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ENERGY SECURITY AND OIL DEPENDENCE

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BEFORE THE

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UNITED STATES SENATE

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ENERGY SECURITY AND OIL DEPENDENCE

TUESDAY, MAY 16, 2006

U.S. SENATE,
COMMITTEE ON FOREIGN RELATIONS,
Washington, DC.

The committee met at 9:34 a.m., in room SD–419, Dirksen Senate Office Building, Hon. Richard G. Lugar (chairman of the committee) presiding.

Present: Senators Lugar, Chafee, Coleman, Martinez, and Biden.

OPENING STATEMENT OF HON. RICHARD G. LUGAR, U.S. SENATOR FROM INDIANA

The CHAIRMAN. This hearing of the Senate Foreign Relations Committee is called to order.

The committee meets today to consider strategies for reducing dependence on oil. This dependence brings intolerable costs to American national security and economic well-being. If oil averages just $60 a barrel this year, the import costs to the United States economy will be approximately $320 billion. This revenue stream emboldens difficult oil-rich regimes and enables them to entrench corruption and authoritarianism, fund anti-Western demagogic appeals, and support terrorism. As global oil demand increases and the world becomes more reliant on reserves concentrated in unstable regions, the likelihood of conflict over energy supplies will dramatically increase, and energy-rich countries will have more opportunity to use their energy exports as weapons against energy-poor nations.

High prices over the past 10 months have demonstrated the vulnerability of supply. A global oil market tightened by underinvestment in production and surging global demand has been aggravated by hurricanes, unrest in Nigeria, speculation about developments in Iran, weakened capacity in Venezuela, and terrorist activity in Iraq and elsewhere. In this environment, the price shock from a major supply disruption could cause a recession.

Today we will concentrate on how our Government can speed up the transition to alternative, sustainable energy sources. We are cognizant that despite past campaigns for energy independence and constant improvement in energy intensity per GDP, we are more dependent on oil imports today than we were when President Nixon authorized Project Independence in 1973. Yet, I believe we are turning a corner. The American public and elected officials are becoming more aware of the severe problems associated with energy dependence and are more willing to take aggressive action.

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The new realism of energy geopolitics requires us to abandon the notion that simply finding more oil will solve oil-driven threats to our national security. More than three-quarters of the world's oil reserves are controlled by foreign governments. With global oil demand projected to rise from 83 million barrels a day to 120 million barrels per day by 2030, the security threats related to oil dependence will continue to intensify unless we make dramatic changes in policy. Efforts to reduce oil consumption must focus on developing sustainable fuels and increasing efficiency. I am pleased that the first commercial-scale cellulosic ethanol plant in the United States is ready for construction and that Americans are beginning to demand more fuel-efficient vehicles.

We must continue investing in advanced energy research, but threats to our national security require us to efficiently deploy the oil-saving technology that is available now. The benefits of reducing oil use at home will multiply when other countries also switch to alternative fuels and decrease the energy intensity of their economies.

I have introduced Senate bill 2435, the Energy Diplomacy and Security Act, to reorient our diplomatic activities to give greater priority to energy matters. We need bold international partnerships to blunt the ability of producer states to use energy as a weapon, to increase our security of supply, and to reduce the vulnerability of our economy to high oil prices.

Today, we will benefit from the views of two distinguished experts. We will ask them to identify the best options for reducing oil use through alternatives and efficiency gains. We will also seek their counsel on what the government can do to accelerate the transition away from oil and how we can most effectively encourage helpful actions by the private sector and consumers.

First, we will hear from Mr. Vinod Khosla, the founding partner of Khosla Ventures, a leading venture capital firm that has invested in many cutting-edge energy technologies. A cofounder of Sun Microsystems, Mr. Khosla is an influential voice on the viability of alternative energy sources.

Next, we will hear from Mr. Jason Grumet, Executive Director of the National Commission on Energy Policy. In December 2004, the bipartisan Commission released its recommendations for a long-term energy strategy. The report comprehensively examined numerous technologies and methods for increasing energy supplies as well as for moderating energy demand. Prior to joining the Commission, Mr. Grumet served as executive director of Northeast States for Coordinated Air Use Management.

We welcome our witnesses. We look forward to your insights. Your full statements will be made a part of the record, but we will ask you to proceed as comprehensively as you wish. The purpose of the hearing is to hear you and then for members to question you and for you to enhance our experience with these issues and, hopefully, with the public that is viewing this hearing.

I mention in advance, so that this will not be disconcerting to you as witnesses or to those participating in the hearing, that we are scheduled to have a rollcall vote on the Senate floor at approximately 10 minutes after 10. These things have a way sometimes of being extended onward, but at some point I will call a recess of

the committee so that all of us will be present to hear what you are saying. You will have a full audience of Senators in that case, and then after a short recess to have votes cast by Senators who are here, we will be back into action again.

We thank you for coming. I note the presence of my colleague, Senator Coleman. Senator, do you have an opening comment or thought this morning before our witnesses begin their testimony?

STATEMENT OF HON. NORM COLEMAN, U.S. SENATOR FROM MINNESOTA

Senator COLEMAN. I am looking forward to hearing the testimony, Mr. Chairman, and I want to thank you for having this hearing. I think this is one of the most important issues facing this country today. There's no question about it. It is a national security issue. It is an economic security issue. It is about our present. It is about our future. So I am glad that we are thinking outside the barrel, and I think this is an opportunity. I am just thrilled to be here. So with that, I want to hear from the witnesses.

The CHAIRMAN. Thank you very much, Senator.

We will proceed with you, Mr. Khosla, if you would give your testimony.

STATEMENT OF VINOD KHOSLA, PARTNER, KHOSLA VENTURES, MENLO PARK, CA

Mr. KHOSLA. Thank you, Mr. Chairman, for this opportunity to speak to you and the rest of the committee and other guests about this important issue of America's energy independence.

Since the President's State of the Union and rising prices at the pumps, there has been a lot of talk about oil addiction. But I come here not so much to talk about what must be done because there has been a lot of talk about that, but rather, how to get it done simply and without a lot of ruffled feathers, aligned with the major political interests, and in a fashion that is not only politically correct, but also the correct thing to do. For once, those things coincide.

If it was not for rapid growth of our domestic ethanol industry, Americans would be seeing prices approaching $4 a gallon or more. For comparison, the Department of Energy has estimated that ANWR drilling would save 1 cent per gallon at the pump by 2025, according to a quote in the most recent Fortune magazine. Because of this unusual opportunity, we have the ability to be the architects of a new global development plan, not just an American plan, a sort of a Marshall Plan for our times that could support technological advancements and sustainable development of a global alternative to petroleum. And what is most attractive to me is it takes almost no money to do it.

I come here with very ambitious goals, but goals that are grounded in science, technology, and a practical knowledge of business. Having gone through similar industry transitions in computing, in the Internet, and in telecommunications, I can tell you that ethanol and biofuels, in general, do not have to be an alternative fuel. In fact, they can be our mainstream fuel. More importantly, with a few policy changes, we can achieve this transition not by 2040 or

2050, but be irreversibly down a new path of energy independence in less than 7 years, in my view.

But before I go there, let me talk about some assertions that, at first, seem implausible. I do not believe we need any oil for cars and light trucks, and we definitely do not need to wait for hydrogen. We do not need new cars, new engine designs, or new distribution systems, and this rapid changeover within 7 years that I talked about, in fact, is economically feasible, possible, and relatively little cost. All this at little cost to consumers, the Government, and automakers.

That might seem implausible, but I hope I can convince you that it is at least plausible. Brazil went from 4 percent of their new cars sold being flex fuel cars to 80 percent in less than 3 years, all driven by consumer demand. They reduced petroleum usage by 40 percent. All the scenarios I have seen in this country talk about doing that in 30, 50 years, or longer. It happened because ethanol costs 75 cents a gallon to produce in Brazil versus petroleum production costs that are between $1.60 a gallon to $2.20. In fact, in the 10th-largest car market in the world, which is Brazil, rumor has it that VW is planning on phasing out all gasoline-only cars. When a major automaker starts to not make gasoline cars in a major market, we should be paying attention. All this has come with a 60- to 80-percent reduction in greenhouse gas emissions and $50 billion in import savings for a small economy like Brazil. Hopefully, that convinces us that it is at least plausible.

So the next question I ask is how we go from the plausible to the possible. Many of us have heard that there are between 5 million to 6 million cars capable of ethanol, FFVs, and a 4-billion-gallon-a-year supply of ethanol in this country already. But to make it more visceral, I submit that at least in the State of California, there are almost as many flex fuel cars on the roads as diesel vehicles. That should prove to us that this is, in fact, possible. U.S. production costs for corn ethanol are about $1 a gallon, far below the cost of petroleum. And a rapid increase in capacity, 20 percent or more per year, is already in process.

So I then ask if, in fact, it is possible, what makes it probable. There are a few issues that come to mind, but I want to give you a sense of what I hear about this new revolution that has quietly been taking place for many, many years in rural America. My friends from the Midwest tell me that ethanol is the talk of every coffee shop in the Midwest. It is the most important topic in rural America in decades. But it also may be the most important thing for global peace and welfare, for the climate crisis, and for consumers.

Fortunately, this time around, environmentalists, the automakers, the agricultural interests, the security and energy independence proponents, and even the evangelicals are all aligned. Finally, a cause all interests can rally behind.

Consumer polls support the same idea. Tom Friedman, reciting a New York Times poll, suggested that 89 percent of U.S. adults favor a mandate for more efficient cars. When asked if they want higher taxes on gasoline, 87 percent say no, but when asked if they favor gasoline taxes to reduce our dependence on foreign oil, that 87 percent drops to 37 percent. When asked if they favor gasoline

taxes to reduce global warming, that 87 percent drops to 34 percent. The American people want that.

The oil interests and the American Petroleum Institute keep propagating myths like insufficient land, poor energy balance, and high production costs to curb enthusiasm for ethanol. This to me is reminiscent of the tobacco companies funding studies to prove that smoking does not cause cancer. The NRDC, somebody I trust a lot more than the American Petroleum Institute, has estimated that it takes only 114 million acres of land to replace our gasoline. Argonne National Labs, a U.S. Government lab, and UC Berkeley, among others, have discounted the energy balance studies. In my opinion, these are either bogus or ill-informed claims, and I hope we can address these falsehoods one by one.

First, on crop lands. Brazil has had a 4X increase since 1975 in the yield of ethanol per acre. Knowledgeable scientists there see a path to another 4X. In the United States, I believe gallons per acre can be extended by about 8–10 times what they are today, about 400 to 500 gallons per acre, even without the innovations that are commonplace in Silicon Valley. Based on my personal forecasts, I can see yields increasing all the way to 3,000 gallons per acre, conservatively, and 5,000 gallons per acre, optimistically, in the next 25 years, compared to about 400 gallons per acre today. This could demolish all energy and land use arguments. Based on my forecasts, including the considerable upside afforded by technology innovations, biomass-based ethanol can replace almost all of our gasoline needs in 25 years, using less than 60 million acres of land.

In the United States, the ethanol industry sold about 1.6 gallons of ethanol at $1.20 a gallon in 2000. In 2005, at $1.50 a gallon, they sold 4 billion gallons. My personal estimates say that at prices for ethanol between $1.35–$1.40 a gallon, approximately, you can build plants and pay off all cash flow and debt requirements. Those numbers are far below the numbers we are seeing today in the marketplace. Today, with prices where they are, one can pay off a new plant in less than a year, far less than the 7 years that could be standard for investors.

While it is disturbing to me to see some factions calling for permanent extensions of the credits, instead of supporting variable credits or other structures that would provide them insurance if oil prices were ever manipulated that I believe is possible, I do think, in general, this is a very viable industry with or without supports. We have sufficient land and energy balance and economics are favorable for ethanol as a transportation fuel. Consumers will demand it once it is available at the prices it can be made available as a commodity. All we need to do is kick-start this process.

The time has come for us to ask ourselves the following questions. Do we want to feed our farmers or Mideast terrorists? Do we want ANWR oil rigs or prairie grasses? Do we want fossil fuels or green fuels? Create farm jobs or Mideast tycoons? Gasoline cars or cars that offer consumers the choice of gasoline or biofuels? Expensive gasoline or cheaper fuels? This appears to me to be nothing less than a simple Darwinian IQ test for us.

Most importantly, I believe this does not take any capital from Government. Risk capital for investors is probably the only solution

to the oil stranglehold we are in. Three simple things that need to change. So let me talk about what these three things are.

If our goal is to convince investors to pour in billions of dollars, we need to assure them both a large market and a stable market exist.

First, I suggest we mandate that at least 70 percent of all new cars sold in America be flex fuel cars by 2014, 10 percent annual increases starting with 20 percent by 2009. We are already approaching that 2009 number. All such cars, new and old, be provided with a yellow gas cap. I might add that flex fuel cars are 100 times more effective at saving petroleum than hybrids per consumer dollar spent in purchasing the car. I am happy to answer questions on that claim later. Of course, flex fuel hybrids are the best combination of all. So I suggest that this mandate makes gasoline savings very cost effective.

My second recommendation would be that we mandate that 10 percent of all gas stations owned or branded by the major gas station owners offer at least one ethanol pump. Sweden, by the way, has mandated 50 percent of its pumps by 2009 to offer E85. Alternatively, mandating a separate RFS for E85 and cellulosic ethanol would serve a similar purpose. I suggest that for the first 20,000 stations that convert at least one pump, we offer an incentive of $30,000 per station in the first year, $25,000 per station in the second year, and $20,000 per year in the third year, a slight modification to current law that offers $30,000, up to 30 percent. I suggest that the proceeds be appropriated from the leaking underground storage tank fund, the LUST fund, that already has over $2 billion. The maximum cost to this program would be no more than $600 million, probably a lot less.

The last and most important recommendation is based on the following somewhat appalling story. In January, I gave a brief talk on this at Davos. A senior executive from a major oil company walked up to me and said, you know, we can drop the price of gasoline to drive the ethanol producers out of business. It galled me that he had the courage to come up to me and say that.

So I suggest that we take the VEETC credit and make it a variable credit. I have already stated that the level of the credit, 51 cents per gallon, is not required for cash flow for ethanol plants today. It was required when ethanol was selling for $1.20 a gallon. I would recommend that we make it a variable credit that changes from 20 cents a gallon to 80 cents a gallon based on the price of petroleum as it varies from $70 a barrel to $30 a barrel. This will ensure that OPEC or the national oil companies cannot manipulate prices as easily, hence driving ethanol producers out of business. I do believe such credits should expire once ethanol capacity exceeds 15 billion gallons in this country because I do not believe they will be needed.

These three policies will ensure investors a permanent market for the ethanol and will cause billions of dollars to flow in.

In addition, certain other policies can accelerate the process, even though I consider them what I call page 2 recommendations and not essential. I do believe if we do make the VEETC credit variable, down to 20 cents, it would benefit the American farmer and the ethanol producer if we shift the credit to an ethanol producers

credit instead of making it a blenders credit. Today it is estimated they get about 25 cents, the oil companies collecting the rest of the benefit.

One variant of that would be to make the credit applicable only to building new plant capacity in America. That has multiple benefits. It will increase plant capacity, increase supply, and drive down prices for consumers for biofuels.

Second, I would suggest that we allow imports of ethanol without tariff but only for consumption above the RFS standard. We have an RFS standard that corn ethanol can meet. I even suggest we extend the standard up toward 15 billion gallons by 2015. But if we allow imports above that without tariff, we will make it more attractive for consumers to buy E85 and we will accelerate the adoption of the E85 economy, which I believe will enhance the value proposition for all ethanol producers, including today's corn ethanol producers, in the United States through this mechanism.

If, in fact, we do build the VEETC credit only for plant construction in the United States, any credits that go to Brazilian producers who import ethanol into the United States will only be for additional plant construction in the United States, enhancing our energy security and probably relatively safe under the WTO action because of the provisions for exceptions for national security under WTO.

I suggest we institute a cellulosic ethanol credit, similar to the VEETC credit. In fact, the last energy bill contained a 1.5X credit. I suggest we monetize that.

I suggest a separate RFS standard for E85, as I have already said.

I would recommend we reform and strengthen CAFE partially by making it a CAFE petroleum mileage standard with automakers incented to provide both increased fuel economy through technologies like hybrids and improved use of biofuels, the renewable fuels. Today they have almost no incentive to encourage the use of biofuels.

I would suggest we provide loan guarantees for the first few cellulosic ethanol plants with every new technology, but only for the first few plants of each technology.

It is not well known that if we institute a system for carbon trading, it should drop the effective price of a gallon of ethanol by between 20 to 30 cents a gallon depending upon what technology is used to produce the ethanol.

Finally, I suggest we switch agricultural subsidies to energy crops, a much safer place to do it, and frankly, a place with much more social good.

My dream with these recommendations is that Wal-Mart offers E85 at $1.99 a gallon at every store in America. They offer an all-American product, a much greener product, at a price that every consumer will want and will increase the demand for flex fuel cars.

Let me stop there, Mr. Chairman, and offer to answer any questions.

[The prepared statement of Mr. Khosla follows:]

PREPARED STATEMENT OF VINOD KHOSLA, PARTNER, KHOSLA VENTURES, MENLO PARK, CA

Good morning. Chairman Lugar, esteemed members of the committee, I want to start by thanking you for allowing me the opportunity to speak to you today about our unique ability to secure America's energy independence. Since the President's State of the Union and rising prices at the pumps, there has been a lot of talk about our oil addiction. I come here to talk not about what must be done but rather how to get it done simply, and pragmatically, in a manner aligned with the major political interests that carry clout in this country. We can not only do the right thing, but also the politically correct thing, while asking each interest group to compromise a little.

If it were not for the rapid growth of our domestic ethanol industry, Americans would see gas prices approaching $4 a gallon with no real alternative or hope in sight. In comparison, the Department of Energy estimates ANWR drilling would save 1 cent per gallon at the pump by 2025 as quoted in Fortune (May 15, 2006). We could be the architect of a global development plan. A Marshall Plan for our times that would support technological advancements and sustainable development of a global alternative to petroleum . . . and best of all it takes very little money to do.

I come to you today with ambitious goals, but goals that are grounded in sound science, technology, and business. I am convinced that we can replace the majority of our petroleum used for cars and light trucks with ethanol within 25 years. This is not an alternative fuel—it can be a mainstream fuel. More importantly, with a few simple policy changes, we can be irreversibly traveling down this path in less than 7 years.

You may ask, why ethanol? Ethanol is substantially cheaper to produce today than gasoline before all subsidies and taxes. For example, the cost to produce ethanol in Brazil is less than $0.75 per gallon, while a U.S.-based corn to ethanol plant's production costs are roughly $1.00 per gallon. That equates, even with U.S. costs, to about $1.25 per "gasoline equivalent" gallon of ethanol. Gasoline on the other hand costs $1.60–$2.20 or more per gallon to produce, depending upon the cost of a barrel of oil.

Why shouldn't it sell for much less than gasoline at the pump, except for the oil interests distorting the price to ensure they don't lose their lucrative profit opportunity or temporary supply/demand dynamics? As new technologies ramp up, ethanol can be cheaper than gasoline even if oil drops to $35–$40 per barrel—a level it is not expected to reach according to the EIA. In addition to lower cost, E85 reduces volatile organic compounds by 15 percent, carbon monoxide by 40 percent, NO_X by 10 percent, and sulfate emissions by 80 percent when compared to gasoline according to an estimate from one environmental organization.

With ethanol, we get a fuel that is cheaper for consumers and automakers, cleaner and greener, and it takes Mideast terrorism fueling dollars and moves them to rural America. We capitalize on American technology to create more jobs and cheaper transportation costs for the American public. What is wrong with this picture?

The single biggest risk we face is the oil interests distorting the price to ensure they don't loose their lucrative profit opportunity? If you were making $36 billion of profit per year like Exxon, would you want things to change? Reports of oil company executives lying under oath are reminiscent of the 1985 price manipulation episodes, Enron's energy price manipulation, and other examples, be it Iran, Russia, or Sudan. I personally received a warning from a senior executive of a major oil company that they could drop the price of oil if biofuels started to take off. We cannot let this opportunity to change our dependence on oil slip away again.

