehicles also come from other sources such as industrial processes, electric power generation, and home heating. As a result, the contribution of motor vehicles to ambient levels varies depending on the pollutant. In most cases, motor vehicles contribute between 25 percent and 40 percent of the ambient levels, although in a few cases (e.g. carbon monoxide, ultrafine particles (PM 0.1), and 1,3-butadiene) motor vehicle contributions are noticeably higher.

To date, most of the attention to reducing emissions from transport has focussed on onroad cars and heavy-duty vehicles. Increasingly, we have understood that nonroad sources, including construction equipment, locomotives, airplanes and ships are also significant contributors to ambient air pollution, for some pollutants emitting amounts equal to or exceeding those from onroad sources.

Exposure

While in general motor vehicles contribute a significant portion, although not the majority, of most air pollutants, there are certain circumstances in which motor vehicles can contribute a substantially higher amount to personal exposure. In particular, in urban centers, along roadsides, and especially in urban street canyons in crowded business districts, mobile source contributions can contribute 2 to 10 times as much as in general background situations. (1) This can have important implications for the potential acute health effects from exposure to these pollutants and, if individuals spend a significant portion of their lives living in these environments, may result in greater contributions of vehicles to chronic health effects as well. This may be especially true for elderly, low-income, and other urban populations that could be sensitive to the effects of air pollution.

Effects

Research over the past several decades has found a variety of effects from the different pollutants, including effects on the lungs, heart, and nervous system, and the promotion of several different types of cancer. Overall, the effects of these pollutants on public health tend to be relatively small in comparison with other risk factors such as cigarette smoking, but because of the large number of people exposed the effects as a whole are of sufficient magnitude to be of public concern.

Despite some uncertainties, there is much known about the effects of each of these pollutants:

Carbon Monoxide is a gas emitted directly from vehicles. High levels of exposure are known to be lethal; low levels found in ambient settings are not likely to have effects in healthy individuals but may cause increased incidence of cardiac effects.

Ozone is known to reduce the lung function of some individuals and epidemiological studies have found evidence of increased asthma attacks and hospitalization related to increased ambient levels. A recent study conducted by the Centers for Disease Control in Atlanta before, during, and after the Olympics found both a distinct reduction in ozone levels resulting from the Olympics traffic reduction measures, and a coinciding reduction in childhood asthma hospitalization.

Particulate Matter in the form of PM_{10} and $PM_{2.5}$ is emitted directly from motor vehicles and other sources, and also formed in the atmosphere from atmospheric reactions with gaseous emissions (e.g. nitrogen oxides become nitrates). Although PM has been of concern for many decades, new studies published in the 1990's found associations of PM with increased mortality and morbidity at ambient levels.

In the past several years, several new epidemiologic studies have begun to strengthen the understanding of the relation between exposure to PM and mortality and morbidity. Recently, HEI's National Morbidity, Mortality, and Air Pollution Study, of the 90 largest cities in the United States, has found a generally consistent effect of PM and mortality, when common methods are applied, and after the effects of other pollutants are considered. HEI's Reanalysis of the Harvard Six Cities and American Cancer Society Studies has also reported on extensive additional analysis of these two studies that have been the basis of most U.S. and European efforts to estimate the population health effects of PM, and have generally confirmed the results. HEI is currently investigating continuing questions about the nature and extent of PM health effects.

Components and Characteristics of the PM Mixture have been identified as potentially being most responsible for mortality and other risks. Diesel exhaust particulate matter has been cited as a probable human carcinogen by several national and international agencies. Hypotheses have also been put forward suggesting that ultrafine particles (less than 0.1 microns), particles containing metals (e.g. iron), and other types of particles may be the most toxic components of the mixture. To date these studies have not identified one component or characteristic that is significantly more toxic than others.

Air Toxics have a variety of characteristics and effects. Most of those emitted from motor vehicles are animal carcinogens. Benzene is a known human carcinogen. Butadiene, for which vehicles are the dominant ambient source, was recently designated as a probable human carcinogen by the International Agency for Research on Cancer and a known human carcinogen by the U.S. National Institutes of Health. Several aldehydes (including formaldehyde and acetaldehyde) have also been designated as probable human carcinogens.

Trends and the Future

Given the health effects of vehicle emissions, action has been taken, and continues to be taken to reduce emissions from both gasoline and diesel vehicles. The U.S. EPA took action in 1999 to further improve fuel formulation and reduce emissions of light duty vehicles (Tier 2), and in 2001 to promulgate stringent new fuel and emissions standards for heavy-duty vehicles. In addition, recent German government analyses determine that these requirements for a substantial reduction in diesel particulate matter emissions are expected to substantially reduce cancer risk from diesel.