My friends from the Midwest tell me ethanol is the talk of coffee shops and maybe the most important thing in rural America in 30 years. It may also be the most important thing for global peace and welfare, the climate crisis, and for consumers. Fortunately, this time around the environmentalists, the automakers, the agricultural interests, the security and energy independence proponents, and even the evangelicals are all aligned. Finally, a cause all interests can rally behind. As Tom Freidman recites a New York Times poll: 89 percent favor a mandate of more efficient cars; 87 percent say no to a gasoline tax but that drops to 37 percent if the tax is to "reduce our dependence on foreign oil" and to 34 percent if the tax is to "reduce global warming."

The oil interests keep propagating myths like insufficient land, poor energy balance, and high production costs to curb enthusiasm for ethanol. This is reminiscent of the tobacco companies funding studies to prove that smoking does not cause cancer. The NRDC, more concerned about land use than the oil interest, estimate a modest 114m acres of land needs, Argonne National Labs and UC Berkley, among

many others, have discounted the energy balance claims. In my opinion, these are bogus if not ill-intentioned claims and I will address these falsehoods one by one.

Crop Land: Yields of corn are increasing in the United States and Brazil. Brazil has had a 4X increase since 1975 and knowledgeable scientists are forecasting another 4X in the next 10 years. U.S. gallons per acre yields can reach 10X the current levels even without the innovations that are common place in Silicon Valley. Based on my forecasts, I can see my way to yields increasing more than 10X to between 3,000 to 5,000 gallons per acre compared to 400 gallons per acre today, demolishing all land use and energy balance arguments. I agree with Rick Tolman, CEO of National Corn Growers Association, who believes that corn can provide 14–17 billions of gallons of ethanol by 2015 without impacting food supply. Based on my forecasts, including the considerable upside afforded by technology innovations, biomass-based ethanol can replace most of our gasoline needs in 20 years, using less than 60m acres of land.

Energy Balance: The only study that claims corn ethanol has an unfavorable energy balance is an outdated study performed by Professor Pimentel. Both USDA- and DOE-affiliated researchers claim that Pimentel's 2005 study overstates energy requirements. Professor Kammen at UC Berkley further states that corn ethanol results in more than a 90-percent reduction in petroleum use and a moderate 10–30-percent reduction in greenhouse gases. The NRDC agrees, stating that (1) corn ethanol is providing important fossil fuel savings and greenhouse gas reductions; (2) cellulosic ethanol simply delivers, profoundly, more renewable energy than corn ethanol; and (3) very little petroleum is used in the production of ethanol . . . a shift from gasoline to ethanol will reduce our oil dependence. Remember tobacco claiming and funding studies, forever, to prove that smoking does not cause cancer?

Though a 25-percent mileage reduction is the reality today, it can be immaterially small, over time, as engines are optimized for a flex fuel world. Saab sells a model in Sweden that adjusts itself to take full advantage of E85's higher octane—100 to 105, versus 87 to 93 octane for gasoline. Called the Saab 9-5 BioPower, its turbocharged engine generates 175 horsepower on gasoline and a whopping 215 hp on E85. (USA Today, 5/4/2006). Even with the additional horsepower, the Saab 9-5 only has an 18-percent lower mileage on ethanol. If the engine was designed to provide the 175 hp on ethanol, we would get an additional substantial step increase in ethanol mileage. This proves that engines can be optimized for ethanol, thus substantially eliminating the mileage penalty which has been a convenient excuse for the oil companies.

In the United States, in 2000, the ethanol industry sold about 1.6 billion gallons of ethanol at about $1.20 per gallon. By 2005, the industry more than doubled its sales to 4 billion gallons, at a price of about $1.50 per gallon. In my view, plants can meet all their cash-flow requirements and pay off construction debt at prices in the $1.30–$1.40 per gallon range, given a cost of production of roughly $1 per gallon without subsidies or tax credits. At today's prices of over $2.50 per gallon, ethanol producers can pay off their plants in just 11 months rather than the standard 7-year payoff period. It is indisputable that ethanol is not only cheaper to produce than gasoline at about $40/barrel, but also, that the returns can be outstanding. It is disturbing to me to see some factions calling for permanent extensions to the credits, instead of supporting a variable VEETC model, which is genuinely needed to prevent oil price manipulation by interested parties. We have sufficient land and the energy balances and economics are favorable for ethanol as a transportation fuel. All we need to do is kick-start the process.

Chairman Lugar and members of the committee, the time has come for us to ask ourselves: Do we want to feed our farmers or Mideast terrorism? Do we want ANWR oil rigs or prairie grass fields. Fossil fuels or green fuels? Create farm jobs or Mideast tycoons? Gasoline cars or cars that offer the choice of biofuels? Expensive gasoline or cheaper ethanol? This appears to be nothing less than a Darwinian IQ test.

Risk capital from investors is the only solution to the oil stranglehold. Three simple things that need a little bit of courage, not a lot of money are sufficient to get this capital flowing.

These three are:

(a) Mandate at least 70 percent of the new cars sold in America be FFVs by 2014 with 10 percent annual increases starting with 20 percent by 2009, and all such cars, old and new, be provided with a yellow gas cap, with possible tax incentives of $50 per car.

(b) Mandate that 10 percent of all gas stations owned or branded by major gas station owners offer at least one ethanol pump. Alternatively mandating a separate RFS for E85 and cellulosic ethanol defined later would serve a similar purpose. For the first 20,000 stations that convert at least one pump, an incentive can be offered up to $30,000 per station in the first year, $25,000 per station in the second year,

and $20,000 per year in the third year, the proceeds being appropriated from the Leaking Underground Storage Tank Fund or through a special tax on oil company profits, up to a maximum of $600m over 3 years.

(c) Make VEETC credit variable with oil price varying from $0.20 at current prices up to $0.80 instead of the current $0.51 credit as oil prices vary from $70 to $30 per gallon. This will insure that OPEC or the national oil companies cannot manipulate prices as easily, hence driving ethanol producers out of business. Such credits should expire once ethanol capacity exceeds 15 billion gallons in this country.

These three policies will assure investors that a permanent market will exist for ethanol and will not be subject to price manipulation by the oil nations. Billions of dollars will flow into the ethanol economy creating a permanent alternative to gasoline, without material government funds.

In addition, certain other policies can accelerate the process but are not essential:

(1) Shift the $0.51 blender's credit to an "ethanol producers credit" preferably to be used only for plant construction instead of giving it to the oil companies as a "blenders credit." This will build permanent U.S. capacity for new ethanol production, independent of whether the ethanol is U.S.-made or imported. In fact this format will supply all the capital required for plant construction the industry needs to replace all our petroleum and can be structured to be self effacing when we reach appropriate plant capacity.

(2) Allow imports of ethanol for consumption above the RFS standard without tariff subject to switching the VEETC ethanol credit to one directed exclusively toward building plant-capacity in the United States. This will create permanent capacity for ethanol production in the United States. It is likely that we will see WTO action challenging the tariff's legality. A proactive program is more likely to be effective than a reaction in hindsight to WTO action. Besides early availability of lower priced ethanol in the market will accelerate the switch to E85 and take ethanol into the domain of a primary replacement for gasoline instead of just being an additive. Concurrent with this provision the ethanol RFS can be extended to 12b gallons by 2015. Based on the national security exemption of the WTO, an incentive or VEETC-like credit, is probably allowed if it is directed toward building ethanol fuel plant-capacity in the United States. An alternative would be to eliminate the tariff only for E85 ethanol use, accelerating E85 adoption while keeping the blending market protected against imports allowing U.S. farmers to get down the learning curve on ethanol costs. Tariff removal could be coincident with funding of additional E85 stations.

(3) Institute a similar limited-period credit for cellulosic ethanol or monetize the current "1.5 times" credit for cellulosic ethanol defined in the 2005 energy bill.

(4) Institute separate RFS standards for E85 (and possibly cellulosic ethanol) to kick-start the E85 market which is currently being discouraged by the oil companies.

(5) Reform and strengthen CAFE replacing CAFE mileage with CAFE "petroleum mileage" to align and incentivize automakers to promote the use of ethanol and other gasoline alternatives, giving them credit for any technology used to replace petroleum; in addition to increases in mileage standards.

(6) Provide loan guarantees for the first few cellulosic ethanol plants built with any new technology.

(7) Institute a cap and trade system for carbon trading. This could effectively reduce the price of ethanol by as much as $0.20–$0.30 per gallon (based on the current trading price of carbon in the European Union) depending upon the ethanol production technology. This would provide incentives to make corn ethanol greener, and less dependent on fossil fuels.

(8) Switch agricultural subsidies from row crops to energy crops.

In the United States as oil prices continue to soar I see the following:

1. Oil companies use big-budget advertising, expensive PR firms, and armies of accountants to prove they are not making too much money while making more money than any industry has ever made in the history of the corporate world. Amazing what money can buy.

2. They blame everybody but themselves, but more importantly, are doing relatively little to invest in alternatives to gasoline, other than token investments and PR campaigns.

3.They put obstacles in the way of their franchisees who want to offer ethanol instead of offering E85 themselves. Why don't we require them to sell ethanol at, at least, 10 percent of their gas stations? We have CAFE standards for automakers, why not E85 green fuel standards for the oil companies?

4. With a fraction of their oil profits invested in new ethanol capacity or ethanol distribution we could be producing tens of billions of gallons of ethanol and solving

our addiction to oil. Instead they are sending these profits to the Mideast instead of creating jobs in the USA.

Are they entitled to their profits? I believe they are. But that should not prevent us from developing alternatives to their stranglehold on our transportation fuel for the good of society. Here are some examples of why it is clear we need to rein in big oil:

1. Governor Pataki proposed a new bill in New York. The bill would exempt renewable fuels from the provisions of "exclusivity" contracts between fuel providers and retail service stations, which only allow the service stations to sell specific brands of fuel. In most cases, these brands do not include renewable fuels. Since the "exclusivity" contracts prohibit service stations from obtaining renewable fuels like ethanol (E85) from other sources, these fuels are not available for sale to consumers. The Governor's proposal would exclude renewable fuels from these contracts if the distributor does not offer these types of fuels.

2. Mobil gas station in St. Louis does not allow use of credit cards for payment and warns against ethanol, is typical of how oil companies discourage consumer use with scary notices. An Exxon in Brazil stated that every third fill-up should be with gasoline for all flex fuel vehicles, another falsehood.

3. The Foundation for Consumer and Taxpayer Rights released a new study of rising gasoline prices in California that found corporate markups and profiteering are responsible for spring price spikes, not rising crude costs or the national switchover to higher cost ethanol, as the oil industry claims. One can find the study at http://www.consumerwatchdog.org/energy/rp/6132.pdf.

4. The 1985 price manipulation and recoupling of an economy that was decoupling from oil is well known.

Gaining independence from foreign oil would not be unique to the United States. I just recently returned from Brazil, which has declared independence from foreign oil. Let me share some insights with you:

1. I got a very visceral feel for carbon capture. As I looked at sugarcane varieties capable of producing 200 (wet) tons per hectare, I could imagine the sound of carbon dioxide getting sucked out of the atmosphere.

2. My estimates of less than 60 million acres required to fuel most of America's cars and light trucks by 2030 started to feel conservative as I saw Brazilian entrepreneurs developing technologies to produce over 3,000 gallons per acre. Imagine what would happen if we let Silicon Valley entrepreneurs and American scientists and technologists innovate in this area. Some fraction of the land used for export crops could replace much of our gasoline needs. We must signal to our innovators that this is a long-term, large market, as Brazil has done.

3. As I saw bagasse roll off the conveyor belts into heaps of waste for burning, it struck me that because of the preprocessing already done on this waste material it could produce cellulosic ethanol very soon. Even today's semideveloped cellulosic ethanol processes could make economic sense without waiting for full development. Orange peels from Florida and wood chips from our Northwestern forests would be next in line.

4. It became clear that America, Brazil, Australia, India, Africa could each produce enough ethanol to meet their local gasoline replacement needs and then export enough to serve much of the planet.

5. It was surprising to learn that the average wage at Cosan, the largest Brazilian ethanol producer, was many times the average for similar industries in Brazil. Over a million jobs had been created in the ethanol economy in Brazil. Ethanol produces substantially more jobs per dollar invested than oil does.

6. Almost astounding was the claim by some entrepreneurs that they could see technology driving costs well below 50 cents per gallon. There is no reason U.S. ethanol production costs won't come down, too. Run, don't walk, seems so compelling suddenly. The big manufacturers confirmed their ability to produce ethanol at below 75 cents a gallon today. Why are we paying over $3 a gallon for our gasoline?

7. If ethanol supplies run low, Brazilian producers can switch production in hours away from sugar to produce more ethanol. Consumers constantly switch back and forth between ethanol and gasoline based on cost and availability. Wouldn't it be nice if consumers here had a choice and not be hostage to oil companies?

8. It was embarrassing to see Brazilian experts laugh at the myths U.S. energy companies spread like we cannot use the same storage tanks, tanker trucks, or transport ethanol in pipelines. They have been doing this for years with no adverse consequences. Why do we let people interested in slowing down biofuels spread these myths by turning molehills into mountains? Some issues surely exist but they are easily resolved in the context of a market as large as the transportation fuels market.

9. I was passionate about ethanol before I went. Going there seemed to completely confirm the potential and opened my eyes to all sorts of new possibilities.

Finally, I will leave you with some thoughts on why now is the time to take action.

1. We have a climate crisis, we have an energy crisis, we have a terrorism crisis, and they are all coupled.

2. The price of oil is up, the cost of ethanol production is down, and we have a visible climate crisis and an overwhelming terrorism crisis.

3. Economics and the right thing coincide this time around. Consumer pull has been proven in Brazil. Our risks are minimal.

4. According to the firm Expansion Capital Partners, clean, or green, technologies netted less than 1 percent of venture capital funds as of 6 years ago. Today, however, the figure has risen to 8 percent, the firm told TechNewsWorld (http://www.technewsworld.com/story/50076.html).

5. Recent news reports that the U.S. insurance industry has decided to formally study the relationship of global climate change to rising insurance costs and availability concerns.

6. Geopolitics and OPEC politics deserve a special mention.

Venezuelan President, Hugo Chavez, is poised to launch a bid to transform the global politics of oil by seeking a deal with consumer countries which would lock in a price of $50 a barrel according to the Monday, April 3, 2006, issue of The Guardian. A long-term agreement at that price could allow Venezuela to count its huge deposits of heavy crude as part of its official reserves, which Caracas says would give it more oil than Saudi Arabia. A $50-a-barrel lock-in would open the way for Venezuela, already the world's fifth-largest oil exporter, to demand a hugh increase in its official oil reserves—allowing it to demand a big increase in its production allowance within OPEC. Venezuela holds 90 percent of the world's extra heavy crude oil—deposits which have to be turned into synthetic light crude before they can be refined and which only become economic to operate with the oil price at about $40 a barrel. Newsnight cites a report from the U.S. Energy Information Administrator, Guy Caruso, suggesting Venezuela could have more than a trillion barrels of reserves.

Saudi Arabia's Oil Minister scorned the popular notion that America can achieve energy independence as a myth (SF Chronicle, May 3, 2006).

Iran, China, India, Sudan, Nigeria, Venezuela, Argentina, Bolivia are all responding to the scramble for oil. Rules and principles go by the wayside given the urgency of energy needs for each nation.

Asset valuation—increase in Venezuela and Saudi Arabia (each) asset values of over a trillion for every $4 rise in the price of a barrel of oil. According to press reports, for similar reasons, the U.S. oil companies have resisted inventory revaluation methods proposed by FASB.

I came to you today with ambitious goals. I hope that you, too, are convinced that we can replace the majority of our petroleum used for cars and light trucks with ethanol within 25 years. More importantly, with a few simple policy changes, we can be irreversibly traveling down this path in less than 7 years and achieve energy independence, reduce greenhouse gas emissions, and create more jobs for rural Americans. I thank you for your time and attention.

The CHAIRMAN. Well, thank you very much for that very thoughtful and provocative testimony. I am certain our Senators will have questions of you, but we will hear first from Mr. Grumet. We will be provoked again and stimulated, as the case may be, and then proceed with our questions. I am delighted to have you, and we will ask you to proceed.

STATEMENT OF JASON S. GRUMET, EXECUTIVE DIRECTOR, NATIONAL COMMISSION ON ENERGY POLICY, WASHINGTON, DC

Mr. GRUMET. Thank you very much, Chairman Lugar. I appreciate very much the opportunity to be here today. I thank Senators Chafee, Coleman, and Martinez for joining. I welcome you to interrupt me whenever you actually need to do the people's business and cast a vote.

The CHAIRMAN. Thank you.

Mr. GRUMET. It is a privilege to be here today on behalf of the National Commission on Energy Policy. It is a privilege to share a table with Mr. Khosla, whose optimism about cellulosic ethanol, buoyed by his willingness to put his own resources behind that optimism, I find one of the more constructive and compelling things that I have heard in the last several months, and it very much reinforces, I think, the Commission's view that cellulosic ethanol is one of a series of important solutions.

Mr. Chairman, as you noted, our Commission was brought here to try to see if we could bring somewhat of a more constructive center in what has been a very polarized energy policy debate on a lot of topics. We were able to put together a consensus report in December 2004, and we are very happy that many of those recommendations were engaged with and some actually even adopted in the Energy Policy Act.

But we are mindful that many were not, and we have decided to stay together and really try to address what we see as the three structural challenges to our energy system, those being the need to begin a long-term effort to address the risks of climate change, the need to figure out a way that we can start to build and site the 21st century energy infrastructure that we are going to need to support our economy, our security, and our environmental needs, and then, of course, the need to address oil security, which we placed as the first chapter in our report because we believed then, as we do now, that it represents some of the foremost challenges to our foreign policy, our national security, and our economic vitality.

Mr. Chairman, I agree with almost everything you said in your opening statement. I am just going to take about four times as long to now repeat it back to you and hopefully add a few additional details.

At $70 a barrel, we get asked—I am popular at cocktail parties for the first time in my life—what can we do to bring down the price of gasoline. And over the next 15 minutes, I commit to offer you not one good suggestion, Mr. Chairman, to bring down the cost of gasoline in the next 6 or 12 months, and that is because a defining aspect of this problem is that there are no good opportunities to meaningfully reduce the cost of gasoline.

What is unfortunate is that much of our debate, understandably, focuses on that need for a quick fix, and what I would hope to suggest to you today is that we have an opportunity and this committee, I think, could lead that opportunity to, in a bipartisan way, seize this moment so that in the next 5, 10, and 20 years we will have a new future for this country that is far more secure.

I would suggest to you that the components of that future are as easy to describe as they are difficult to implement. We simply must increase and diversify our sources of petroleum in the near term. We must aggressively pursue greater efficiency, primarily through increased fuel economy, and we must seek to significantly diversify petroleum through alternative fuels.

What I would like to do, Mr. Chairman, with the bulk of my remarks today is to talk about what I think those big opportunities are. The back of my now slightly damp testimony is an Appendix A, what I like to call measures that matter. These are those things

that could really take something on the order of, at least, a million barrels of oil a day off of domestic demand or add that to global production. Just as context, we presently use about 21 million barrels a day of petroleum. That is projected to grow to 26 million or 27 million; the global market, 85 million, growing to 110 million. So you really need to think about these in the scale of a million barrels a day if you think you are really going to start to nibble at the problem.

But before I do that, I want to—I guess at the risk of being branded somewhat a heretic—directly challenge what have been the dual aspirations for our energy policy over the last 30 years, those being, I think, the mythologies of energy independence and foreign oil. This is not simply an academic exercise because it is my sense that our failure over the last 30 years to make real progress toward these goals is twofold. One, I think they are unrealistic goals and actually probably undesirable if we retain them. But as importantly, I do not think they lay out a measurable or productive metric that allows us to be held accountable to the kind of long-term progress that is required.

The litany of problems that you laid out, Mr. Chairman, are deeply compelling. It leads one to emotionally desire to basically take our marbles and go home, get away from these guys. The problem is we have 3 percent of the world's marbles and we use 25 percent of annual oil production. So the notion that we can somehow isolate ourselves from this global dynamic is a vestige of a past that really does not exist. We now live in a global reality, global markets and clearly a geologically global reality. And I can tell you more times than I would like that I have had really passionate discussions with people about energy independence which then end with someone suggesting we have got to make sure we site those LNG facilities because my chemical industry is really getting kicked in the teeth. I think that just further demonstrates that our energy markets, be they oil, natural gas, or others, are global markets. And if we can recognize and better manage our energy interdependence, I think we will be in a much stronger position to deal with this problem meaningfully.

Let me say another word or two about foreign oil because that, of course, is the mantra. Right? Let us get off foreign oil. When it comes to economics, what people are paying at the pump, what our economy feels each and every year, oil is oil. There is one fundamental benchmark price for oil. The big variety in oil prices at the pump are purely a function of taxes and subsidies. The cost of a barrel of crude oil in Norway, which is an exporting nation, is the same as it is in Japan, which is an importing nation. The extent to which our economy is vulnerable to oil price shocks is solely a function of how much oil we use, the ratio of imports to exports, the continent from which that oil was originally brought to the surface has no bearing on that, Mr. Chairman. So it is my suggestion that if we can accept that our economic security is really more a function of how much oil our economy depends upon and not the province of that oil, we can then begin to articulate a set of solutions that really can start to have a real impact.

Between 1975 and 2000, oil intensity per GDP—that is, the amount of oil we use to produce $1 of domestic product—was cut

in half. What that did was make our economy twice as resilient to the kinds of oil price shocks that we have experienced recently, and many would argue that the fact that we have been able to increase and continue economic growth in the last several years in the face of high prices is, in many regards, due to that enhanced resiliency.

An ambitious goal, Mr. Chairman, would be to try to do that again. Between now and 2025, if we could reduce 7.25 million barrels a day of oil, we would again have halved the dependence of our economy on oil.

Now, before starting to review the measures that I think could get us there, I want to just note three themes that I think will hopefully resonate through the balance of my remarks.

The first is that the components of this solution are complementary. We have to move beyond the divisive debate about whether it is supply or demand, whether we need alternatives or efficiency, because unless we put all of these pieces together, we will simply fail. While I think the future that Vinod lays out is the place we need to go—this is a future toward alternatives—if we do not buy time by better managing our global oil assets and by dramatically increasing efficiency, I fear we will suffer as a nation immeasurable pain on the road to that future.

Second, Mr. Chairman, I believe the solutions are going to require activist government. Until and unless we internalize the true costs of oil dependence, foreign policy costs, environmental costs, economic shock costs, military costs, into the private marketplace, private decisions will inherently fail to provide efficient outcomes. So that is why I think Government is going to have an ongoing obligation to confront market barriers and to place standards in place such that those costs ultimately get borne by the private market decision.

My final reflection is that this is, of course, a long-term challenge. There is incredible negative momentum in the system. No matter how ambitious we are today, no matter what policies we put into place this year, this problem will continue to get worse for a time before it gets better, as the ongoing demand for greater energy use outstrips our meager efficiency and relatively flat-line ability to produce more oil domestically.

Finally, Mr. Chairman, if history is a guide, public support will wax and wane as the price of gasoline goes up and down. The solution, therefore, requires a kind of commitment and consistency that this country really only is able to muster when we truly understand that our future is at risk, and I think this committee's ability to frame this challenge and its true force is going to be a critical component.

So, Mr. Chairman, if I can turn from the lofty to the specific and now start to talk a little bit about specific measures, I want to start on the question of oil supply.

We are the third-largest oil producer in the world here in the United States, something that most people, I think, don't appreciate. We produce about 9 million barrels a day, roughly. We import about 12 million barrels a day. However, we have a very mature oil market. We have punched a lot of holes in these continental 48 States, and despite significant investment increases in

the last decade, our production has stayed flat and has even begun to decline a little bit.

Now, there is a tremendous focus on reserves that are off-limits and a view that that is really an obstacle to our own energy security. I will tell you that there are very significant oil reserves in this country that are presently off-limits to drilling. Between the Pacific Coast, Alaska, gulf coast, we have about 25 billion barrels of proven reserves. Now, there are very serious choices, and the Commission did not make specific recommendations about how to balance those competing interests.

I will note that if we drilled everywhere, Santa Monica, coast of Connecticut, ANWR, coast of Rhode Island, coast of Florida—sorry, Mr. Coleman, I can't bring you into that discussion—estimates are that we could raise domestic production by about 2 million barrels a day over the next 20 years. Now, that is a lot of oil, but one must recognize that when thinking about the benefits of production measures, you have to think about those benefits on the basis of the global market because all the benefits of production are shared with all around the world who use that oil. So if we were to produce another 2 million barrels a day in the United States, it would have a salutary effect of about a 2-percent increase on the global oil market, certainly not insignificant. But I think thinking about that against the 20 or so million barrels a day we use here in the United States would be misleading.

So to turn to global production, two-thirds of the world's oil is found in Saudi Arabia, Iran, and Iraq. The good news is that of late, the efforts in the former Soviet Union have been basically offsetting the demand growth in China. There has been an eery parallelism between their ability to increase production while China's demand has skyrocketed. So continuing effort to try to open investment in these countries to diversify global production is of critical importance.

We have had real success there. When Kazakhstan opened its borders to foreign investment between 1996 and 2002, they fully doubled their oil production.

One of the challenges I think we face, Mr. Chairman, which you mentioned, is that an increasing fraction of the global oil market is now being tied up by statist enterprises. So thinking about how we, in our foreign policy, are able to ensure that the competitive marketplace, American technology and investment has access to that global reserve is very important.

I want to turn now to unconventional oil. These are the tar sands in Canada, the heavy oil in Venezuela, as well as the opportunity to take our incredibly abundant coal supplies and transform them into liquids like alternative diesel fuels. This is an incredible resource when one thinks about its magnitude. If, in fact, we were to include those heavy oils and unconventional oils in our global picture, it would dramatically shift the hemispheric balance such that the North American Hemisphere would move from 13 percent of global reserves up to 36 percent of the global reserves. If we brought in coal to liquid technologies, that would further increase the hydrocarbon potential of the people who we know and like.

The problem is not enough resource constraint. The problem is not enough atmosphere. At present, developing oil out of unconven-

tional reserves or out of coal basically has about a 3-time impact on the greenhouse gas emissions of those fuels. If you were to sequester each and every molecule that was used in the production, you could basically hold it even. And I think that is an incredibly important and realistic aspiration because it is our view at the Commission that one need not solve our climate change problems through our oil security measures. But I think we feel equally strongly that we cannot fundamentally undermine an alternative and equally compelling national challenge by trying to solve our oil security problem. So, I guess I would suggest to you that it is incredibly important that if we seek to rely upon these unconventional resources, we begin a fundamentally very different series of investments to try to make sure we can understand how to develop those resources in ways that are compatible with our other challenges. Otherwise, I do not think that they will, in fact, become part of the long-term equation.

Now, let me move on to efficiency, but just say one word about strengthening strategic reserves. As I think all are aware, we have a significant strategic petroleum reserve here in the United States, as do the other countries in the OECD who are members of the International Energy Agency. These reserves provide a very significant insurance policy and a real significant, I think, psychological deterrent against those who would like to manipulate the oil market.

China and India and the developing countries in which much of the recent growth is occurring, are not members, do not participate in this global strategic reserve. I think this committee has begun this discussion and has taken up the serious question of what we can do to encourage all countries who play a significant role in putting strain on the system to pay into the security policy. There are a lot of rules to become a member of the OECD, a lot of things that deal with human rights and economic transparency and a lot of, I think, obstacles that will keep China out of the strategic reserve for some period of time unless we find a way to be creative, give them some kind of special observer status and welcome them in more quickly. But I think that is a critical component of the long term.

I will now try to efficiently move into the discussion of efficiency measures, Mr. Chairman. I think that these measures deserve focus because not only do they have the largest impact potentially in purely absolute terms, but as I mentioned earlier, every barrel of oil we save or displace, the benefits of those accrue entirely to the United States. So if we can reduce our demand from 25 million to 24 million barrels, that 1 million barrels is a 4-percent benefit to our country, whereas a 1-million-barrel production is about a 1-percent benefit to global security.

Far and away, significantly strengthening and reforming CAFE is the single most important thing we can do in the near term to increase our energy security. There are a plethora of proposals around Congress right now about how to become energy secure. I would say to you, flatly, that unless those proposals contain a serious obligation to increase fuel economy, I do not believe they provide a serious option for a solution.

Mr. Chairman, fuel economy in this country has been stagnant for over 20 years and many confuse that with the notion that we are not making technological progress, and nothing could be further from the truth. Each and every year for the last 20 years, energy efficiency of our engines have become much, much more efficient, by 2–3 percent a year. However, absent any obligation to take those technological gains and put them toward the public good of reducing our oil dependence, companies have done the understandable thing. We have made our cars bigger, heavier, and faster. A car today, on average, is about 25 percent heavier than it was 20 years ago and gets fully 100 percent more power. The economy cars of today outperform the muscle cars of the 1970s. So one of the key conclusions of our Commission was that looking at this incredible opportunity coming forward by hybrids and advanced diesels, that Government must act to both accelerate those programs and to direct the efficiency toward the public good of lowering our oil dependence.

I want to talk for a couple moments about the challenges with CAFE that primarily revolve around safety and job concerns, and I will just skim these complicated topics. But for a long time, there has been an assertion that to increase fuel economy, we have to make cars smaller. That is simply not the case. We do not need to make cars smaller. We may need to stop making them bigger every year. We may need to stop making them more and more powerful every year, but if we just held the line on our rather delightful automobile fleet and started to direct the future efficiency gains toward making those cars go farther on a mile of gasoline, we would be on the way to a more efficient future.

Now, the safety issue is far more complex. There are opportunities with new materials. There are opportunities to make cars safer. The problem we have is when Hummers eat Minis. It is the disparity of weight on the highways more than anything else that creates the safety issues we are concerned about. So there are ways to reform CAFE which I think can help in that regard.

On the issue of jobs, there is a depressing reality that our domestic industry is less capable of competing to create the advanced cars of the future. We have worked with the UAW and experts at the University of Michigan and others to try to assess the validity of these concerns and believe that they are real. One of the recommendations we proposed, which has been batted about by many, is the idea to provide significant tax incentives for the retooling of domestic facilities and domestic parts suppliers, not unlike what Vinod was suggesting about the tax incentives for domestic production of ethanol. We believe that those would not only be GATT-legal, but they would allow us to both provide the cars people want while keeping the American auto base strong.

We were caught a little short when I think a representative from Ford mentioned that they do not pay a lot of taxes these days, and so offering them tax incentives was maybe not the most efficient mechanism of giving them the relief that they desired. Senator Obama, who could not join us today, offered a new alliterative mechanism with the health care of hybrids, the idea that we address the catastrophic health care costs of some of the auto industry in exchange for a commitment to building hybrids. While I

think we have work to do on finding the perfect mechanism, the tough love metaphor, I think, is going to be a component of the solution. We have to challenge the domestic industry and recognize at the same time that they do not have a level playing field with their foreign competitors and will have to address that.

Finally, on CAFE, there has been a lot of discussion about reforming CAFE as of late. The Commission strongly believes that pairing a significant increase with significant reform is the right thing to do. We commend NHTSA for their restructuring of the recent light duty truck rule. We are a little bit less sanguine that they have significantly strengthened that rule. They have changed the model so that it is a much more effective tool. They just have not taken that tool out for a drive. And the key reason is that the way NHTSA tries to set CAFE is quite reasonable. They try to determine what is the value of a gallon of gasoline saved, social total value, and set the new CAFE standards such that the costs of new technology are offset by the fuel savings.

In this last rulemaking, NHTSA determined that the total social value of a gallon of gasoline saved over the next decade was $1.70. They used the EIA projections, which they are obligated to do, which says real cost of gasoline will be about $1.60 and we are going to add 40 cents of taxes. So it is $1.60 of real value. And then they looked at all of the different externalities they could think about, and they came up with 6 cents. It is not because they are not good people who try hard. They simply do not have the authority or the tools to think about the issues that, I think, this committee cares about. They looked at dozens of different things. They looked at air pollution costs. They looked at protecting the economy from price shocks. They even placed a value on saving consumers time by not having to go to gasoline stations.

Unfortunately, when they grappled with the question of military costs, they concluded that they could not ascribe any quantifiable costs that our country pays to have our military provide access to oil. So they factored that in as zero. They could not even begin to contemplate the issues, Mr. Chairman, that you addressed at the beginning: The likelihood of increased tensions with China, the extent to which our foreign policy prerogatives are inhibited. These are concerns that this committee, I think, understands well and that only this Congress has the ability to, in fact, instruct NHTSA as to how to engage.

So, I believe, the President's request for greater authority is intelligent and should be supported. I think Congress should also try to provide some direction as to how the executive branch use that authority not only by suggesting that they incorporate the annual increases in efficiency and direct them toward improvements, but help NHTSA think about how to grapple with the very real costs of oil dependence that this committee is keenly aware of.

I want to end, Mr. Chairman, by a few words on alternatives and will not begin to add to what, I think, Mr. Khosla has done a very fine job of. Simply to note that as long as our transportation system is 97 percent dependent upon petroleum, we will not be in control of our own destiny. Very much like Mr. Khosla, the Commission concluded that cellulosic ethanol is the most promising opportunity to displace a significant amount of petroleum, and there are

four reasons. And we applied these tests to a number of different options, but there is an ample domestic feedstock, it has low net greenhouse gas—inching benefits. It can largely rely on existing infrastructure, and it has the potential to be cost competitive over time with gasoline. Those are kind of the four horsemen of a real fuel.

Let me just note that I very much agree that infrastructure in the near term is the challenge. I support the suggestion that we really focus, as you have with Senator Obama and others, on bringing forth that infrastructure. I note that once we get above 10 or 15 billion gallons of corn-based ethanol, we start running out of corn flakes. So I think corn is the pathway to our biofuture. It is the pathway to our infrastructure but, like Mr. Khosla, believe that it is cellulosic ethanol that has the real long-term potential.

And then, finally, a note on land. We very much agree that land is not ultimately a challenge for a big cellulosic industry. We concluded that you could displace half of the gasoline in this country with about 30 million acres of land. I will note that we presume significant increases, as Mr. Khosla does, in the yield per acre of energy crops, real but not remarkable increases in the conversion efficiency of that product to fuel, and a doubling of fuel economy. If you do not do those three things, you are looking at 180 million acres, which would be entirely unacceptable. These are incredibly realistic opportunities, but they all have to be pursued.

Having begun with the heretical challenge of energy independence, I think I want to end with something equally provocative, thinking about authorization, appropriations, and noncompetitive earmarks.

EPAct did a fine job. There are 10 programs in the Energy Policy Act which are directed toward providing incentives for the first mover of ethanol facilities that we all want about $4 billion of authorizations. I think we all know that in this fiscal climate, the challenge of providing appropriations for that is a real one, and the Commission urges this Congress to do whatever it can.

I will also note that in 2005 fully half of the DOE research budget for cellulosic ethanol was directed to noncompetitive earmarks. The irony here, Mr. Chairman, is I think this clearly reflects the keen interest that Congress has in this program. I will simply note that unless we try to channel that interest, we will literally love this program to death as we continue to pull it apart in ways that frustrate long-term research progress.

So, truly, now in conclusion as promised, I am here to offer no near term solutions, whatsoever. I think there is an understandable frustration about that, which leads us to want to talk about windfall profits and price gouging and restricted environmental laws as if a few bad people or poorly crafted statutes were somehow responsible for the misery that people are feeling. I guess I would suggest to you that we need to look beyond those quick fixes and that if, in fact, we come together and agree that there is an opportunity in a bipartisan way to focus on increasing traditional oil supply, on significantly enhancing the efficiency of our fleet, and on simultaneously moving toward the vision that we share about a biofuels future, we can then put ourselves in a position where we will be in charge of our own destiny. It is clear to me that we will

use less oil in this country in the future. I think the question is whether we do that on our terms or whether it is done to us on terms that will fundamentally be unacceptable to our health and happiness.

Thank you for the opportunity to be here today.

[The prepared statement of Mr. Grumet follows:]

PREPARED STATEMENT OF JASON S. GRUMET, EXECUTIVE DIRECTOR, NATIONAL COMMISSION ON ENERGY POLICY, WASHINGTON, DC

INTRODUCTION

Good day, Chairman Lugar and members of the committee. I have the privilege to speak to you today on behalf of the National Commission on Energy Policy (NCEP), a diverse and bipartisan group of energy experts that first came together in 2002 with support from the Hewlett Foundation and several other leading philanthropies. In December 2004, the Commission released a report entitled "Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges." The first chapter of that report was about oil security because our Commission believed then, and still does, that oil security is one of our Nation's foremost economic, national security, and energy challenges.

This isn't news to anyone, of course—least of all this committee. In fact, as national policy obsessions go, America's oil dependence has been one of our most enduring. For more than 50 years, Congress and multiple administrations of either party have decried our reliance on imported oil and vowed to do something about it. Today, with oil prices topping $70 per barrel and gasoline prices at $3 per gallon, we are again enmeshed in an active debate over energy policy. The lack of real options to address near-term energy prices is a source of great frustration here in Congress and throughout the country. The challenge we face is to move beyond slogans, blame, and false promise of "quick fixes" and seize upon this moment of collective focus to develop long-term policy responses that will meaningfully protect our economy while strengthening our national security.

The basic elements of an effective response to our current oil predicament are as easy to summarize as they are difficult to execute. Put simply, the Commission believes we must:

1. Expand and diversify supplies;
2. Reduce demand; and
3. Develop alternatives.

At the outset, I want to stress four themes that I hope will resonate throughout my remarks.

First, the elements identified above are complementary components of an effective strategy. If they are not pursued in concert the effort will fail. We must have supply increases and demand reductions. We must pursue greater vehicle fuel economy and aggressive efforts to displace petroleum with biofuels. Simply put, we must move beyond divisive and false choices to develop a comprehensive approach that does not seek to trade one element off against the success of another.

Second, until, and unless, private markets reflect the full economic, security, and environmental costs of oil dependence—and until, and unless, consumers possess adequate information to make efficient choices—policies that rely solely on private market decisions will continue to fail. It is, therefore, incumbent upon government to overcome market barriers and motivate private sector innovation by creating incentives that better reflect the true benefits of greater energy security.

Third, improving our energy security is a long-term challenge. If we commit the Nation to a fundamental course correction, a secure energy future is within our reach. It will take several years, however, before we begin to reap the benefits of improved policies and technologies. During this time, the problem of high prices and tight supplies will almost certainly get worse as growth in petroleum demand continues to outstrip the rate at which vehicle fuel economy improves and new sources of oil come on line. While biofuels hold great potential, near term gains will also be incremental when compared against our annual petroleum consumption. If history is a guide, public interest and support for long-term policies will wax and wane as the price of gasoline rises and falls. A real solution, therefore, will require the kind of commitment, consistency, and courage our Nation has mustered in the past when we understood that our future was at risk.

Finally, we must better understand and articulate the risks of oil dependence and establish goals that encourage consistent progress and accountability. I believe that

our failure over the past 30 years to implement measures commensurate with the risks is, in part, due to widely held misconceptions about the true nature and scope of the problem and to our inability to establish realistic interim goals and mechanisms to measure our progress in achieving them.