However, continued growth in travel is expected to offset a portion of these reductions. As a result, continued attention to reducing emissions is likely in the future. This will come in three ways:

- continued tightening of fuel and emission standards for petrol and diesel vehicles;
- introduction of new technologies: natural gas vehicles, electric and electric hybrid vehicles, and fuel cell vehicles are all in development or beginning to appear on the market. While these have certain air quality advantages, they may also raise new health questions (e.g. the use of methanol to power fuel cells), and will need to be introduced with appropriate care.
- policies to discourage growth in personal auto use—this is potentially the most important future direction, and at the same time the most challenging. Future land use and transportation policy can significantly affect travel behavior, but the ability to implement effective measures may be limited as the general public is increasingly used to and reliant upon the flexibility of the private automobile.

In conclusion, the emissions of a variety of pollutants from vehicles account for, in general, approximately 25 percent to 40 percent of the ambient levels of air pollution (and in some cases more, depending on the pollutant and location). These pollutants have been found to have a measurable effect on the public health. As a result, the long-term trend has been toward reducing emissions from motor vehicles,

and that trend is likely to continue in the future. However, continued growth in vehicle travel is likely to offset at least a portion of the expected reductions, suggesting continued efforts to reduce the emissions and other impacts on public health.

HEALTH EFFECTS INSTITUTE,
July 25, 2001.

DANIEL S. GREENBAUM,
Transport and Human Health,
Health Effects Institute,
Cambridge, Massachusetts USA

Concerns about ambient air pollution and public health first rose to broad public attention in the 1950's, following significant air pollution episodes in London, England, Donora, Pennsylvania, and elsewhere that were linked to noticeable increases in hospitalization and premature mortality. These incidents, which involved air pollution largely from industrial sources and home heating, presaged public policy action for the past four decades to reduce air pollution and improve public health. Increasingly during that time, as vehicle travel has grown dramatically, attention has focussed on air pollution from transport and its impacts on human health.

Beginning in the 1970's in the United States and in the 1980's in Europe, there has been substantial progress to reduce the emissions from individual vehicles, and more recently improvements in the quality of fuel, resulting in reductions of some emissions by greater than 90 percent. At the same time, traffic volume has grown substantially, offsetting much of the improvement achieved. Also, scientific knowledge has increased, identifying health effects from emissions from motor vehicles at lower levels of exposure. Thus there has been, and there continues today to be, significant public attention to reducing the emissions from vehicles and fuels, and their attendant affects on human health.

Since 1980, the Health Effects Institute has been producing extensive research on the health effects of air pollution from motor vehicles and other sources. (2) We have learned much during that time about the emissions from vehicles, personal exposure to those emissions, and the resulting effects. This paper attempts to review briefly what we know about emissions, exposure, and effects, and to discuss current and likely future trends.

Emissions

The combustion of gasoline and diesel fuel in vehicle engines produces a number of emissions of potentially harmful substances. Increasingly we have understood that these emissions are not solely the result of the combustion process, nor do they come only from the tailpipe of the vehicle. Rather, it has become clear that such emissions result from a combination of the engine design and the fuel characteristics. Evaporative emissions—from refueling, spills on to heated engine parts, etc.—can equal emissions from the tailpipe.

The emissions from motor vehicles come in two primary forms: major gaseous and particulate air pollutants which can be found in relatively high amounts in the atmosphere, and air toxics which usually are found in lower amounts in the atmosphere but can have important health impacts. The gaseous and particulate pollutants to which motor vehicles contribute include carbon monoxide, ozone (through its atmospheric precursors volatile organic compounds (VOCs) and nitrogen oxides (NOx)), fine particulate matter PM_{10} and $PM_{2.5}$ (particles smaller than 10 and 2.5 microns in aerodynamic diameter respectively), and nitrogen dioxide. The air toxics emitted from motor vehicles include aldehydes (acetaldehyde, formaldehyde, and others), benzene, 1,3-butadiene, and a large number of substances known as polycyclic organic matter (including polycyclic aromatic hydrocarbons, or PAHs).

All of the emissions from motor vehicles also come from other sources such as industrial processes, electric power generation, and home heating. As a result, the contribution of motor vehicles to ambient levels varies depending on the pollutant (see Table 1). In most cases, motor vehicles contribute between 25 percent and 40 percent of the ambient levels, although in a few cases (e.g. carbon monoxide, ultrafine particles ($PM_{0.1}$), and 1,3-butadiene) motor vehicle contributions are noticeably higher.

Table 1. Contributions of Motor Vehicle Emissions to Ambient Levels of Major Air Pollutants

Pollutant	Percent Contribution	Reference
Carbon Monoxide	1190 percent	EPA (2000a)
PM_{10}	1120 percent–25 percent.	DETR (1999)
$PM_{2.5}$	1125 percent—30 percent.	DETR (1999)
Nitrogen Oxides	1140 percent	EPA (2000a)
Volatile Organic Compounds	1135 percent	EPA (2000a)
Average Air Toxics	1121 percent	EPA (1999a)
Urban Air Toxics	1142 percent	EPA (1999)

Exposure

While in general motor vehicles contribute a significant portion, although not the majority, of most air pollutants, there are certain circumstances in which motor vehicles can contribute a substantially higher amount to personal exposure. In particular, in urban centers, along roadsides, and especially in urban street canyons in crowded business districts, mobile source contributions can contribute 2 to 10 times as much as in general background situations. (3) For example, while urban background levels of PM_{10} in England have been measured at 22—25 /m3, and at street side levels have been measured at 24—38 /m3. (DETR 1999) This can have important implications for the potential acute health effects from exposure to these pollutants and, if individuals spend a significant portion of their lives living in these environments, may result in greater contributions of vehicles to chronic health effects as well. This may be especially true for elderly, low-income, and other urban populations that could be sensitive to the effects of air pollution.

Effects

Research over the past several decades has found a variety of effects from the different pollutants, including effects on the respiratory, neurological, and cardiac systems, and the promotion of several different types of cancer. One of the challenges of understanding these effects is that they are usually experienced as part of a complex mixture of pollutants, and it is often difficult to disentangle the specific effects of one pollutant from the effects of other pollutants that follow similar spatial and atmospheric patterns. (HEI 2000) At the same time, it is apparent that not all members of the population are equally sensitive to such effects, and that some subgroups (e.g. the elderly, asthmatics, children, people with heart disease) may at more risk from exposure to air pollution.

Overall, the effects of these pollutants on public health tend to be relatively small in comparison with other risk factors such as cigarette smoking, but because of the large number of people exposed the effects as a whole are of sufficient magnitude to be of public concern.

Despite some uncertainties, there is much known about the effects of each of these pollutants:

Carbon Monoxide is a gas emitted directly from vehicles. When inhaled it replaces oxygen in the bloodstream, forming carboxyhemoglobin and interfering with the normal transport of oxygen to the heart and brain. High levels of exposure are known to be lethal; low levels found in ambient settings are not likely to have effects in healthy individuals but can advance the time of angina (chest pain) in people with coronary artery disease and may cause increased incidence of cardiac effects. Some recent epidemiologic studies have found relationships between increased CO levels and increases in mortality and morbidity (EPA 2000).

Ozone is a gas formed in the atmosphere from combinations of nitrogen oxides and volatile organic compounds (both emitted from vehicles) in certain meteorologic conditions normally found in the summer time. It is known to reduce the lung function of some individuals, (see Figure 1) and epidemiologic studies have found evidence of increased asthma attacks and hospitalization related to increased ambient levels. It may also increase the lung's reaction to allergens and other pollutants. Although recent studies have found associations of daily increases in ozone with increased mortality, there is not comprehensive evidence that long-term exposure causes chronic health effects, and some evidence suggests that the lung may develop a form of tolerance after repeated short-term exposures (EPAQS 1997, HEI, 1996).

Particulate Matter in the form of PM_{10} and $PM_{2.5}$ is inhalable material which is emitted directly from motor vehicles and other sources, and also formed in the atmosphere from atmospheric reactions with gaseous emissions (e.g. nitrogen oxides become nitrates). Although PM has been of concern for many decades, new short

term and long-term epidemiologic studies published in the U.S. and Europe in the 1990's found associations of PM with increased mortality and morbidity at ambient levels below then-established national air quality limit values. It is these studies that have been the basis for recent action in both the European Union and the United States to establish more stringent standards for PM.