RETHINKING "ENERGY INDEPENDENCE"

Before delving into solutions, I would like to take on the somewhat heretical task of challenging the aspiration of "energy independence" with its attendant focus on reducing our Nation's use of "foreign oil." While emotionally compelling, these concepts are vestiges of a world that no longer exists. By failing to recognize the fundamentally global nature of the oil market, and the increasingly global nature of markets for natural gas, the call for energy independence has become an obstacle to effective policy design. There is one world market for oil. It is a fungible global commodity that has a single benchmark price. Wide disparities in the price of gasoline around the world are the product of national subsidies and taxes, but have nothing to do with how much oil different nations import or produce. Our economic vulnerability to oil price shocks is entirely a function of how much oil we use—the continent from which the oil was extracted has no bearing, whatsoever, on this equation.

Moreover, as members of this committee know better than anyone else, some of the most profound consequences of America's dependence on oil go well beyond the economic. It's virtually impossible to put a dollar figure on all the costs of that dependence, but there is no question that our thirst for oil constrains our foreign policy, imposes burdens on our military, accounts for, approximately, one-third of the U.S. current account deficit which soared to $805 billion in 2005, swells the coffers of undemocratic and even actively hostile governments, and directly, or indirectly, provides some of the funding for terrorist organizations that mean us harm. These risks and vulnerabilities too, like those we face strictly in terms of our own economic well-being, will surely continue to grow if we don't take action. Put simply, if current trends don't change we face a global scramble for energy resources within this century that is sure to be economically and geopolitically damaging to all concerned.

Confronted with these realities it is tempting—but wrong—to imagine that if we could only become energy self-sufficient everything would be fine. I can't underscore this point too strongly: Energy "independence" must not be confused with energy "security." Energy independence is simply unrealistic and has been ever since President Nixon first proposed to enshrine it as a national goal in the 1970s. U.S. oil imports have been rising inexorably ever since. The United States, alone, currently accounts for fully one-quarter of world oil demand. What may be less well known is that we are also the world's third-largest oil producer at present. But this will not last forever. Our Nation holds less than 3 percent of the world's proved oil reserves. Sixty-one percent of world reserves, by contrast, are located in the Middle East.

Region	Percent of world's proved reserves
Middle East	61.7
Europe/Eurasia	11.7
Africa	9.4
South and Central America	8.5
North America	5.1
Asia Pacific	3.5

* Only 9% of world reserves are held by countries considered ''free'' by Freedom House.

Current projections indicate that oil production by the United States and other industrialized countries will decline by 6 percent over the next two decades, even as oil production in the former Soviet Union increases by nearly 50 percent and OPEC output increases 33 percent. This means that U.S. oil imports will continue to grow in the future, as they have for the last several decades, and that we like everyone else will increasingly need to rely on oil supplies that originate in what are now unstable and undemocratic regions of the world. Nor will our dependence on foreign sources of energy be limited to oil: Given declining domestic production of natural gas—another fuel that plays an extremely important role in the U.S. economy—it appears inevitable that we will increasingly need to rely on overseas sources for natural gas as well. The key, then, to greater energy security for the United States lies in recognizing—and better managing—our fundamental energy interdependence.

OIL MARKET FUNDAMENTALS

Nearly all experts agree about the fundamental drivers behind today's high oil prices and extreme market volatility. For some time now, rising global demand for petroleum—driven not only by growing U.S. demand, but in part by the very rapid modernization of countries like China and India—has been outpacing the discovery and development of new sources of supply. The result is that we now live in a world that requires approximately 85 million barrels of oil daily, but has only very little spare production capacity (as little as 2 percent, according to various estimates) and barely sufficient refining capacity. In this environment even small disruptions along the supply chain can cause serious repercussions. The dynamics are further strained by OPEC's ability to manipulate production quotas and by the participation of market players that operate on motives outside the bounds of economic efficiency.

Unfortunately, this set of conditions seems unlikely to change soon. U.S. and total world demand for oil are expected to increase substantially over the next 20 years. (See Fig.1) Between 2004 and 2025, U.S. demand is projected to grow 24 percent (from 21 to 26 million barrels per day) and total world demand is expected to increase 34 percent (from 82 to 110 million barrels per day). (In the last year, the U.S. Energy Information Agency has downgraded its 20-year domestic demand projection by 3 million barrels a day based on expectations that high global prices are here to stay.) The world is suffering from what can best be described as a "demand shock" as China, India, and much of the developing world modernize their economies and dramatically increase their use of motor vehicles. Equally concerning, there is currently very little spare capacity in the global oil market to make up any shortfall in oil supplies that arises as a result of political instability, unforeseen demand growth, acts of terrorism, or weather-related events. In 2005, global spare-production capacity totaled approximately 1.5–2.0 million barrels per day; by contrast spare-production capacity in 2001 was approximately 7.3 million barrels per day. This means that any event that prevents even a relatively small amount of oil from reaching today's global markets can have a dramatic impact on prices.

In partnership with the organization, Securing America's Energy Future (SAFE), NCEP has been exploring the potential consequences of today's tight supply margins by examining the impacts of any number of possible disruptions in global oil supply. With help from industry and military experts, as well as from the Wall Street analysis firm, Sanford C. Bernstein and Co. LLC, we concluded that any number of truly unexceptional circumstances could cause global oil prices to literally skyrocket. As part of an oil crisis simulation called Oil ShockWave, we found that a mere 4-percent shortfall in daily world oil supplies could lead to a 177-percent increase in world prices. It wouldn't take much, in other words, to send oil prices even higher—perhaps significantly higher—than they already are. With the U.S. transportation system over 97 percent reliant upon petroleum, the impacts of such an increase could be devastating. As then-Chairman of the Federal Reserve, Alan Greenspan, observed in 2002, "All economic downturns in the United States since 1973 have been preceded by sharp increases in the price of oil."

A BETTER GOAL FOR OIL SECURITY

If we accept that the key measure of our energy security is not how much oil we import, but how much our economy depends on oil, we can begin to articulate more realistic goals and actually set about achieving them. In fact, the oil intensity of the U.S. economy, as measured by gallons consumed per dollar of GDP generated, was cut in half between 1975 and 2000. (See Fig. 2) There were multiple reasons for this decline and they are worth reviewing as we explore our policy options for the future. First, there were structural shifts in the U.S. economy that led to reduced oil consumption, including a shift to less energy-intensive enterprises generally, together with more efficient oil use in some industries and a shift away from oil to different fuels altogether in other industries, notably in the electric power sector. Second, and very important, were vehicle fuel economy standards introduced in the late 1970s that doubled the average mileage of our passenger car and light-duty fleet.

An ambitious goal is to cut the oil intensity of the U.S. economy in half again over 20 years. To achieve this goal would require roughly a 7.25-million-barrel-per-day reduction in oil consumption by 2025. Unfortunately, progress in further reducing the overall oil intensity of the American economy has slowed in recent years, while progress in improving the efficiency of the Nation's vehicle fleet has stalled altogether. But for a modest recent increase in light-truck standards, fuel economy requirements for passenger vehicles have been essentially unchanged since 1980. As a result, average fleet efficiency actually began to decline in recent years as large trucks and SUVs captured ever larger shares of the U.S. auto market. Simply stat-

ed, the United States will not have a serious policy to increase oil security until we achieve a significant increase in the fuel economy of our vehicles.

A fundamental premise underlying the Commission's oil security recommendations is the belief that we can neither drill nor conserve our way to energy security. We simply must address both the supply and demand sides of the equation if we are to have any hope of lasting success. As Congress and ordinary Americans search for solutions to the current costs of gasoline, it is painfully clear that there are no good near term options. We must accept this unfortunate reality and direct our attention to minimizing the harmful effects of the oil shocks that are likely to occur with increasing regularity and severity over the next 20 years.

SOLUTIONS

As noted at the outset, the Commission believes that there are three essential elements to enhanced oil security: Increasing supply, reducing demand, and developing alternatives. The first two of these imperatives can be seen as buying us time to achieve the more fundamental benefits of a diversified portfolio of transportation fuels. We must seek to widen the gap between available supply and demand in the short to medium term as a means of calming today's extremely volatile markets and putting downward pressure on prices, even as we begin developing clean and affordable alternatives for the long term. The Commission's specific recommendations for widening the gap on the supply side include:

1. Expanding and diversifying conventional supplies of oil, both at home and abroad;
2. Expanding the global network of strategic petroleum reserves; and
3. Exploring technologies and processes that would allow for the use of unconventional oil resources in a manner that is compatible with climate change and other environmental concerns.

On the demand side, the Commission recommends:

1. Significantly strengthening fuel economy standards for new passenger vehicles, while simultaneously reforming the existing CAFE program to reduce compliance costs and provide cost-certainty for manufacturers and consumers;
2. Creating incentives to accelerate the market penetration of highly efficient hybrid vehicles while also helping the domestic auto industry retool to meet growing demand for these vehicles; and
3. Exploiting opportunities to boost the efficiency of heavy duty vehicles and to improve the fuel-economy performance of the existing light duty vehicle fleet.

Finally, to develop long-term alternatives to petroleum, the Commission recommends a sustained and vigorous effort to spur public and private sector investment in the development and early deployment of domestically produced transportation fuels derived from biomass and organic wastes. Of all available alternatives to petroleum fuels, the Commission believes that cellulosic ethanol holds the most potential for displacing a significant fraction of transportation oil demand within the next 20–30 years and should, therefore, be a focus of near term RD&D activities.

A summary of the potential benefits of supply and demand measures can be found at Appendix A.

OIL SUPPLY MEASURES

The Commission believes that opportunities exist to substantially boost global oil production within the next 10 to 20 years. This would help to relieve upward price pressures and reduce the risk of significant supply disruptions over the same timeframe.

Domestic Production: The United States is currently the third-largest oil-producing nation after Saudi Arabia and Russia. As such, U.S. production clearly has a significant impact on the stability of the global oil market and efforts to expand production within our own borders must be pursued. Currently, the United States produces about 8.5 million barrels per day of oil (crude and products) and consumes about 21 million barrels per day of finished oil products. Domestic oil production is important to the Nation's economy—it remains an important source of jobs and tax revenues in some regions of the country—and it offers the important advantage of reducing financial transfers to foreign nations. Although domestic production has generally declined over the past decade, it is now projected to increase modestly in the near term (1 million barrels per day in 2016) and to resume a gradual decline thereafter.

The United States is thought to have about 25 billion barrels of proved, conventional oil reserves, the great majority in Alaska and off our Pacific coast with a smaller fraction off the Atlantic coast and the eastern Gulf of Mexico.

Conventional reserves	Crude oil (billions of barrels)
Alaska (ANWR)	10.36
Pacific Offshore	10.71
Eastern Gulf of Mexico	3.58
Atlantic Offshore	2.31

Though technically recoverable, much of this oil is currently off-limits to leasing. If all of it were tapped, it is estimated that U.S. oil output could be increased by about 2 million barrels per day in 2020. Obviously, many issues must be considered in weighing whether it is appropriate to open a particular area to oil drilling and the Commission takes no position on whether the status of specific regions that are currently off-limits should be changed. To provide a sound basis for future decision-making, however, the Commission does believe that an inventory of domestic petroleum reserves should be undertaken as part of a regular, comprehensive assessment of the Nation's known and potential energy resources. Again, however, it cannot be stressed often enough that while U.S. production makes an important contribution to global supplies (and hence is critical to maintaining the near term stability of global markets), our Nation's economic vulnerability to oil price shocks is largely a function of how much oil we use and not how much we produce.

Global Production: Much more substantial oil reserves exist, of course, in other parts of the world, including—besides the Middle East—parts of the former Soviet Union, Africa, and South and Central America. The Commission, therefore, recommends that the U.S. Government encourage nations with significant underdeveloped oil reserves to allow foreign investment in their energy sectors to increase global oil production. Kazakhstan, for example, provides an example of the benefits of liberalized investment policies. Having opened its oil resources to significant foreign investment in the mid-1990s, Kazakhstan's crude oil production rate more than doubled between 1996 and 2002. (See Fig. 3) Output from this one nation is now expected to reach 2 million barrels per day in the next few years and could peak at as much as 4 million barrels per day further down the road. The Commission also recommends that the U.S. Government consider impacts on world oil markets in cases where unilateral economic sanctions imposed by our Nation may be limiting investment in foreign energy markets without necessarily achieving their stated policy objectives.

Unconventional Oil Supplies: Accounting for unconventional oil supplies—such as tar sands in Canada, heavy oil in Venezuela, and oil shale in the United States—would significantly shift the hemispheric balance of world petroleum resources. (See Fig. 4) With today's high prices, these unconventional resources are already being tapped to a greater extent and by 2015 it is likely that Canada and Venezuela together will produce nearly 3.5 million barrels per day of unconventional crude. At the same time, the Fischer-Tropf process, which has been used for over 50 years to convert coal into a form of clean diesel fuel, could—at prices above $50 per barrel—become a significant source of domestic transportation fuel.

Further reliance on unconventional oil resources in the future, however, will require substantial progress toward reducing the substantial energy requirements and negative environmental impacts currently associated with extracting and processing them. Absent efforts to sequester the carbon used in producing unconventional oil, for example, the total greenhouse gas emissions associated with these resources are roughly two and a half times greater than the emissions associated with conventional oil production. While the Commission does not believe that our Nation's oil policy must be viewed as a vehicle for achieving its climate protection objectives, it seems equally clear to us that it would be foolhardy to pursue an oil policy that is at odds with other compelling public policy objectives. Unless and until we learn how to develop these resources without significantly increasing greenhouse gas emissions, the Commission believes that exploiting unconventional oil reserves does not offer a viable long-term pathway toward a more secure energy future. Therefore, the Commission has recommended increased funding to improve the environmental performance of technologies and practices used to produce unconventional oil resources.

Strategic Reserves: Oil stockpiles provide an important insurance policy against the potentially dire consequences of a significant short-term global supply disruption. Combined with private stocks, the U.S. Strategic Petroleum Reserve currently provides us with enough spare capacity to cover the loss of all imports for approximately 150 days, or a partial disruption for much longer. To improve global and domestic oil security, the Commission recommends that the U.S. Government work

with other major oil-consuming nations to increase their public reserves and participate in the global network of strategic reserves.

In particular, membership in the International Energy Agency (IEA) could provide major emerging oil-consuming nations like China and India with: (1) A greater feeling of ownership on their part in how the "global energy system" is run; (2) improved transparency in energy statistics and policymaking; and (3) an established forum to communicate concerns, success stories, and partnership ideas. IEA membership also brings with it a requirement that nations maintain strategic oil stocks sufficient to supply 90 days of demand and agree to manage them in coordination with IEA member countries (although this requirement is not legally binding). Because the IEA is a cooperative group of the Organization for Economic Cooperation and Development (OECD)—the IEA's 26 member nations include most OECD countries—a number of issues would have to be addressed with respect to the inclusion of currently non-OECD developing nations. In the past, initiation into the OECD has been a lengthy and sometimes controversial process in which standards of economic development, openness, and human rights are considered. Given the potential benefits noted above, however, possibilities for bringing countries like China or India into the IEA on an expedited or alternative basis—perhaps with special observer or some other unique status—should be explored.

OIL DEMAND MEASURES

While the Commission firmly believes that both supply and demand measures must be pursued as part of an effective strategy to enhance the Nation's energy security, it is important to emphasize that when it comes to protecting the economy from oil price shocks, a barrel produced and a barrel conserved are not the same thing. The benefits of every added barrel of supply—whether produced domestically or abroad—accrue to oil consumers the world over, in the form of a marginal reduction in the market price. By contrast, the benefits that can be achieved through demand side measures and alternative fuel production—besides being much larger in absolute magnitude—are largely captured by those who implement them. The Commission, therefore, devoted significant attention to the potential for reducing our Nation's oil demand, particularly in the transportation sector, which because it accounts for nearly 70 percent of current domestic consumption and is nearly solely dependent on petroleum fuels—is key to oil use in the broader U.S. economy.

Strengthening and Reforming CAFE While Promoting Advanced-Technology Vehicles and Addressing Jobs and Competitiveness Concerns: Improving passenger vehicle fuel economy is by far the most significant and reliable oil demand reduction measure available to U.S. policymakers. As noted previously, CAFE standards played an important role in substantially reducing the oil intensity of the U.S. economy between the late 1970s and early 1990s. However, a longstanding political stalemate has blocked significant progress in fuel economy for over two decades. (See Fig. 5) People often confuse our failure to increase domestic fuel economy with the view that technology options for improving vehicle efficiency have not advanced over the past two decades. Nothing could be farther from the truth. The efficiency of our automobiles increases annually. Estimates of this annual increase vary substantially from a low estimate of roughly 1.5 percent per year to a high estimate of over 5 percent per year. However, absent any requirement to direct these substantial efficiency gains toward achieving the public good of reduced oil dependence, vehicle manufacturers have instead devoted recent technological advancements to simply maintaining fuel economy while dramatically increasing vehicle size and power. While vehicle fuel economy is now no higher than it was in 1981, vehicle weight has increased by 24 percent and horsepower has increased by over 100 percent over this same time period. In fact, most of today's economy cars outperform the "muscle" cars of the 1970s. If we enhance the rate of efficiency advancement and channel the majority of this improvement into greater fuel economy, we can maintain the amenities of the current vehicle fleet while gradually increasing fuel economy every year.

In proposing to significantly strengthen and reform vehicle fuel economy requirements, the Commission sought to address the three issues we believe are most responsible for the last two decades of stagnation in this critical policy area: (1) Uncertainty over the cost of future fuel-saving technology; (2) concern that more stringent standards will compromise vehicle safety; and (3) fears that new standards will put the U.S. auto industry and U.S. autoworkers at further competitive risk relative to foreign automakers.

CAFE Reform: Pairing a significant increase in standards with reforms that would make the CAFE program more flexible and reduce the compliance burden for manufacturers would help to address cost concerns. The Commission commends recent ef-

forts by the National Highway Traffic Safety Administration (NHTSA) to introduce program reforms as part of its 2005 rulemaking to update CAFE standards for light trucks. Further reforms that should be considered include allowing manufacturers to trade fuel economy credits with each other and across the light truck and passenger vehicle fleets, as well as "safety valve" mechanisms that would set a defined upper limit on compliance costs in the event that fuel savings do not mature as expected or prove more expensive than anticipated.

The adequacy of NHTSA's authority to craft effective CAFE standards for passenger cars has recently been called into question. The Commission believes that NHTSA should be granted the requested authority and similarly that Congress should provide NHTSA with clear direction about how to apply it. When NHTSA sets new standards, the Agency seeks to fully offset the costs of new fuel-saving technology with the value of saved gasoline. This approach has obvious merit, but its application depends significantly upon NHTSA's ability to assess the full societal benefits of avoiding a gallon of gasoline consumption. At present, NHTSA lacks both the tools and authority to adequately factor in many of these broader externalities. This inability results in a systematic undervaluation of the benefits achievable through improved vehicle fuel economy and results in standards that are lower than would be justified by a more comprehensive assessment. It's not that NHTSA doesn't work hard to assess these externalities—in its recent light truck rulemaking, the Agency sought to include factors such as reduced vulnerability to oil price shocks, reduced air pollution, and even the value of spending less time at gas stations.

However, NHTSA has no ability to quantify the value of reduced future tensions with China over tight oil supplies or the constraints that oil dependence imposes on our foreign policy. After considering the costs of protecting our access to global oil resources, NHTSA, in its recent rulemaking, decided not to include any value in reduced military costs as a result of increased fuel economy. The Regulatory Impacts Assessment reads: "The U.S. military presence in world regions that represent vital sources of oil imports also serves a range of security and foreign policy objectives that is considerably broader than simply protecting oil supplies. As a consequence, no savings in government outlays for maintaining the Strategic Petroleum Reserve or a U.S. military presence are included among the benefits of the light truck CAFE standard adopted for MY 2008–2011."

All told, NHTSA's recent rulemaking assesses total petroleum market externalities to be slightly less than 6 cents per gallon. When added to projected gasoline costs of $1.60 per gallon over the next decade ($2 pump price minus roughly $.40 in taxes), NHTSA arrives at a total societal value of a gallon of gasoline saved at just under $1.70 gallon. This number clearly helps explain why the increase in truck standards that emerged from the rulemaking process was so modest.