In the past several years, several new epidemiologic studies have begun to strengthen the understanding of the relation between exposure to PM and mortality and morbidity. Recently, HEI's National Morbidity, Mortality, and Air Pollution Study (HEI, 2000a) of the 90 largest cities in the United States, and preliminary results from the APHEA-II (4) study of over 30 European cities, have found a generally consistent effect of PM and mortality, when common methods are applied, and after the effects of other pollutants are considered. The Reanalysis of the Harvard Six Cities and American Cancer Society Studies (HEI 2000b) has also reported on extensive additional analysis of these two studies that have been the basis of most U.S. and European efforts to estimate the population health effects of PM, and have generally confirmed the results, although the reanalysis did in several important ways extend and challenge our understanding. At the same time, although there has been progress in research to better understand the biological mechanism that might be causing these effects at relatively low exposure levels, there is not today an agreed-upon plausible biological mechanism for the effects.

Components and Characteristics of the PM Mixture have been identified as potentially being most responsible for mortality and other risks. Diesel exhaust particulate matter has been cited as a probable human carcinogen by several national and international agencies (including the International Agency for Research on Cancer and the U.S. Environmental Protection Agency) because of findings of lung cancer in exposed workers, although there are limits to our ability to estimate a precise risk (HEI, 1999). Hypotheses have also been put forward suggesting that ultrafine particles (less than 0.1 microns), particles containing metals (e.g. iron), and other types of particles may be the most toxic components of the mixture. To date these studies have not identified one component or characteristic that is significantly more toxic than others. (EPA 1999)

Air Toxics have a variety of characteristics and effects. Most of those emitted from motor vehicles are animal carcinogens. Benzene is a known human carcinogen. Butadiene, for which vehicles are the dominant ambient source, was recently designated as a probable human carcinogen by the International Agency for Research on Cancer, and a known human carcinogen by the U.S. National Institutes of Health. Several aldehydes (including formaldehyde and acetaldehyde) have also been designated as probable human carcinogens. In addition, several of the mobile source air toxics, especially the aldehydes, have exhibited evidence of acute respiratory effects. Recently, the U.S. Environmental Protection Agency identified a total of 21 air toxics emitted from motor vehicle exhaust (U.S. EPA 2000c)

Trends and the Future

Given the health effects of vehicle emissions, action has been taken, and continues to be taken to reduce emissions from both gasoline and diesel vehicles. The U.S. EPA took action in 1999 to further improve fuel formulation and reduce emissions of light duty vehicles, and in 2001 to promulgate stringent new fuel and emissions standards for heavy-duty vehicles. The EU is on a similar path, which is expected to substantially reduce emissions over the coming 20 years (see Figure 2). In addition, the requirements for a substantial reduction in diesel particulate matter emissions is expected to substantially reduce cancer risk from diesel as well (IFEU, 1999). At the same time, continued growth in travel is expected to offset a portion of these reductions. As a result, continued attention to reducing emissions is likely in the future. This will come in three ways:

- continued tightening of fuel and emission standards for petrol and diesel vehicles (in 2000, the U.S. EPA tightened fuel and emission standards for both light duty and heavy duty vehicles, and in 2001 the EU is expected to tighten standards for sulfur levels in fuel)
- the introduction of new technologies: natural gas vehicles, electric and electric hybrid vehicles, and fuel cell vehicles are all in development or beginning to appear on the market. While these have certain air quality advantages, they may also raise new health questions (e.g. the use of methanol to power fuel cells), and will need to be introduced with appropriate care.
- policies to discourage growth in personal auto use—this is potentially the most important future direction, and at the same time the most challenging. Future land use and transportation policy can significantly affect travel behavior, but the ability to implement effective measures may be limited as the general public is increasingly

used to and reliant upon the flexibility of the private automobile (Greenbaum, 1995).

In conclusion, the emissions of a variety of pollutants from vehicles account for, in general, approximately 25 percent to 40 percent of the ambient levels of air pollution (and in some cases more, depending on the pollutant and location). These pollutants have been demonstrated to have a measurable negative effect on the public health. As a result the long-term trend has been toward reducing emissions from motor vehicles, and that trend is likely to continue in the future. However, continued growth in vehicle travel is likely to offset at least a portion of the expected reductions, suggesting continued efforts to reduce the emissions and other impacts on public health.

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1. While this is in general true, there is one instance—the case of ozone—where urban levels are generally lower than those found outside cities, the result of "scavenging" of the ambient ozone by high levels of ambient nitrogen oxides.

2. The Health Effects Institute is a not-for-profit research institute funded jointly and equally by environmental regulatory agencies and the worldwide motor vehicle and fuels industry. Established in 1980, and overseen by an independent Board of Directors, HEI provides high-quality, impartial, and relevant science for public and private decisionmakers on the health effects of air pollution from motor vehicles and other sources in the environment. All of its research is selected competitively and overseen by a distinguished Research Committee of leading U.S. and European experts. Comprehensive results of its work are reviewed intensively by an independent Review Committee which has had no part in designing or overseeing the research. Although funded initially to inform regulatory decisionmaking in the United States, HEI has increasingly been called upon and funded by public and private officials in Europe to address key air pollution and health issues facing the European Union and its member countries. Full details about HEI and its publications can be found at www.healtheffects.org.

3. While this is in general true, there is one instance—the case of ozone—where urban levels are generally lower than those found outside cities, the result of "scavenging of the ambient ozone by high levels of ambient nitrogen oxides.

4. Air Pollution and Health, A European Assessment.

STATEMENT OF JEFFREY A. SAITAS, P.E., EXECUTIVE DIRECTOR, TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Good afternoon, Mr. Chairman and members of the committee. My name is Jeff Saitas, and I am the executive director of the Texas Natural Resource Conservation Commission. Our agency implements a broad range of regulatory and nonregulatory activities that protect the health of Texans and their environment. The agency is led by a three-member commission appointed by the Governor. About 3,000 staff members work in Austin and at 16 regional offices around the State. Clean air issues continue to be one of the agency's top priorities and toughest challenges.

Thank you for the opportunity to testify about our experiences implementing the Clean Air Act and about our suggestions for improvement. I had the opportunity to testify before this committee back in September and I appreciate the invitation to address the committee once again. I will highlight our current planning efforts and the challenges that we continue to face.

In September I discussed the successful partnership effort between local, State, and Federal Governments in developing the State Implementation Plan for the Dallas/Fort Worth area. I also addressed some of the challenges we have faced due to litigation and delays in full implementation of Federal regulations. We have now completed a significant phase in our planning efforts for the Houston/Galveston area, again with the same partnership efforts, however the challenges that we face with this area are even greater. The Houston/Galveston area needs far more emission reductions than the Dallas/Fort Worth area, therefore, we are forced to count on the Federal Government more than ever to fulfill their commitment to this partnership.

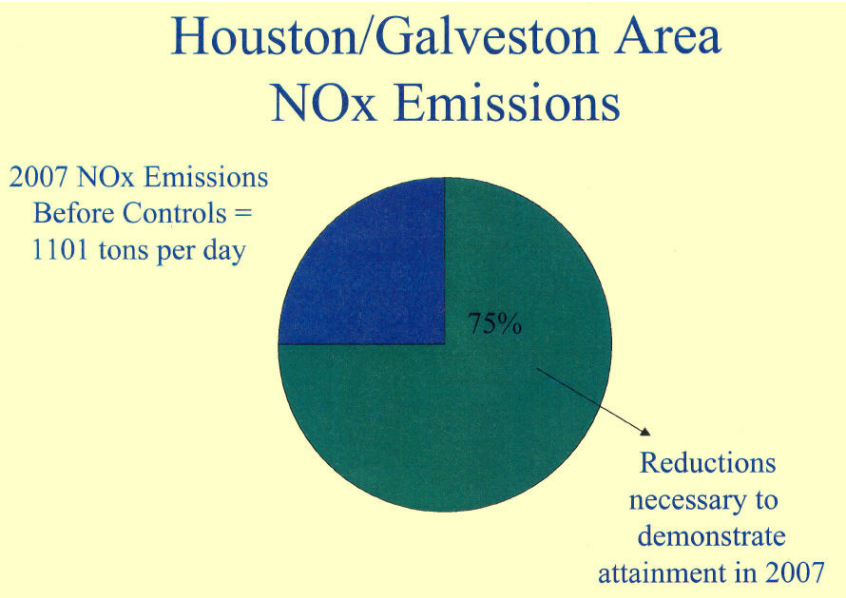
We will need to reduce nitrogen oxide emissions in the Houston/Galveston area by a total of 75 percent with up to 90 percent reductions from industrial sources. However, the State is pre-empted from regulating a significant portion of the emission sources in the area. The State's only viable option in controlling these sources has been to adopt time-of-day use restrictions and even these have been struck down through litigation due to preemption issues. Therefore, the State must be able to count on the emission reductions from the Federal regulations.

While some of the Federal regulations are beginning to be implemented now, most of the Federal rules that are most beneficial to the Houston/Galveston area are not scheduled to be fully implemented until 2006 or later. Further, full implementation of the standards does not equal full emission reduction benefits. Most of the Federal standards only apply to the purchase of new equipment. Therefore, it will be many years before all of today's equipment is replaced with new emissions controlled equipment.