When considering the administration's recent request that Congress grant NHTSA broad authority to reform passenger car standards along the same lines as the recent light truck rulemaking, Congress must also consider giving the Agency specific, updated guidance about the factors to be considered in establishing standards and about how these factors should be weighted and analyzed. Moreover, given the apparent political difficulty of revisiting fuel economy regulations, Congress should also consider establishing—or directing NHTSA to establish—a dynamic fuel economy target that becomes gradually, but steadily, more aggressive over time, rather than picking a single number. A defined percent-per-year improvement goal, coupled with an effective cost-capping mechanism or well-defined "off ramps" in the event that later requirements begin to impose unacceptable trade-offs in terms of cost or other vehicle attributes, may prove more effective over time and more palatable in the short run, than choosing a particular mpg requirement that remains fixed for years or even decades.

Vehicle Safety: Safety concerns have long contributed to the prevailing CAFE stalemate, but there is reason for optimism that the terms of this debate, too, have begun to shift in important ways. First, the rapid emergence of hybrid-electric-vehicle technology clearly demonstrates that substantial fuel economy improvements can be achieved while maintaining, or even increasing, horsepower and without reductions in vehicle weight or size. Second, a more sophisticated approach to the issue of safety—one that accounts for the impact of heavier vehicles on other vehicles in the event of a collision and their effects on overall fleet safety as well as on the safety of their individual occupants—has served to illuminate the fact that while the relationship between vehicle weight and safety is clearly important, it is far from straightforward. Finally, some argue that advances in light but very strong composite materials that allow for significant weight reductions to be achieved in concert with ongoing safety improvements—together with other advances in vehicle de-

sign and safety features—will prove fundamentally game-changing, although for now cost issues remain.

Domestic Industry Competitiveness: Given the recent, well-publicized troubles of U.S. automakers, concerns about jobs and competitiveness will continue to figure prominently in any debate over vehicle fuel economy. The Commission worked with the United Auto Workers and experts at the University of Michigan to assess the competitive impacts of a significant increase in fuel economy requirements on the domestic automobile industry. Our analysis suggests that the domestic automakers currently are at a disadvantage, relative to their foreign competitors, in terms of the expertise and manufacturing capacity needed to design, produce, and incorporate the most advanced hybrid electric and diesel technologies. Therefore, the Commission urges policymakers to consider mechanisms for addressing jobs and competitiveness concerns that would strengthen the domestic industry and better position it to meet future global demand for advanced technology vehicles. Specifically, the Commission recommended in its 2004 report that consumer tax incentives to stimulate consumer demand for highly efficient, advanced-technology vehicles be extended and coupled with business tax incentives aimed at helping parts suppliers and manufacturers with U.S. facilities retool their plants to produce these vehicles. Importantly, the Commission's analysis showed that such incentives could be designed to ensure that their cost to the U.S. Treasury would be more than covered by the additional tax revenues associated with increased domestic production. In light of the fact that domestic manufacturers are presently losing money and, hence, not paying much in the way of taxes, additional work is underway to design alternative mechanisms to provide the suggested incentives.

Oil Savings Through Increased Fuel Economy: The oil savings achievable through improved new vehicle fuel economy depend, of course, on specific assumptions about how quickly and aggressively new standards would be introduced and on whether other aspects of the current CAFE program are reformed at the same time. Appendix A summarizes the results of a bounding exercise intended to portray the savings that could be achieved if new vehicles technologies were employed to increase fuel economy over the next 20 years. The results are cumulative (that is, each row includes the demand reductions associated with all of the rows above it) and reflect oil savings in 2025 from a baseline business-as-usual demand forecast of 26 million barrels per day. The table suggests that the United States could reduce oil consumption in 2025 by 2.2 million barrels per day by implementing a 40-percent improvement in gasoline vehicle efficiency. If a significant fraction of fuel-efficient hybrid vehicles were added to the mix, the savings would rise to roughly 3.5 million barrels per day. Under the most aggressive scenario considered, U.S. oil consumption could be reduced by nearly 5 million barrels per day if the new-vehicle fleet in 2025 were comprised of a combination of efficient gasoline, gasoline hybrid, and plug-in hybrid vehicles.

Fuel Economy Improvements in the Heavy Duty Truck Fleet and Existing Light-Vehicle Fleet: Smaller, but nonetheless important, opportunities exist to reduce U.S. oil consumption by improving the fuel economy of the heavy duty truck fleet and of the existing light-car fleet. The Department of Energy's 21st Century Truck Program, for example, is being undertaken with the cooperation of major heavy-truck engine manufactures; it estimates that the fuel economy performance of so-called "Class 8" long-haul trucks, which are the largest fuel consumers of all heavy trucks, could be improved as much as 60 percent. Enhanced diesel technology and improved aerodynamics in the heavy duty truck fleet could produce oil savings of as much as 1 million barrels per day in 2025. As an initial step, the Commission recommends that EPA be instructed to develop a test procedure to assess heavy duty vehicle fuel economy so that we have an opportunity to seek reductions from this sector should the will to do so emerge in the future. For the existing light duty vehicle fleet, simply ensuring that replacement tires have the same low-rolling resistance as original-equipment tires can improve vehicle fuel economy by as much as 4.5 percent at very low cost to the vehicle owner.

Efficiency improvements are important not only because they produce demand reductions that will allow us to "buy time" to develop new alternatives to oil (a serious effort to diversify our fuel supply will likely take decades), but because they are essential to making many of those alternatives technologically and economically viable on a commercial scale. Biofuels and most other alternative fuels suffer from feedstock constraints, a lower energy density than gasoline, or both. Unless the vehicle fleet becomes more fuel efficient, efforts to promote a greater reliance on alternative fuels will likely falter due to inadequate supply or inadequate driving range. Conversely, the land requirements for cellulosic ethanol production or the battery requirements for a plug-in hybrid electric vehicle become much more manageable if the vehicles that employ these fuels or technologies are also highly efficient to begin

with. Once one recognizes that the successful development of petroleum alternatives depends on highly efficient vehicle technologies, it becomes apparent that current provisions intended to promote the production of flexible fueled vehicles by providing credits that weaken overall fleet fuel economy are shortsighted and ultimately counterproductive.

DEVELOPING ALTERNATIVES TO OIL

The United States burns nearly 140 billion gallons of gasoline each year and relies on petroleum-based fuels to supply nearly all of its transportation energy needs. To meaningfully improve our Nation's energy security, alternative transportation fuels must be capable of being economically and reliably produced on a truly massive scale. The Commission identified four criteria that characterize a promising alternative fuel: (1) It can be produced from ample domestic feedstocks; (2) it has low net, full fuel-cycle carbon emissions; (3) it can work in existing vehicles and with existing infrastructure; and (4) it has the potential to become cost-competitive with petroleum fuels given sufficient time and resources dedicated to technology development. Among the variety of alternative fuel options potentially available for the light duty vehicle fleet, the Commission believes that ethanol produced from cellulosic biomass (i.e. fibrous or woody plant materials) should be the focus of near term federal research, development, and commercial deployment efforts. Let me briefly discuss the attributes of traditional corn-based ethanol and then turn to cellulosic ethanol.

Corn-based ethanol is far and away our most successful nonpetroleum transportation fuel. The Renewable Fuels Standard adopted in the 2005 Energy Policy Act imposes an annual ethanol sales requirement that grows to 7.5 billion gallons in 2012. Ethanol sales were roughly 4 billion gallons last year. Despite the beneficial sales-volume credits given to producers of cellulosic ethanol, virtually all of this mandate will be met with traditional corn ethanol. A requirement to sell 250 million gallons of cellulosic ethanol takes effect in 2013. To an extent, Congress's effort to stimulate demand for cellulosic ethanol may be undermined by the unexpected demand for ethanol of any kind. Present expectations are that demand for ethanol will exceed the requirements of the RFS for most, if not all, of the program. In this context, credits may have little or no value and the 2.5:1 cellulosic credit advantage may provide no meaningful benefit. Congress may want to investigate other policy approaches to achieve the intended aims of these credit provisions.

For years, detractors of corn-based ethanol have asserted that the energy content of a gallon of ethanol is matched or even exceeded by the energy required to produce it. The Commission's analysis disputes this conclusion, finding that corn-based ethanol provides nearly 20 percent more energy than it takes to produce. A more recent study by Argonne National Laboratory finds nearly a 35-percent benefit. Nevertheless, the fundamental liability of corn-based ethanol is that there is simply not enough corn to begin to keep pace with expected growth in transportation energy demand, let alone to reduce current U.S. gasoline consumption in absolute terms. Put simply, it takes roughly 4 percent of our Nation's corn supply to displace 1 percent of our gasoline supply. Even organizations devoted to ethanol advocacy agree that it will be difficult to produce more than 10–12 billion gallons of ethanol a year without imposing unacceptable demands on corn supply and significant upward pressure on livestock feed prices.

Cellulosic ethanol is chemically identical to corn-based ethanol and is equally compatible with existing vehicle technology and fueling infrastructure. The added advantages of cellulosic ethanol lie in its significantly lower energy inputs and greenhouse gas emissions, its much larger base of potential feedstocks, and its greater potential to become cost-competitive with gasoline at very large production volumes. For cellulosic ethanol to succeed on a commercial scale, however, important concerns about land requirements must be overcome and production costs must be reduced. The central challenge is producing enough feedstocks without disrupting current production of food and forest products. Some cellulosic ethanol can be produced from currently available waste products such as corn stalks, sugarcane bagasse, and wheat straw. Production volumes on the order of 50 billion gallons per year, however, will require improved high-yield energy crops like switchgrass, the integration of cellulosic ethanol production into existing farming activities, and efficiency improvements in the processes used to convert cellulosic materials into ethanol.

A Commission-sponsored analysis of the land required to produce enough cellulosic ethanol to fuel half of the current U.S. passenger vehicle fleet reveals the importance of the advancements noted above. Using status quo assumptions for crop yields, conversion efficiency, and vehicle fuel economy, Oak Ridge National Laboratory has estimated that it would take 180 million acres or roughly 40 percent of the

land already in cultivation in the United States to fuel half the current vehicle fleet with cellulosic ethanol. Estimated land requirements can be reduced dramatically—to approximately 30 million acres—if one assumes steady but unremarkable progress over the next two to three decades to (1) double per-acre yields of switchgrass, (2) increase the conversion efficiency of ethanol production by one-third, and (3) double the fuel economy of our vehicle fleet. As a point of reference, there are roughly 30 million acres in the Conservation Reserve Program (CRP).

Another central challenge is reducing production costs for cellulosic ethanol. Because energy crops like switchgrass can be grown with minimal inputs of energy, fertilizer, and pesticides, the use of such feedstocks offers obvious economic benefits, as does producing ethanol from materials that would otherwise be treated as waste. The National Renewable Energy Laboratory and a separate analysis sponsored by the Commission both suggest that mature cellulosic ethanol production could compete economically with gasoline. However, these studies are projections. At this time, no full-scale production of cellulosic ethanol exists anywhere in the world. Until cellulosic ethanol is produced in a variety of commercial facilities, it will not be possible to prove, or disprove, current cost estimates. These are serious challenges, but they are achievable if we dedicate ourselves to a serious, coordinated, and sustained research, development, and commercialization effort.

As a critical first step in this direction, the Energy Policy Act of 2005 contains at least 10 major programs to promote ethanol derived from cellulosic feedstocks. These programs include explicit authorizations for more than $4.2 billion over the next decade to support critical R&D as well as "first mover" commercial facilities through a combination of grants, loan guarantees, and production incentives. While these programs demonstrate Congress's clear intention to promote biofuels, continued vigilance will be required to ensure that this vision is achieved. Historically, efforts to promote biofuels have been undermined by a lack of appropriations, inconsistent funding year to year, and an unusual degree of congressional earmarks. These factors, if continued, will make it difficult to achieve the critical objective of diversifying our Nation's fuel supply.

The 2005 Energy Policy Act also took steps to ensure that increased use of ethanol will not undermine air quality and public health standards. Eliminating the opportunity for ethanol-blended gasoline to meet less protective evaporative emission standards remains necessary to ensure that our efforts to increase energy security do not undermine our clean air goals. Finally, carmakers will need to take some steps to better accommodate ethanol-blended gasoline. The Coordinated Research Council, which is supported by the automotive and petroleum industries and the State of California, has been conducting research to examine the extent to which automobile evaporative emissions increase in cars using ethanol-blended fuels. The research appears to indicate that when a small quantity of ethanol is blended into gasoline, the resulting mixture escapes more readily through the hoses and seals in the vehicle's fuel system leading to more smog-forming emissions. The problem appears less prevalent in newer vehicles but demonstrates the type of challenges that will arise as we begin to transition toward a more diverse suite of transportation fuels. One of the many reasons for interest in promoting flexible fueled vehicles capable of running on up to 85 percent ethanol blends is that when ethanol is the dominant constituent, the overall volatility of the fuel is reduced and evaporative problems go away. Efforts by Chairman Lugar, Senator Obama, and others to increase the number of flexible fueled vehicles sold over the next decade and significantly increase ethanol refueling infrastructure deserve serious consideration.

In sum, the Commission urges Congress to make every effort to fund the research and demonstration projects authorized in the Energy Policy Act of 2005. While it is clear that all discretionary programs must come under continual budget scrutiny, inconsistent funding from year to year can be devastating to long-term research efforts by making it impossible to hire and train experts, build infrastructure, and amass knowledge based on iterative experimentation. The Commission recognizes that Congress alone is responsible for appropriations, but can't help but note that the high level of noncompetitive earmarks is undermining the strategic goals of our Nation's bioenergy programs. For example, in 2004, of the $94 million in appropriations for DOE's bioenergy programs, nearly $41 million was directed to earmarked projects. In 2005, earmarks accounted for nearly 50 percent of the program's budget. Paradoxically, this high level of earmarks reflects the enthusiasm of many Members of Congress for promoting domestic alternatives to petroleum. However, an effective national effort that coordinates the efforts of Federal, State, and private institutions cannot be mounted under these circumstances.

CONCLUSION

Sadly, there are no good options for delivering immediate relief from high prices at the gas pump. And while it's understandable at times like this that people want to focus on price gouging, windfall profits, or restrictive environmental laws—as if our plight was somehow the result of a few greedy people or poorly written statutes—we must direct the vast majority of our attention to confronting the fundamental roots of our oil security predicament. To make real progress, we must substitute thoughtful analysis for rhetoric and rise above the temptation to take political advantage of the current crisis by crafting a truly bipartisan response.

Prices may, of course, fall again in the months ahead. But there is almost no scenario in which the underlying causes of the current crisis simply resolve themselves without a concerted effort by the United States and other major oil-consuming nations to change course. The real tragedy would be if this "moment" simply passes as others have with no real progress toward a lasting solution. In short, there is no question that we will someday use less oil than we do now. The question is, rather, whether we arrive at that point on our own terms or on someone else's. The Commission believes that the sacrifices we choose are infinitely preferable to those imposed on us by forces we cannot control. The National Commission on Energy Policy looks forward to working with this committee in its ongoing effort to chart a more secure energy future for our Nation.

APPENDIX A

SUMMARY OF MEASURES FOR IMPROVING U.S. OIL SUPPLY

INCREASING SUPPLY	
Measure	Projected impact
Exploit all domestic conventional reserves	Increase U.S. output by 2.0 MBD.
Exploit global reserves of unconventional oil	Increase global supply by 4.0+ MBD.
REDUCING DEMAND	
Measure	Projected oil savings
Heavy Duty Trucks:	
Enhanced diesel technology and aerodynamics	1.0 MBD.
Reduce average highway speed by 10 mph	0.3 MBD.
Passenger Vehicles and Delivery Trucks:	
Advanced gasoline engine technology (32 mpg)	2.2 MBD.
Advanced gasoline engine technology + 50% advanced hybrid/diesel sales (40 mpg).	3.5 MBD.
Advanced gasoline engine technology + advanced hybrid/diesel + 25% plug-in hybrids (50 mpg).	4.6 MBD.
DEVELOPING ALTERNATIVE FUELS	
Measure	Projected oil savings
Quadruple ethanol production post-2012	2.0 MBD (30 billion gallons).
Dramatically increase biodiesel production	0.5–1.0 MBD (7.5–15 billion gallons).
Create Domestic Fischer-Tropsch Industry (Coal to Diesel)	0.5–3.0+ MBD (7.5–45+ billion gallons).

Figure 1

World Oil Demand Forecast

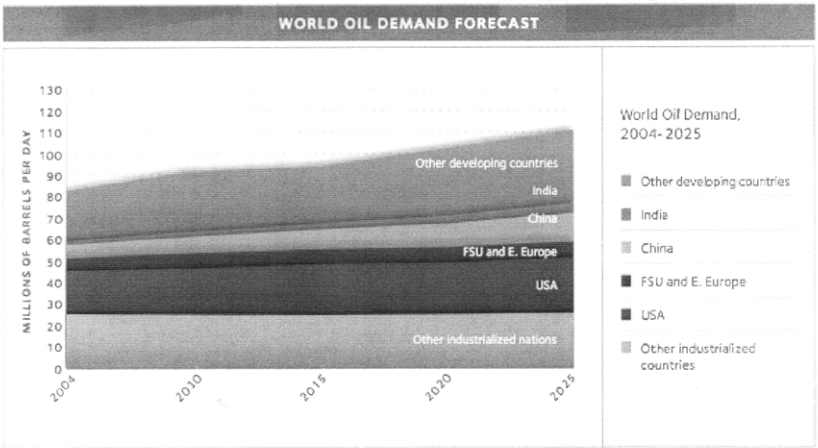


Figure 2

Oil Intensity 1970 -2000

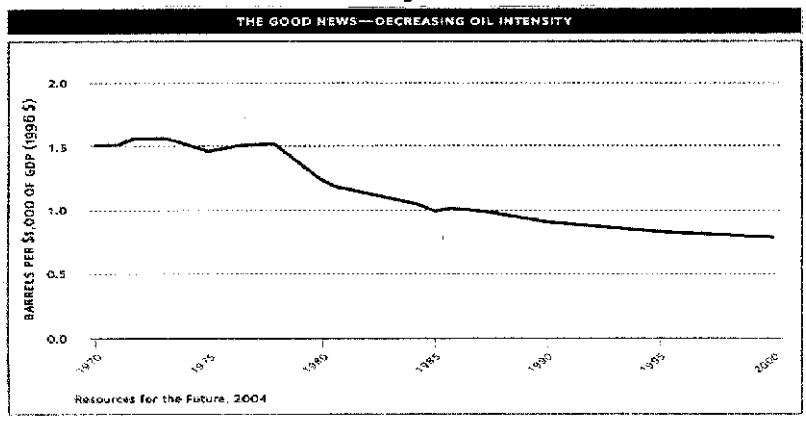
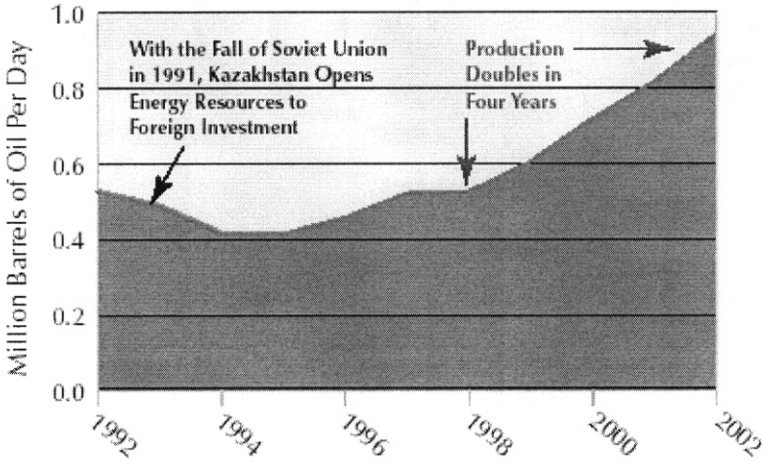


Figure 3

Impact of Foreign Investment on Oil Production

Kazakhstan opened its energy resources to foreign investment in the early 1990s and witnessed a rapid increase in oil production over the next decade.



Data Source: Energy Information Administration, 2004

Figure 4

Unconventional Oil

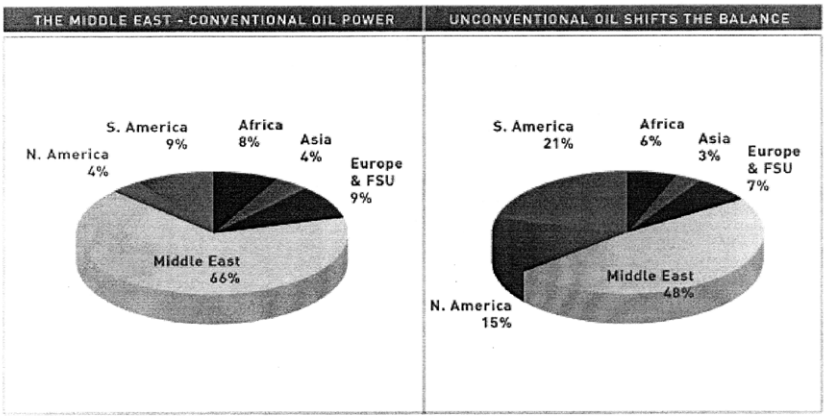
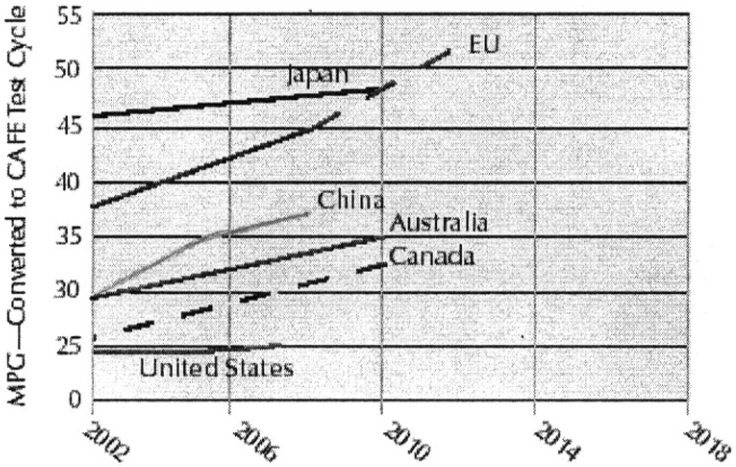


Figure 5

Comparison of Projected Fuel Economy Levels

The fuel economy of the U.S. automobile fleet—both historically and projected based on current policies—lags behind most other nations.[29]



* Dashed lines represent proposed standards

Adapted by permission from An and Sauer, Pew Center on Global Climate Change, forthcoming

The CHAIRMAN. Well, thank you very much, Mr. Grumet. We really appreciate the extraordinary testimony of both of our witnesses.

I want to recognize now the distinguished ranking member of our committee, Senator Biden, for his opening statement or comments.

OPENING STATEMENT OF HON. JOSEPH R. BIDEN, JR., U.S. SENATOR FROM DELAWARE

Senator BIDEN. Mr. Chairman, I would ask unanimous consent that my opening statement be placed in the record.

The CHAIRMAN. It will be placed in the record in full.

Senator BIDEN. By way of brief explanation, I had 170 Delawareans that I had agreed to meet with prior to this hearing being set.

But I just want to reference your leadership again here. There is not a single more significant thing we could be doing than what we are doing right now.

My dear old mother has an expression. Out of everything bad, something good will come if you look hard enough for it. I think this has presented us with an overwhelming opportunity, if we seize it, to be able to regain control of our national security and our destiny here. It would not have happened had we not reached this crisis state and the cost of oil skyrocketing. I hope we do not shrink from this as we did 25 years ago.

So I want to thank you, Mr. Chairman. I will read the witnesses' statements with great interest. I thank you again for your leadership in this area.

[The prepared statement of Senator Biden follows:]

PREPARED STATEMENT OF HON. JOSEPH R. BIDEN, JR., U.S. SENATOR FROM DELAWARE

With gasoline at $3 a gallon, and with our most pressing foreign policy challenges centered in the oil-producing countries of the world, today's hearing before the Foreign Relations Committee could not be more timely or more important.

We heard a few weeks ago in this committee about the hidden costs of our dependence on foreign oil. The United States has just one third of the world's oil reserves, and less than 5 percent of its population, but we consume fully one-third of the global oil output.

Over 60 percent of the world's oil reserves are held in the Middle East, and as one of our witnesses points out today, only 9 percent of world reserves are held in countries we would call "free."

We are dependent on oil, and that makes us dependent on countries with whom we will continue to have, at best, many differences and, at worst, open hostility. What Michael Mandelbaum has called "the axis of oil"—an axis that stretches from Russia to Iran to Venezuela to Saudi Arabia—will have as great an impact on our national security as the so-called "axis of evil."

That dependence means we pay a huge price militarily for access to a resource that we cannot do without. One estimate suggests we pay as much as $825 billion a year in security expenditures to project our influence and secure access to oil.

Some part of every dollar we pay for imported oil finds its way into the hands of our sworn enemies. As some observers have put it, the war on terror is the first war in which we are paying for both sides in the conflict.

Disruption to our economy from interruptions in supply can be huge, and will grow as our dependence grows. As Alan Greenspan has warned us, all economic downturns since the 1970s have been preceded by spikes in the price of oil.

We pay a price environmentally for our dependence on oil, most profoundly in dealing with the repercussions of climate change, driven by our use of fossil fuels.

There can no longer be any doubt that our dependence on oil is a critical problem, one that must be addressed.

The sheer size of this problem is such that there will be no quick fix. Oil represents about 40 percent of our energy consumption and we import about 60 percent of the oil we use. Fully 70 percent of our transportation is dependent on oil. That statistic will not be transformed overnight.

But there are other statistics that will not change, as well. China has accounted for fully 40 percent of the recent increase in global oil demand. It will put another 120 million vehicles on the road over the next 5 years. Along with India, and a reindustrializing Eastern Europe, that growth in global demand is not going to be reversed.

The fit between global supply and demand today is extremely tight. Billions of dollars of new investment may keep pace with demand, but will do little to ease the price at the pump. And new supply, from conventional or unconventional sources of oil, will only hasten the process of climate change, and will simply delay our transition to the alternatives than can address our addiction to oil.

What are our alternatives to oil? In the short term, ethanol from corn could be a first step away from our oil addiction, by providing a liquid fuel that is compatible with existing internal combustion engines that power our cars, trucks, and buses. We will hear today about the costs and benefits of taking such a step, and the steps that must follow toward sugar or cellulosic ethanol.

Ethanol will be just part of a broader energy policy that will reduce our dependence on oil, and will reduce the leverage that the oil-producing nations have over our foreign policy and our national security.

If it was not clear before, it is now. Domestic energy policy is at the center of our foreign policy.

The CHAIRMAN. Well, thank you very much, Senator Biden.

Let me just indicate, as the witnesses have, that in this area there has been strong bipartisan cooperation on this committee and with members of other committees, for that matter. But almost all of the significant legislation has bipartisan cosponsorship and many cosponsors, 24, 25, maybe upward, which is important because sometimes it is difficult for the Congress to move, even for this body to move. But I think there is an impelling need that you have illustrated.

Now, at this point, at the risk of losing the entirety of the committee, the vote has commenced, and as I indicated, we will have a recess, we will vote, and hopefully then we will have time to ask our questions without interruption. But I wanted both of you to give your testimony and for all of us to get set and then we will come back and commence our questioning.

For the moment, the committee is recessed for the vote.

[Recess.]

The CHAIRMAN. The committee is called to order again.

We will have a 10-minute round of questioning by members of the committee, and I will commence with my questions.

Mr. Khosla, you mentioned some intriguing possibilities with regard to the acreage issue. As you pointed out, sometimes critics of alternative plans point out that we are limited in this country by the number of acres we could devote. Usually the argument is made, first of all, with regard to corn ethanol, but then as you observe, maybe more generally with regard to switchgrass or biofuels materials that might come in the cellulosic ethanol in addition.

In the figures that you gave—and sort of retrace this for us, if you will—you talked about 400 to 500 gallons of ethanol per acre coming from, as I understand, current practices. Is that in the corn field or the cellulosic field? What are the 400 or 500 gallons at this point?

Mr. KHOSLA. Sir, roughly 140-some bushels per acre times 2.7 or 2.8 gallons of ethanol per bushel would result in about 400 gallons per acre, roughly.

The CHAIRMAN. So that is the corn yield, the 140 bushels.

Mr. KHOSLA. Yes.

The CHAIRMAN. Now, how do we get from there to some multiple? And, ultimately, in the years beyond, you were even talking about 3,000 to 5,000, which is quite a jump.

Mr. KHOSLA. I expect that we can get to yields of corn, according to the National Corn Growers Association, approaching 2,000 bushels per acre.

The CHAIRMAN. 2,000 bushels per acre.

Mr. KHOSLA. By 2015. And we might improve some yields. But corn is fundamentally limited.

Sir, my presentation has a slide on the various technologies, but I believe cellulosic technologies have the most impact when it comes to achieving yields of 3,000 gallons per acre.

[EDITOR'S NOTE.—The slides and graphs contained in "Biofuels: Think Outside the Barrel" and shown by Mr. Khosla during his presentation at this hearing, were not reproducible but will be maintained in the permanent record of the committee.]

The CHAIRMAN. Now, let me just run back through this because 2,000 bushels per acre in a timeframe of 2015——

Mr. KHOSLA. I'm sorry; 200 bushels per acre.

The CHAIRMAN. OK; 200. I have sort of a parochial view as a corn farmer.

Mr. KHOSLA. I apologize.

The CHAIRMAN. For a moment, I was beginning to do the math here and thinking I really have something going out there at the farm. [Laughter.]

However, 200. And that seems within the ballpark of what I understand. From my father's experience on the same farm, 60 years ago, we were getting 40 or 50 and we are now getting 140 or 150 in our generation. There really has not been a great deal of impetus to improve the yield of corn.

As one of you pointed out just obliquely, you suggested that if we have another agriculture program, the subsidies or whatever payments that are made to farmers ought to come this time for energy. That will be a big sell, putting on capital over in the Agriculture Committee, because I would just have to advise you we have had a hearing, and a very good one, on sugar, recently, and on one other southern crop that is heavily subsidized, currently, with all sorts of intricate payment systems.

Now, into the hearing on sugar—and this is why this is on my mind—Saxby Chambliss, our chairman, had to go off to another meeting and left me in charge of the hearing, which is a dangerous situation because we engaged the sugar people, the users, the growers, the whole lot in a very good conversation. Their future lies in producing ethanol from sugar, not really from doubling the price to American consumers and trying to extract their due. And that will be a tough sell but not impossible. I notice papers throughout sugar land, whether it was the sugar beet people up north or the ones down south, picked this up in the same spirit in which you are talking about it this morning. Not only Brazilian sugar might be available, but, in fact, American sugar, which is in abundance and which now keeps out other people and ruins our CAFTA agreement with Central America and CARVAS with South America, and creates all sorts of diplomatic problems.

But, nevertheless, as you point out, even if we get to 200 bushels to the acre times 2.7, that gets you to 540 or so, which is not 3,000. So when you get to the 3,000 mark, there has got to be something else, and this is more in the cellulosic variety, I gather.

Mr. KHOSLA. Yes, sir. If you might refer to the presentation that you have, slide 58 speaks to the yield for various technologies.

The CHAIRMAN. All right.

Mr. KHOSLA. A basic assumption I make is we can now get about 6 tons per acre of biomass yields. The best plant biologists in the country I have talked to completely support the notion that in 25 years, that yield can go up to 27.5 tons per acre. If we can do 27.5 tons per acre and 118 gallons per ton of biomass, then the numbers

are what we get in this chart on page 58, roughly about 3,000 gallons per acre.

The CHAIRMAN. Yes, and that chart is very instrumental in our understanding and as a part of your presentation.

I want to just develop the point from the standpoint that this often is a criticism of all we are talking about today. The skeptics would say, after all, there is not enough land left in America to do all these sorts of things. At best, this is still a niche idea in which you do a little bit of it, get maybe, single digits or 20 percent of our needs, but that is about where it ends. So, therefore, all this talk about independence—you are not claiming independence today. We still have a foreign policy going in both of your testimonies.

But in my opening statement, I am talking about some grim facts, and that is, even if there is a lot of oil left on earth and if, in fact, there are a lot of reserves that are still not exploited, 77 percent plus are held by other governments. And these are not benign people. Somebody that shuts off the tap to Ukraine, for example, accomplishes something that you do not have to send aircraft over or tanks or what have you to do. You can obliterate a country this way. It is not advisable people do this very often. And that is one reason that we are talking about this because we have said as these things begin to close in, the knives get sharper and the elbows, likewise. People in a strategic position decide to use this aggressively against others and maybe against us. People who do not understand the existential problem here, not just for Ukraine, but, ultimately, for the United States, really need to wise up.

You have pointed this out in different ways. Let me just touch on some.

Both of you have mentioned, in one form or another, oil sands, Canada, Alberta. Now, the Energy Minister was in last week, and he said the problem there is that we cannot get people to do the work. Literally this is very tough work. It is very cold. It is very messy. It is very dirty. They cannot get enough Canadians, Americans, Mexicans, anybody in the hemisphere. The Mexican Energy Minister was there. They cannot furnish enough people from Mexico to make that work. So, theoretically, you have oil sands up there. We have, unfortunately, some human problems. How do you get people to work the oil sands? Now, eventually, we may get through that.

You have touched on the coal business. There is a lot of coal underneath this country, all of it dirty from an environmental standpoint. The whole clean coal technology business, whether you finally get it into transportation fuel or the more conventional power, really requires a sequestering process. How do you do this? Where do you put the carbon? These are critical measures. We talk today about the transportation side principally, but the other side of heating, power, and so forth is, obviously, equally important. And with great resources here, there was no need really to think about it.

First of all, we still have people in denial that climate change or global warming is a real problem. This is almost a theological debate even with major newspapers and publications in this country. So although you are in a group of people that believe this is for real

and we have to deal with it, as politicians we find a lot of people who do not believe in this, who think essentially it is sort of an elite group of people who meet with the Foreign Relations Committee from time to time and talk about things that are vaguely subversive to normal American practice.

Senator BIDEN. To the oil industry. They think it is subversive.

The CHAIRMAN. Now, finally, while I am spouting off about all of my prejudices, which you have listened to, on the CAFE standards, we have got a situation here. We debate this issue all the time. In the House committee last week, by a vote of 28 to 26, they, at least, had a nominal CAFE standard. Democrats on the committee, who voted en bloc against that—and they were the 26—said, well, this does not amount to anything. What you really need is a 33-miles-per-gallon standard. That was offered by one gentleman and that lost 37 to 16, as I recall. I do not know where they all stand now, but we go around and around with this.

I am curious as to whether your view is that this is an essential aspect almost in the way of pegging the price of oil. You have suggested another way of getting at this, these flexible credits, 20 to 80 cents and so forth. In other words, you have to offer some certainty to the public. First of all, the problem is not going to go away, and second, the oil companies cannot subvert it, so it will not go away that way. In essence, we are confronted with it. Is that basically the strategy you have in mind in offering these pegs?

Mr. GRUMET. I think you wrapped your arms around it very aptly, Senator. I guess I would say that I do believe that efficiency, whether you call it CAFE or by any other name, is an instrumental component of the solution not only because of the land issues and the need to actually reduce the amount of biomass we need, but also because we have a global challenge here. Not every country in the world is going to have the same kinds of biomass attributes that we have, and so we have an obligation for our own benefits, as well as to protect ourselves from the kind of economic shocks as we transition toward biofuels also to export these technologies to make our fleet more efficient.

I guess I just point out again and again that this is not about putting us all into little VW bugs from the 1970s. If we simply capture the increases in vehicle technology that are happening each and every year and are really now on a very strong up-slope because of hybrids and were to direct those increases toward fuel economy, that in and of itself would put us on a 2- to 3-percent upward trajectory each year.

So I think the CAFE debate, like so many of these debates, are stuck in these old, well-worn grooves. They are stuck in a technology posture of the 1970s. They are stuck with an economic policy of the 1970s. And if we think a little bit creatively, I think the safety issue can be taken off the table with intelligent reform. I think the jobs issues is something that we have to grapple with as a nation, whether we are increasing CAFE or not, and that there is a tough love metaphor that both gets us better cars and better jobs. So we need to bring these two ideas together. But absent strengthening fuel economy standards, I do not think we can get the job done.

I would just note that it was bewildering to me that we spent a lot of time debating whether the President and NHTSA really needed the authority or not. Who cares? Give it to them three times if, in fact, that is what they think they need, but let us give them some direction as to how to apply it because I think the reason why there was resistance in the House was that the President was asking for the same authority they just applied when regulating light duty trucks and they used that authority with the assumption that a gallon of oil saved was worth $1.70 and they raised the light duty truck standards by a couple of miles per gallon.

So there is a sense that giving the administration the authority without then giving them better tools and better direction as to how to apply that authority is just kicking the can down the road for 18 months. So I think that is where this debate now needs to be put back together.

The CHAIRMAN. Now, as I yield to Senator Biden, I would say to my colleague that earlier on, Mr. Grumet testified that his group has been visiting with the automobile companies and the UAW, both, because they take seriously the jobs issue, as both of us do. Now, in my State, there is an article in the Anderson, IN, paper today that states that the UAW is selling its headquarters. The number of members is down by 80 percent, and the jobs are gone. Ditto for the automobile industry, basically, in a place that was totally auto. That is not unique in our country.

So, as you are talking about tough love presently, we are almost back to the situation we were in with the Chrysler company in the 1970s and the question of how to save Chrysler. The legislation that the Senate and the House passed, then, was a tough love measure. President Carter had offered simply a loan guarantee without many strings attached. The Congress said you have got to do a lot of things. UAW's Woodcock came here and said we have never backed down on any of these things, period. Ditto for Lee Iacocca and those folks. But they made some changes. They made huge changes. They paid off the whole loan because Paul Volcker raised the interest rate and it was very uncomfortable, rapidly, and there was still a Chrysler until they merged.

So I mention that this is not hypothetical. We have been down that trail before, many of us around here, and that is why I was interested in your testimony.

Yes, sir.

Mr. KHOSLA. Senator, if I might comment on the question of oil shales and alternative technologies. Today I proposed a variable tax credit on ethanol. In fact, the superior way to do it would be to have a price floor on gasoline. If we had a $40 floor on oil and I suggested in the past that if we use any money anytime oil drops below $40 as a fee to be put into a price stabilization fund, which can be used to reduce the price of oil when the price goes high, it has multiple benefits. The variable credit for ethanol would help the ethanol business.

I prefer the mechanism of a price floor because it would encourage all alternative technologies, not just ethanol. It would encourage the development of oil shale, coal to liquids, and other opportu-

nities. So, in fact, theoretically and from an economic point of view, that is a superior option if we can enact it.

I might also add, specifically, to the issue of oil shales. Personally, I believe the biofuels approach, the ethanol approach, is so much easier to do and so much more cost effective and has so many side benefits. That arises from the fact that we have three major problems here. We have an energy problem. We have a climate crisis, and we have a terrorism crisis. All those are coupled and all of them are simultaneously addressed by the biofuels approach or any renewable fuels approach. Oil from shales and sands does not solve the climate issue.

I might also add on CAFE, as much as I completely agree with Jason on increasing and pushing hard to increase CAFE mileage, Senator Daschle and I coauthored an op-ed in the New York Times, a week ago Monday, that suggested that we can decouple the issue of how far we push CAFE up. And I am very much in favor of doing that, but we decouple it from the issue of measuring petroleum mileage, not mileage because that will incentivize the automakers to reduce petroleum use in this country.

So some people would suggest we couple reforming CAFE to increase petroleum mileage to the issue of efficiency. I very much favor pushing hard on both fronts, but I do favor decoupling the two issues and solving the efficiency problem separately from the issue of switching to petroleum mileage so almost immediately the auto companies are aligned with the environmentalists in reducing the use of petroleum.