Likewise, many of the new engines will not operate at the lower emission level without the lower emission fuels.

The State intends to demonstrate attainment for the Houston/Galveston area. We are again requesting an equal commitment from the Federal Government in this partnership effort. If Congress feels it is appropriate to require States to reach attainment goals by 2007, it should also ensure that States are given a reasonable opportunity to comply by imposing Federal regulation deadlines that are in line with States' requirements. As future air quality standards are being finalized and new deadlines for attainment areas being set, it is critical that this point be taken into consideration to give States a fair chance to comply with Clean Air Act requirements.

Thank you again for the opportunity to testify today. We look forward to working with the committee and all interested parties.


Houston/Galveston Area
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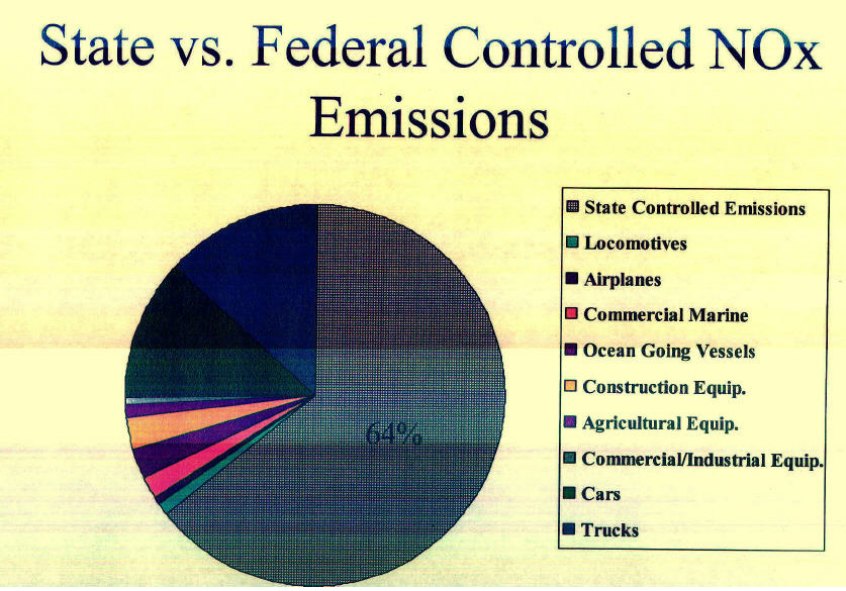
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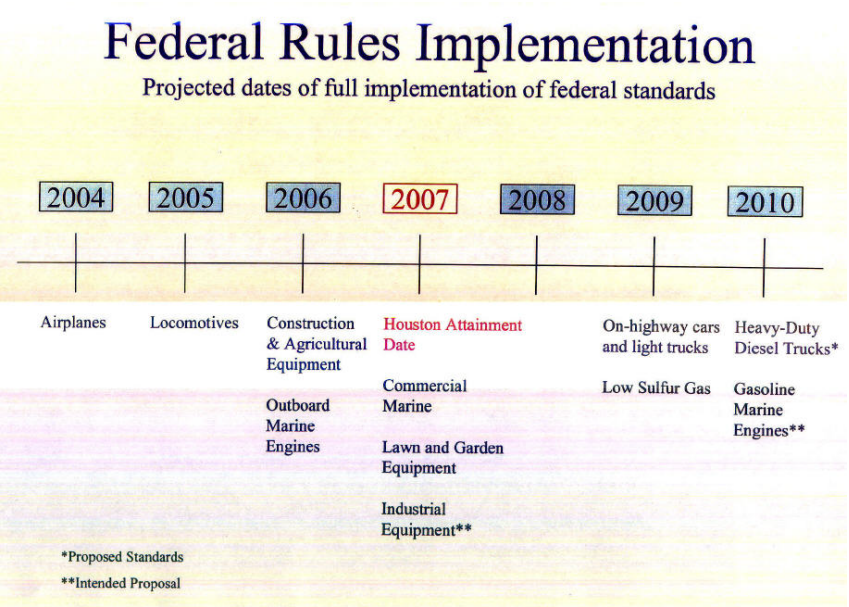
Federal Rules Implementation
Projected dates of full implementation of federal standards
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Commercial Marine
Lawn and Garden Equipment
Industrial Equipment**
On-highway cars and light trucks
Low Sulfur Gas
Heavy-Duty Diesel Trucks*
Gasoline Marine Engines**
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**Intended Proposal

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