The CHAIRMAN. Thank you.

Senator Biden.

Senator BIDEN. Thank you very much.

Let me ask you both, maybe you, Mr. Grumet, first. You indicated, I am told, that the National Highway Transportation Safety Administration, although it is well intended—the discussion of CAFE standards may not produce the effect we desire. What should we be doing here in Congress?

Mr. GRUMET. Thank you, Senator Biden.

I think this really does come down to a question of institutional capacity. The people at NHTSA are well-intended, hard-working people, and when they imagine how to make the optimum changes in CAFE, what they try to do is figure out what is the total social value of saving a gallon of gasoline and what is the cost of new technologies to achieve that, and they try like any good economists to make the lines cross.

So what NHTSA just did was they reformed the structure of CAFE in ways that I think bring greater economic efficiency to the program. It gets you out of the idea that all cars have to meet the same standards. So it is kind of a continuum of weight-based results. And all of that is perfectly fine and good.

But the key input was the number they put into the model to say what is the total social value of saving a gallon of gasoline over the next 10 years, and that was $1.70. They used, by law, the EIA projections of the cost of a gallon of gasoline, which are presumed to flatten out by around $2, and they take the taxes off that. So we get $1.60 of real value of a gallon of gasoline. And then when they looked through 50 different ways that gasoline and oil also affect

our economy, the sum total of the benefits of reducing a gallon, they come up with is about 6 cents.

And they looked hard within the abilities of a guy with green eyeshades and a computer. They looked actually at the value of spending less time standing at a gasoline station squeezing fuel into your tank. They looked at what they perceived to be the value of reducing air pollution. They looked at what they perceived to be the value of reducing the vulnerability to price shocks. They looked at the value of military, and I will read to you the quote from the regulatory impact statement. "The U.S. military presence in world regions that represent vital sources of oil imports also serves a range of security and foreign policy objectives that is considerably broader than simply protecting oil supplies. As a consequence, no savings in Government outlays for maintaining the Strategic Petroleum Reserve or a U.S. military presence are included among the benefits of the light duty truck CAFE standards."

Now, I do not think that it is fair to say to the people at NHTSA or Guy Caruso at EIA, "tell me how much it costs and put it in your model." I think it is fair to say to this committee, "you tell NHTSA how much it matters." One suggestion was that when they put the number in their model, at least they should look at the actual real cost of gasoline over the last 12 months, that the idea of the price going forward should be less than what people are actually paying might be one floor, and then have Congress tell them to double it, tell them to put 5 percent on it. But someone has to help NHTSA think about tensions with China, foreign policy prerogative, military costs, and things that are simply beyond their tools and competence.

Senator BIDEN. You indicated that the idea of moving to alternative fuels here, biomass fuels, biofuels, ethanol, cellulosics, depends upon dealing with efficiency in automobiles. What number do you have to get to in order to reach the efficiency under whatever you want to call them, CAFE standards or whatever the new standard may be? What do you have to get to? How much do you have to save in the models you have done to get you to the point where it intersects with the amount that we can produce to render the outcome we are looking for?

Mr. GRUMET. There are a number of different ways to look at that question. When we looked at the question of land mass, which I agree most people see as the dominant constraint—and we did similar analyses to Mr. Khosla—the conservative assertion is it would take 180 million acres—this is based on Carnegie Mellon analysis that has been around for 5 years—to displace half of the petroleum supply. We were somewhat more conservative in saying, well, let us say we just doubled the yield of an acre, much less than I think Mr. Khosla suggests is possible, that takes you down to 90 million acres. Let us say we increased the efficiency of converting that mass to fuel by 50 percent, also I think very realistic to conservative. That takes you down to 60 million acres. And then we said, well, let us double the fuel economy. That takes you down to 30 million acres.

Now, the reason that a doubling of fuel economy, I think is notionally the right way to think about the issue, goes back again to what we believe would be a useful goal, and that would be to,

again, halve the amount of oil we use per dollar GDP over the next 20 years. We did it from 1975 to 2000. If we did it again, we would make our economy twice as resilient to price shocks so that we could get to the future that I think we both want without suffering too much along the way.

To do that, would require about a 7.25 million barrel reduction of oil a day over 20 years. If you brought fuel economy of the country over that same timeframe up to about 45 miles per gallon, 50 miles per gallon, that would get you about 5 million barrels a day reduction.

One third way to think about it is if, in fact, you believe that we can achieve about a 3-percent increase in efficiency each year going forward and say, we are not going to tangle with the questions about safety and making cars smaller and lightweight materials, but we are just going to say put that 3 percent a year into efficiency, you compound 3 percent a year over about 20 years, and you are also getting to about a doubling. So there are a lot of different ways, both in terms of technology and cost and goal and aspiration of doubling fuel economy over 20 years, and is notionally, I think, the right model to work toward.

Senator BIDEN. What percentage of oil consumed in the country is transportation?

Mr. GRUMET. About 70 percent.

Senator BIDEN. And how much natural gas and coal do we consume in the nontransportation area?

Mr. GRUMET. I guess, coal into locomotive engines and very, very little amounts of natural gas; 97 percent of transportation is petroleum.

Senator BIDEN. Mr. Khosla, you spoke about moving past talking and moving toward making things happen. What needs to get done? What do we have to do to get more flex fuel vehicles on the road? Who do we talk to? Who do we call in to sit down in front of us? You indicated that there are between 5 million and 6 million flex fuel automobiles on the road right now. What do we do from a Government standpoint that encourages a significant change? What are the factors we have to——

Mr. KHOSLA. Sir, the most important role Government can do is send the right signal, and that signal to Wall Street will serve all our purposes. First, if you mandate 70 percent of new cars be flex fuel cars, that is a relatively low-cost option. I believe it costs an automaker about $35 to produce a flex fuel car over a gasoline car. They will quote a higher number of about $100 because they include a sensor that is also required to meet pollution requirements. They include it in the cost of conversion. So that is item number one.

Item number two is to mandate distribution of E85 stations. I have chosen to push the idea of 10 percent. Higher numbers would be better, but 10 percent could get us to the minimum critical mass we need to get it started. Obviously, the more we have, the faster——

Senator BIDEN. Excuse me. 10 percent?

Mr. KHOSLA. I'm sorry. Ten percent of all gas stations in this country offer one E85 pump. Specifically, I am suggesting that for any owner or brander of gas stations with more than 25 stations,

to not put an undue burden on the mom-and-pop stations, should be required to offer E85 at 10 percent of their stations, which means at least one E85 pump.

The last thing I am suggesting is this variable credit on ethanol, and what that does is protect ethanol producers and investors if the oil companies were to manipulate the price of oil down to, say, $30 a barrel. With this variable tax credit, the actual amount of credit given out will probably decline. The farmers will get no less, and they will have the benefit of essentially getting insurance against price manipulation.

Senator BIDEN. What would you estimate the cost of that to be?

Mr. KHOSLA. Today we have a 51-cent-a-gallon credit. I expect with oil prices where they are likely to be in the next 5 or 10 years, it will be a net savings because I am suggesting that that credit be dropped to 20 cents while oil prices are high. If we have an 80-cent tax if oil prices are low, I think it is highly unlikely the oil companies or the oil nations will try and manipulate the price of oil down because they will believe that ethanol will still be competitive. So just the fact of instituting a variable tax will eliminate or discourage the possibility of price manipulation down to low levels to drive ethanol producers out of business. So I actually believe it will be a net savings to Government.

None of the things I have recommended require Government money, either the mandates on flex fuel cars or the distribution or the variable tax credit. I think those three would get us 90 percent of the way there.

Senator BIDEN. My time is about up. What would the floor of $40 do? Would that be a fulsome way to deal with this?

Mr. KHOSLA. Absolutely. If we can enact that, that is not only the simplest, but economically most efficient way to do it. Once we have a floor—and frankly, I believe we will only need a floor for about 10 years at the most—we will have signaled to investors that they can invest in ethanol capacity in this country without being subject to the manipulation of oil prices.

Senator BIDEN. One of the things I have found in my experience here, when you try to affect the economic impact on average families out there, it is a lot easier to deal with something and pass something that in the future may have an impact than it is to deal with something that will have an immediate impact. So a $40 floor now, it seems to me, would be—not in terms of the politics down here, but the public at large—a fairly painless suggestion.

Mr. GRUMET. Many would welcome it as a problem they would like to have.

Senator BIDEN. Exactly right. Seriously.

If I can editorialize for a second here, Mr. Chairman. I think the American people are a lot smarter than we give them credit for. I found it astounding that when the chairman began to talk about—we had a discussion one day about 6–8 months ago about the need for this committee—it took no urging from me. I mean, it was just responding to the chairman's raising the question about us beginning to focus very heavily in this committee on energy. I saw a poll that absolutely reconfirmed my faith in the instincts of the American people. About a month ago, there was a poll—I think it was the New York Times and whoever they do it with—that showed

that slightly more people thought that our security and our foreign policy flexibility depended more upon energy and how we dealt with that issue than upon the war in Iraq, for example. They happened to be right, but it was really, I think, confirmation of the fact folks get it.

We are all just sort of grappling with this in a very fulsome way now. I think the American people are really ready to take on some genuine challenges and I think they are prepared to even make significant sacrifices long term. Imagine if after 9/11 the President said, by the way, I am going to go to the Congress in 2 weeks and introduce an energy bill to free us from the grip of the oil oligarchs and it is going to be painful and I expect your help. Who the heck would have said no?

Mr. KHOSLA. I would completely agree with you. In fact, Tom Friedman had an article in the latest issue of Foreign Policy magazine that says there is a strong inverse relationship between our energy dependence and human rights outside this country.

I would suggest further, to reinforce what you said, that we are very, very close to a tipping point of permanently getting away from petroleum. And where I would like to disagree with Jason is I believe we have the capacity in this country to meet all of our needs within a relatively short period of time. Bottoms-up forecast based on technologies I have seen in the labs today, not even unimagined technologies, say we can achieve our energy independence with less than 60 million acres even with modest assumptions about efficiency. With 1 percent a year demand-growth on oil, which would be modest energy efficiency improvements, compared to the 2 percent a year growth we are seeing today, we can get to energy independence on less than 60 million acres. That is less land than we use for export crops today by a lot; by half. It is almost equal to the 40 million acres of CRP land that we have today, and millions of acres would be returned to prairie grasses, which is a wonderful thing to do.

So I will just suggest that these simple measures need very little money but are focused, laser-like, and instead of having, if I might be bold enough to say, 15 different versions of bills, if we could have three or four simple things happen, we will put ourselves past the tipping point. And 7 years from now, we will be at a place where no oil company can decouple the two. That is what I mean by irreversibly down this path within 7 years.

Mr. GRUMET. Senator Biden, if I could just add, we are very, very good at framing a problem with great rhetorical flourish and we then go to the American people and say, by the way, here is a solution and it will not really cost anybody anything and no one is going to mind, I do not think it is credible. I think I agree with you that while we do not need to tell people that they need to go have cold showers and warm beer—this is not going back to the 16th century. What we need to say to people is you can have the amenities that you are used to, and you are going to have to pay a little bit of money in order for all of these other amenities that we also care about.

Senator BIDEN. Look, every single time in American history we have been faced with a genuine crisis and people believe it is genuine, that it is not manufactured, and that it is not something that

you are going to ask just one part of the community, one part of the population to bear the burden of, when have we ever not done it? We have never failed to do it. People rode on bald tires for a long time during the war. A safety hazard. But I do not get it. I do not get why we think the American people are not prepared.

By the way, I apologize for taking the time, Mr. Chairman, but I hope I have an opportunity to spend some time with each of you off this podium here. Jason, I come from an autoworker State. Ten years ago, we had the largest percentage of UAW members of any State in the Union outside of Michigan, and as a matter of fact, as a percent of population, probably higher. We had a workforce, when I began in the Senate back in 1973, of only 350,000 people; 31,000 were UAW members. That is a gigantic percent. We now have grown. We have almost doubled our population. We are close to 1 million now, and we were only 570,000 then, and our workforce is a lot larger and the autoworkers are fewer. But guess what. They figured it out. They get it.

I have the guys where we make the Durango. I have the guys where we make a number of General Motors systems installed in some other vehicles. Guess what. They are worried. They are the ones raising the questions about we are not going to be able to sell the vehicles we are making because of the fuel economy.

This is not a labor or management—I am not trying to have sort of a theological debate about labor and management. But the truth of the matter is labor does not get to make many of these decisions. They do not get to vote on what product is made. I am not suggesting they should. So the idea that there is this resistance among autoworkers to moving in the direction where 70 percent of the automobiles are flex fuel automobiles, I think they see that as a way in which maybe they will preserve more of their jobs instead of costing them their jobs.

I was here at the same time when we had the first Clean Air Act. I will never forget a guy named Ricardo, who was chairman of the board of Chrysler at the time—not Iacocca, Ricardo—and a guy named Leonard Woodcock. I was a young Senator in this building in a garret on the sixth floor. I remember them both coming to see me, and I remember thinking is my office set up nicely enough. I had been there several months. They both came in to tell me how I could not possibly vote for the Clean Air Act. And I ran on that issue. I said, no, no, no.

I remember Leonard Woodcock, who was a revered President of the UAW, and Ricardo sitting there and Ricardo saying, look, we are going to move from Chrysler having 18 percent of the large car market to 30 percent of the large car market, and that is our goal. We are going to build bigger cars, more of them. I remember knowing nothing from nothing sitting there and saying, that does not seem to make sense to me and Woodcock saying, it is the only way we can preserve our jobs.

I did not listen to their advice, but the generic point I am making is I think that everybody is a lot more sophisticated. They may not know what you know, but they do know certain basic things. There is no painless way to get from here to there. They think there is a rational way to do it, and they are prepared to do it and they think maybe their future lies in the fact that our independence

may generate other kinds of technologies where we become a net exporter of energy of sorts, and that is, energy technologies that work.

At any rate, I am really impressed with both your testimonies, and I am happy to invite any comment you all have. Again, I warn you. I am going to get to both of you, if I can, to spend a little more time with you.

Mr. KHOSLA. Sir, if I might add a very hopeful sign to what you just said. I believe GM management has decided, for lots of business reasons, that flex fuel cars make a lot of sense for them, and in fact, I believe the 2007 model year they will be producing more flex fuel cars than the credit they get under CAFE. So they are doing the right things for lots of good business reasons. They have lost the branding for hybrids to Toyota. The only other brand they can have is flex fuel, and that helps America and American farmers. It is a very hopeful sign. So I think it is not only something that the workers can support, but I think management is well down that path and we can accelerate it.

I think they are hurting themselves by saying we do not like the idea of a 70-percent mandate because it will make so much more ethanol available in the marketplace because investors will believe the cars will be there, that their competitive advantage over Toyota will go up substantially. And that is what they should be doing if they were looking beyond just the natural reaction saying, I do not want any mandate, no matter what it is.

Mr. GRUMET. I will just close, Senator, by saying that the notion that we cannot effect the kinds of technological, environmental, security outcomes we want without damaging the domestic auto industry is so fundamentally at odds with the way we imagine ourselves as a country. We cannot ignore it, but we cannot let it stand.

I have many friends in the UAW and they hate coming down here opposing these kinds of things because I think they know that it is where they have to go. But they do have real fear. I do not think they have any disadvantage when it comes to flexible fuel vehicles. We made some bad choices and we are behind the Japanese when it comes to hybrids. We are behind the Europeans when it comes to diesels, and the domestic auto industry does have to deal with things like health care costs and other aspects of their business that are somewhat less competitive with their competitors.

So we can, without, I think, tremendous effort, right that ship and give them the tools so that they can, in fact, not only make the cars we want but do it here in the United States. I think that is where the UAW sees the future. It is where the coal miners see the future on climate change. And it requires a broader kind of economic policy consistent with our foreign policy and our environmental interests.

I would very much welcome the opportunity to work with you and your staff.

Senator BIDEN. Well, I thank you very much. I knew if I stayed in this job long enough, Senator, I would live to see the day where I have an issue that unites my autoworkers and my farmers, literally. The largest industry in my State, as you know, Mr. Chairman, is agriculture. Everybody thinks it is the auto industry or the

chemical industry. It is agriculture. This is one of the uniting factors.

I will end with a strange little story. Mr. Chairman, you will appreciate this. I got involved in politics because of the civil rights movement, and my last campaign 2 years ago, I had a meeting in August at a Boys and Girls Club in a town called Bear, DE. I think I may warrant the Nobel Prize for this. I drove up to the town meeting and the county police officers were in the parking lot of this brand new Boys and Girls Club. They said you cannot go in. I said why. They said the Ku Klux Klan is in there.

This is the only area in my State where there is genuine integration in the new developments. It is the only place you can buy a new construction home that you can sell somewhere between $125,000 and $200,000 in decent neighborhoods. They are truly integrated. My State has the ninth largest black population in the country.

So I went down and I said, no, no, I have to go in. In summer garb, there were a dozen members of the Ku Klux Klan there, and they wear blue pressed khaki pants, white shirts, the grand kleagle emblem and a blue hat with a white middle. They looked very orderly and they stand against the back wall. Thirty to thirty-five percent of the audience of roughly 100 people were African-American. The first question I got asked was about immigration. I have a view similar to President Bush's view on immigration. That is what built this country and we ought to be able to figure this out. I got finished my answer and the guy who asked the question was a Ku Klux Klan guy. He said, well, I totally disagree with you, Senator Biden, and with that, 35 African-Americans stood up and clapped for him. And I started laughing and no one quite got the humor. I said I never thought I would live to see the day where I could unite the Ku Klux Klan and the African-American community. [Laughter.]

Now with the opportunity to do the same for the UAW and farmers in my State, this job is getting much more exciting.

Thank you very much for your testimony. I appreciate it a lot.

The CHAIRMAN. Senator Biden has demonstrated the affinity between the ranking member and the chairman because corn farmers have been talked about a bit today, also UAW members. We even claim not a per capita basis but the second largest number, aside from Michigan. We have been trying to help both.

You have offered some formulas. I just want to explore the nitty-gritty of your three simple action items. The first one is to require 70 percent of new cars to be flex fuel vehicles. Just to get this straight, if we pass such a law, does that mean that in 2007 car companies have got to produce 70 percent of all the cars they are doing that year? Or is this a graduated thing? Be more explicit, if you can, as to how rapidly we arrive at this.

Mr. KHOSLA. Yes. Sir, the number I have suggested in my written testimony is 20 percent by 2009 because they need the time to adjust their models.

The CHAIRMAN. Why would they need that? If you have a simple process, as you have described, $110 deal you think, although the car companies might say $180 or whatever, why the long delay?

Mr. KHOSLA. Sir, they probably do not, but they will argue they do. So I used to use a 90-percent number and GM convinced me because of certain esoteric testing requirements in California, that I should use a lower number, and they suggested the 60- to 70-percent range. So I did accommodate them, to get their support, to suggest 70 percent. I think it would be very, very conservative to say 2009 model year which starts in 2008 should be 20 percent and we should increase it 10 percent a year to, by 2014, having 70 percent.

The CHAIRMAN. Let me stop you a second there because you diplomatically were negotiating with these people trying to be amicable. Let us say that Senator Biden and I say, listen, you folks are headed to chapter XI bankruptcy. You may not get to 2009. You may not have that option at all, as a matter of fact. All this may be decided by a judge in a court of law, as a matter of fact, as to how in the world you even stay in business. So as friends of the family, we are coming to say you may have to wrench around your bureaucracy, the same way we may have to wrench around our Department of Energy to get some things straight.

We talk in terms of our vital national interests, how predator countries are about to do us in, but then we say, but we have a simple timetable. We incrementally, 10 percent, 20 percent at a time, go all the way out to 2009, 2015. I understand how you, as an investor and a diplomatic person, have to deal with these people. Perhaps we do, too, ultimately.

But, nevertheless, if this is serious, I just pick up your 70 percent thing and, just for sake of argument, have asked you, why not in 2007 say 70 percent of the cars? Because then you would say, well, that is great, but it takes 12 years to go through the whole fleet. We have got a lot of cars out there. So even if 70 percent of all the new cars are flex fuel, do the math and this will barely get you a single digit number. That is what worries me about this.

Mr. KHOSLA. Sir, the most aggressive number you would like to support and enact, I will cheerlead and clap and support you on. [Laughter.]

The only thing to keep in mind is they have an engine testing requirement and they claim they have limited capacity to retest these engines. So there is an engine certification requirement because they have to recertify each engine, and even, for example, the Ford——

Senator BIDEN. Excuse me. Would you explain that more? They have to recertify each engine.

Mr. KHOSLA. Yes.

Senator BIDEN. They manufacture in the Chrysler plant in Newark, DE, an engine for whatever vehicle. There are several vehicles they make there. So as it goes off the line, they have certified it. Correct?

Mr. KHOSLA. They have certified it for gasoline use.

Senator BIDEN. No, but if we mandated that 70 percent of those vehicles going off that line had to be flex fuel, what is the added difficulty of certifying it before it gets off the assembly line?

Mr. KHOSLA. They claim it costs $1 million or $2 million to recertify it to take ethanol and meet all EPA and California requirements. Now, how long should that take?

Senator BIDEN. $1 million or $2 million per plant?

Mr. KHOSLA. No. Per engine.

Mr. GRUMET. Per engine family.

Senator BIDEN. So they are talking about $50 million to $75 million total. Right?

Mr. KHOSLA. I believe they would do it by engine, not by engine family because the Ford F–150, they have one of the engines certified but not the others.

But if they were to prioritize this, which I believe is in their interest, given how much of a branding benefit they get from it, I think an aggressive time line would be to mandate something in 2 to 3 years. Now, we know the same companies, Ford and GM, have done that in Brazil already.

Senator BIDEN. Yes.

Mr. KHOSLA. So I would be a supporter of more aggressive time lines.

The CHAIRMAN. Very well. Well, in any event, we are agreed on that and we will see, pragmatically, what the tide will bear, I guess.

Now, you have made some interesting comments today and in your charts, Mr. Khosla. You have the hybrid business and flexible fuel and point out how you get more for the dollar and so forth with the flexible, which sounds good.

Now, then, I begin to ponder in my own mind, well, how do I find one of these hybrid flexible fuel cars? Now, you have got a picture of a Saab 9–5 launched May 2005. Are these cars selling anywhere? Is this a case in which you are trying to make also the point that you do not have to have a small car—I do not know how large that car is—but you can have the regular cars, to which we have become accustomed, and somehow change the engines and what have you?

Mr. KHOSLA. Absolutely. Sir, let me give you the history of Saab 9–5 because it is a very interesting car in many, many respects. It is being sold in Sweden by General Motors.

The CHAIRMAN. In Sweden.

Mr. KHOSLA. Yes. And surprisingly for General Motors, it has become one of the hot General Motors models in Sweden. So it has been a commercially extremely successful car. It is a regular car, a mid-sized sedan, lots of peppy performance.

What they did different in this car—and they often talk about a 25-percent reduction in fuel mileage for ethanol—they optimized it somewhat to accommodate ethanol, not just take a standard engine and recertify it. Suddenly the mileage reduction in the Saab 9–5 went to only an 18-percent reduction. It went to an 18-percent reduction and they got in a 175-horsepower car an extra 30 horsepower out of it.

If you were really designing it for ethanol, you would design it to run at 175 horsepower with ethanol, which means you would make the engine smaller, improving the mileage efficiency with ethanol. Suddenly the difference to get 175 horsepower and a performance of 0 to 60 in, whatever their specification is, 8 seconds, you would have almost the same mileage, single digit percentage differences between an ethanol car and a gasoline car. That is the kind of change that is not figured into any of my projections or any-

body else's projections, and I believe that will start to happen because we are starting to see it happen in Sweden. We are starting to see examples of that in Brazil. And this is a car that is a peppier, more hard-performing car than the gasoline version of the same car. So it is very, very encouraging.

And the most encouraging thing to me is consumers are demanding it. If they were to bring that car into this country—and as of now, I know of no plans to do that, which is a shame—it would be a hot-selling car in America.

The CHAIRMAN. Well, this is astonishing. That was the question I was going to ask. Where are they? In other words, it is a hot car in Sweden and elsewhere. It is General Motors, the same General Motors to which we have become accustomed. I was once an employee as a summer student. I would just say, why not here? Do you have any idea, as you have queried your General Motors friends, why has this car not ever appeared in the United States?

Mr. KHOSLA. They gave me a long story. Sir, in a bureaucracy, you can give an excuse to not do anything. It takes time. It takes recertification, retesting. In fact, General Motors is hurting from not having hot-selling models.

The CHAIRMAN. Well, that we have noticed.

Mr. KHOSLA. This could be that, and if I were CEO of General Motors, I would make it my highest priority, especially since long term they want flex fuel vehicles as their corporate brand. This is brain-dead simple to me.

The CHAIRMAN. Yes. They are advertising that 250,000 will be built this year, but that raised the question, why not 500,000, why not a million? If you have got problems moving cars, that is a basic question. Hopefully, the chief executive of General Motors will catch all this on C–SPAN and be advised by your testimony.

Let me just ask this, because in a personal way I asked Jim Woolsey, when he appeared before us, and you all know him. In fact, he sort of preempted the situation. He knew that I bought a Prius 14 months ago, but he wanted to disabuse me that I was that much ahead of the curve. He said, Lugar, what you need is a battery on that Prius that you can plug into the wall in your garage. That way you can get enough juice in that car that you can drive to the Hart Building every day and drive back, which is essentially what I do in this car, and never use any gasoline at all.

Now, we are going to see a demonstration, I understand, here at the Senate in the next week, in which there will be some batteries and a car and so forth, showing that the state of the art is bumping ahead, I hope, a whole lot.

But what about all of this? Is there something to this sort of thing in competition with the other ideas you have?

Mr. GRUMET. Keeping up with Woolsey is no small feat, Senator. So I think we should let him get one first.

But it is an absolutely intelligent design for the kind of vehicle that we need in this country because it is a vehicle that is a hybrid vehicle, but it allows you to operate the entire driving cycle on the battery for some 30 or 40 miles, which, as you said, is really in urban driving what we generally do.

Five to ten years ago, the car companies said that hybrids were not going to work because it was bringing two systems together.

You were going to have a gasoline engine and an electric motor and it was too complicated and it was not going to work. Now we are being told that plug-in hybrids are not going to work because it is adding a third system. You have the gasoline, you have the electric motor, and then you have this demand for a larger battery. And it is true that you are bringing three different ideas together.

My understanding is that the challenge is not that you cannot drive around one of these cars, because you will figure that out yourself next week. The challenge is creating a battery that has longevity to stick with the car and the owner for 130,000 or 140,000 miles. What the car companies will tell you is that these batteries are going to be a couple thousand dollar items and that they cannot get them to last more than 3 or 4 years. So, I think this is a challenge. It is well within the ability, I would think, of this great Nation if we really wanted to get batteries that could last three times as long.

So it is a vehicle that I think would have a great possibility. Of course, if you really want to get Jim happy, you then put E85 in that hybrid. Then you can get what is a functional equivalent of 500 or 600 miles of distance per gallon of petroleum. I think that is, for the moment at least, the highest aspiration of automobility that we have been able to describe.

The CHAIRMAN. That then brings your second point and that is this E85 distribution. This only works for me or anybody else if, in fact, there is such an E85 pump within 50 miles of where I am. Now, all of us, whether it is in Delaware or Indiana, we are all riding herd on this situation. We celebrated the 30th such pump in Indiana last week. We know it is the 30th because this is a big event. The Secretary of Energy, himself, was in Indiana for the dedication of this one pump.

Now, having said that, this has not impressed the oil companies to whom this committee has written. They have written back, respectfully, that you have to understand the impurities of ethanol, the fact that you cannot just put one of these pumps together with our pumps. It requires a very separate situation. It is very expensive. Furthermore, we are not really enthusiastic about the idea to begin with.

Now, it is almost like the automobile companies. You sort of say, "what century are you living in, what country are you living in? Do you understand the foreign policy thing, getting back to all of the grim situations?" And surely they do, but, nevertheless, this is cumbersome.

We have General Motors in Indiana now sponsoring E85 stations. So giving credit where credit is due, not the oil companies, but in this case, the auto company and the UAW people and the people who are our constituents. It is important that there is a group interested in this sort of thing.

But I must say I am not sure how we move these situations out. We have got charts of 92 counties in Indiana, explaining how many flex fuel cars there are in the State of any kind, about 160,000, and where they are positioned. Most of them are not positioned very close to the 30 tanks. There may be 60 by December. But even if there were, right now all the ethanol in Indiana seems to be going to California and to New England to solve the MTBE problem. The

cost of the ethanol is $2.75, not $1.50 or whatever we prophesied. Supply and demand.

Now, eventually all these places that we are all talking about get built, but as working politicians now, we really are riding all sorts of horses going off in different directions, encouraging these pumps. We need a supply for the pumps. We are encouraging the car that could use the pumps, and it is hard to get people to build enough of these cars. Clearly, these are the practical solutions, and we have these hearings really to cheer ourselves up, I suppose, and try to find a few supporters out there——

[Laughter.]

The CHAIRMAN [continuing]. Because this really works.

This can make a very large difference in the perception of Vladimir Putin of the United States, or of other people who do not wish us well, Hugo Chavez, Evo Morales, and so forth. For the moment, they think we are on the run. In many ways they are right because we are fixed in our own attitudes, as I cited, yesterday, in a debate. The Wall Street Journal had an editorial the other day sort of aimed at people like us. They said, essentially, if you have a virtue feeling about a Prius, go ahead. But nevertheless, in essence, real people want safe cars and they are big. Therefore, cars save lives if they are big cars. Now, of course, you are coming along and saying, well, you can have a big car and save your life and still perhaps have a flex fuel car, have a car with an engine that gets mileage. These things are not altogether separate. But I think that is the debate, and it is out there in print.

I am intrigued by your talking about South Dakota. You have here a chart about South Dakota, which is fascinating. You say, "Turning South Dakota," and you have got 44 million acres today and tomorrow, and you have got tons per acre. Well, they go up by three times presumably because they are doing cellulose, switchgrass out there now in South Dakota in your tomorrow chart. So there are thousands of barrels a day coming out of South Dakota, 3,429,000.

Then you have a chart and you ask, is South Dakota a member of OPEC. The only two countries that produce more at that point per day are Saudi Arabia and Iran. South Dakota comes in third, ahead of Kuwait, Venezuela, UAE, Nigeria, Iraq, all very difficult cases. Now, that is astonishing. I am not sure South Dakotans really have seen that chart.

Mr. KHOSLA. It could become the most valuable State in the country.

Senator BIDEN. Who did you coauthor that article with again? That was a joke.

The CHAIRMAN. Yes; our dear colleague of South Dakota.

But in any event, now let us have a reality course. When does South Dakota become third in the batting order with OPEC? What is tomorrow here and what has to happen?

Mr. KHOSLA. Sir, practically it will not happen this way. The 44 million acres we are talking about would be spread throughout the Midwest and probably throughout most of the country. There are good biomass regions in Florida, in the South, in California, in the Northwest in terms of our forests and wood chips that are a great source of cellulosic ethanol, even in Canada. So this was more for

illustration. It was a chart done by a friend of mine that I chose to use for illustrative purposes.

But practically, these numbers are achievable. In fact, I talked earlier about getting to 3,000 gallons per acre. When I talk to my plant biologist friends from what they can actually yield with 25 years of biomass development geared toward producing more energy, the numbers I hear are more like 45 tons per acre, best case, and then you are talking about 5,000 gallons, and even with modest demand increases over the next 25 years, that would mean our energy needs with 40 million acres or some small number like that. Those are astonishing numbers.

I would only add that ex-Secretary of State, George Shultz, and Jim Woolsey have coauthored an article that talks about over 60 million acres. So the land use requirements are not humongous. In fact, they are relatively modest because we now have 72 million acres of soybean crop in this country, which did not exist some time ago. Our corn crop has gone from 120 million acres to 80 million acres over the last 75 years or so. So we have more than enough land.

We do need to enforce—back to your second question—distribution. I have recommended a very modest number of 10 percent. I would love to see it be like Sweden which has a 50-percent requirement by 2009. I think the independent gasoline operators are dying to do this if they are not obstructed. Governor Pataki last week introduced a bill in New York State that could ban all franchises like Chevron and Exxon from discouraging the adoption of E85 by independent gas station owners. I think that is a wonderful idea and I think we should do it for the whole country, and I would love to see a more aggressive target than the 10 percent I have recommended.

The CHAIRMAN. Well, I appreciate very much your chart, imaginative or not, with regard to South Dakota. I would just observe that they might not want to put all of their acreage into ethanol production. Some people might still want wheat or corn or other items, at least that will be the claim of the turkey growers, the cattle people and so forth.

Mr. KHOSLA. This was more fun than anything.

The CHAIRMAN. Leaving aside that point, however, it illustrates what could occur—and this is another story altogether—in terms of wealth production in our own country. I was in Jasper County, IN, giving a commencement speech at St. Joseph College, a Sunday ago. I went down the road to the ethanol plant that should be completed by December. I pray that it will be completed by December so that somehow the ethanol gets out to these E85 stations, few as they may be. But 40 million is the tag for this one. It is a fairly small plant, but 40 million times $2.75 is a lot of new wealth into Jasper County, a county of 31,000 people. People have no idea of the impact that this is going to have. When you talk about the impact in South Dakota, 44 million acres into this sort of thing, that is extraordinary.

One of the reasons we talk about OPEC is because this has made some rulers very wealthy, not necessarily the people of the country, but somebody in Saudi Arabia and Iran and so forth is, as a matter of fact, stowing away a lot of cash. Our problem, as a country, is

that sometimes this cash is not used to our benefit. In the case of Iran right now, we are going to have a hearing tomorrow, and a part of the reason we are having the hearing is because of the subject we are discussing today.

And Tom Friedman, right in this article that you have cited, shows a graph that political scientists have helped him with. As the price of oil went from $20 to $40 to $60, civil liberties in each of the countries involved went down, precipitously, almost by the same amount. There was no need for democracy. There was no need for anybody else. In fact, the rulers of the country had the stuff. And we can talk until we are blue in the face about democracy in the Middle East or in these countries, but we will be blue in the face and there will not be much democracy simply because that is where the wealth is, the patronage, all of the sinews that keep the system going. That is very serious.

That is why I highlight the illustration of specific States and specific locations in the United States—and I would encourage you and those who work with you on these publications to do much more of this because the reality of this makes a big difference when we are saying to our constituents this is for real and we believe we have an idea here.

Mr. KHOSLA. I want to just reiterate these three simple things that do not cost very much money and are not too much of a burden on any industry, not the auto industry or the oil industry, and do not take Government money. These three simple things can completely forever change the face of America in a way that is hard to imagine. If we have 200 billion gallons of ethanol coming out of America even at $1.50 a gallon production cost, we are talking about 300 billion dollars' worth of extra GDP in rural America. That is transformative in this world.

I might also, since this is a Foreign Relations hearing, refer you to a chart that has a map of the world.

The CHAIRMAN. That is equivalent almost to the $320 million deficit we have in our foreign accounts from imported oil.

Mr. KHOSLA. If you can imagine going beyond America, because it is transformative of rural America, it will repeat that phenomena all over the world. If one was to address the question of poverty, another question I am personally very interested in—and microfinance is my other area of endeavors—and you draw a poverty belt, it is all around the equator. The poverty belt runs 20 degrees north and 20 degrees south of the equator. That is the part of the world that will be rejuvenated completely by a switch to biomass fuels. We will address the poverty question much more effectively with this transformation and have global impact.

Also, if one might imagine a map of the world, one can see America meeting its needs and Canada's needs, sort of North America meeting its needs; South America supplying South America and Europe; Australia with lots of land supplying China; India being relatively self-sufficient; and Africa sort of being a big buffer zone for biomass. So one can almost paint a global picture of supply and demand and the regional and local balances that I am happy to elaborate in more detail, if you would like. That to me is the most exciting part of this transformation beyond just meeting our energy

independence goals. It changes the planet beyond changing the face of rural America, and that is exciting. That is very exciting.

The CHAIRMAN. It certainly is.

Mr. KHOSLA. And it is very doable. It is not esoteric.

The CHAIRMAN. Senator Biden.

Senator BIDEN. This is one of the most interesting hearings I think we have ever had. Mr. Chairman, I think whether you and I do it or not, but I just think that we should be, with your leadership, just setting the standard here, just taking these three things and putting them in the form of legislation and laying them out there and start to make the case. Every single major change, since you and I have been here in the Senate, on any area, whether it has been domestic or foreign, has begun with a couple of our colleagues being out front and setting a goal and forcing a debate around those issues.

I cannot tell you how much I appreciate the time and the effort that you fellows have put into this because, again, the thing that excites me about this is the attitude of the American people is one that they are wondering where their leaders are. They are looking for some hope. They understand that things, as they are now, if the status quo remains, look relatively bleak for them. They look bleak for them in terms of jobs. They look bleak in terms of rural development. They look bleak to them in terms of our dependence. They look bleak to them in terms of our current account deficit. They look bleak to them, and they are an optimistic people. They are optimistic. They know there is something else out there. They know it does not have to be that way.

I just think merely by raising the expectation of the American people that there is a way, a path, it will unleash a whole lot of energy. It will unleash a whole lot of energy in the States. It will unleash a whole lot of energy from the Governors. It will unleash a whole lot of energy from local communities. You will find in my State and I suspect in yours, Mr. Chairman, you will have everyone from city councils to county councils deciding that they want to figure out how to promote the access, that 10 percent. Was it Thomas Paine who said we have the ability to remake the world? I am paraphrasing it. We really do. I do not want to make this sound too grandiose.

Mr. KHOSLA. Absolutely. I want to stress again how much support we can get among normal people. Not only that, for the first time in this issue, we can involve a whole new generation. It is the one thing I have worked on in my career—and I have four children between the ages of 13 and 18—that they are really excited that I am working on it. Every time there is a story, they share it with their friends. It is hugely motivating when young people care enough and get excited about the idea to share it with their friends. Many in my daughter's class watched the Dateline piece with their parents. That is very exciting, but it also tells us how much potential we have to mobilize people who you would not think are normally part of effecting a change like this.

I think this has implications all over and completely changing even the way the youth of America look at these kinds of issues. Otherwise, they are boring, old issues decided in Senate Chambers,

but they can get involved this time. I just see my own children and that is all the energy I need to keep doing this.

The CHAIRMAN. Well, you have stimulated not only your own children, but both of us, and we thank you both for extraordinary testimony. Senator Biden and I will be thinking together about how we can proceed with the important ideas and objectives you had, and this is why we have tried to explore the nitty-gritty of some of these to understand better in our own mind's eye the negotiations you already had in your public lives, as well as the ones we must have. We thank you very much for coming.

Senator BIDEN. Gentlemen, thank you very much.

Mr. KHOSLA. Thank you very much, sir.

The CHAIRMAN. The hearing is adjourned.

[Whereupon, at 12:03 p.m., the committee was adjourned.]

ADDITIONAL STATEMENT SUBMITTED FOR THE RECORD

PREPARED STATEMENT OF HON. RUSSELL D. FEINGOLD, U.S. SENATOR FROM WISCONSIN

I appreciate the Chair's unfailing commitment to the issue of energy security. He has been a constant voice, using this committee's area of jurisdiction, warning us about the implications of our energy choices and today's hearing continues these efforts.

As we all know, our current over-dependence on oil poses grave risks for our country—for our national security, for our economy, and for our environment. While I remain saddened that we didn't use last year's energy bill to really push the envelope, I am optimistic that we will soon get it right and provide an energy vision to bring us into the 21st century.

Today's hearing should prove useful as we look for ways to move forward and I am thankful for both witnesses, Vinod Khosla and Jason Grumet, joining us this morning.

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