FUTURE OF FEDERAL COAL: STATUS, AVAILABILITY AND IMPACT OF TECHNOLOGICAL ADVANCES IN USING COAL TO CREATE ALTERNATIVE ENERGY RESOURCES

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON RESOURCES
U.S. HOUSE OF REPRESENTATIVES

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OVERSIGHT HEARING ON THE "FUTURE OF FEDERAL COAL: STATUS, AVAILABILITY AND IMPACT OF TECHNOLOGICAL ADVANCES IN USING COAL TO CREATE ALTERNATIVE ENERGY RESOURCES"

Thursday, May 4, 2006
U.S. House of Representatives
Subcommittee on Energy and Mineral Resources
Committee on Resources
Washington, D.C.

The Subcommittee met, pursuant to call, at 10:00 a.m. in Room 1324, Longworth House Office Building, Hon. Jim Gibbons, [Chairman of the Subcommittee] presiding.

Present: Representatives Gibbons, Drake, Pearce, Cannon, Grijalva and Costa.

STATEMENT OF THE HONORABLE JIM GIBBONS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEVADA

Mr. GIBBONS. Good morning, ladies and gentlemen. The oversight hearing by the Subcommittee on Energy and Mineral Resources will come to order. The Subcommittee is meeting today to hear testimony on the Future of Federal Coal: Status, Availability and Impact of Technology Advances in Using Coal to Create Alternative Energy Resources.

However, before we get started today, I want to ask unanimous consent to allow the gentleman from Pennsylvania, Mr. Holden, to be allowed to sit on the dais to participate in the hearing, and without objection so ordered.

Under Committee Rule 4[g], the Chairman and the Ranking Minority Member can make opening statements, However, if any Member wishes to be heard and have an opening statement their remarks can be recorded under unanimous consent.

The Subcommittee meets today to review the future role of coal-to-liquids technology and resolving the Nation's liquid fuel problem. About 95 percent of the Nation's transportation fuels are derived from petroleum. These fuels are used to transport people, food, goods and services that are vital to our economy. They also power our nation's air, naval and land forces. Without a secure, stable, affordable supply of liquid transportation fuel, both our economy and our national defense will suffer.

We will hear today about the hidden costs that the Nation pays for its dependence on imported fuels. We will be getting an update on what has happened to the external or hidden costs of imported fuels since we last examined them in 2004. I suspect that they have gone up like the rest of the costs associated with petroleum.

We will hear about the Nation's coal resources. We will hear about the findings and the recommendations contained in the National Coal Council's report on the future of coal. That report was delivered to the Secretary of Energy in March of this year.

We will also examine the current efforts of industry to bring commercial coal-to-liquids fuel to the marketplace. We will hear today about the proposed projects in the East, the Midwest, the South and the West. We can be assured that a successful coal-to-liquids industry will play a significant role in helping to meet the national energy needs of the country, and during this hearing we will examine the potential for a set of technologies to create liquid fuels from a variety of feedstocks, including coal.

These technologies are sometimes known as the Fischer-Tropsch, after the two scientists who discovered the chemical reaction. Often this is a simple abbreviated symbol, abbreviated as FT.

These are not new technologies, and they are certainly not untried technologies. They were first developed in the 1920s and used by the Germans and the Japanese to make military fuels during the Second World War. Following the war years, the United States continued to conduct research to refine the technologies.

What kept the technologies from being commercial in the early post-war years was the low cost of liquid transportation fuels derived from petroleum. Nonetheless, the government continued to conduct research on FT fuels.

In the years since the 1973 energy crisis, the Federal government has invested nearly $4 billion on research aimed at improving FT technology. The ups and downs of oil prices during this time continued to discourage the commercial use of FT fuels. However, the current high price of petroleum has once again made FT fuels attractive, although the possibility of future price swings remains a concern.

The Energy Policy Act of 2005 contained provisions to encourage the commercialization of innovative fuels such as coal to liquids. The Act continues the investment and emphasis on FT research in Section 417 of the Energy Policy Act of 2005, committing $85 million to the further study of producing FT-derived transportation fuels from Illinois Basin coal.

Title 17 of the Energy Policy Act of 2005 authorizes loan guarantees for innovative technologies, including coal-to-liquid projects. I expect that these provisions of the Energy Policy Act will play a crucial role in expanding our ability to utilize these important domestic energy resources.

Before I conclude my remarks, I must note that even before there was a Fischer-Tropsch technology, there was an earlier set of technologies that made coal oil from eastern U.S. coal. Throughout the 1850s and the early 1860s, oil produced from coal was a competitive source of fuel for lamps.

Alas for this growing industry, Colonel Drake's well in northwestern Pennsylvania changed the economics of producing petroleum and coal oil and was relegated back to the research lab.

As we look at Fischer-Tropsch technology, we should be mindful that this is not a new or strange technology. Its commercial viability has been subject to price swings in the past and could be subject to price swings in the future.

In closing, I must note that just like the character in the 1985 movie, we are going "Back to the Future" when we talk about commercializing coal-to-liquid technology, and I want to thank the witnesses for joining us today. I look forward to your testimony.

Before I turn it over to our witnesses I would like to invite the Ranking Member of the Subcommittee, Raul Grijalva, for any opening remarks that he may wish to give. Mr. Grijalva?

[The prepared statement of Mr. Gibbons follows:]

Statement of The Honorable Jim Gibbons, Chairman, Subcommittee on Energy and Mineral Resources

The Subcommittee meets today to review the future role of coal-to-liquids technology in resolving the Nations liquid fuels problem.

About 95 percent of the Nation's transportation fuels are derived from petroleum.

These fuels are used to transport people, food, goods and services that are vital to our economy.

They also power our Nation's air, naval and land forces.

Without a secure, stable and affordable supply of liquid transportation fuels both our economy and our national defense will suffer.

We will hear about the "hidden" costs the Nation pays for its dependence on imported fuels.

We will be getting an update on what has happened to the external or "hidden" costs of imported fuels since we last examined them in 2004.

I suspect that they have gone up like the rest of the costs associated with petroleum.

We will hear about the Nation's coal resources.

We will hear about the findings and the recommendations contained in National Coal Council's report on the future of coal that was delivered to the Secretary of Energy in March of this year.

We will examine the current efforts of industry to bring commercial coal-to-liquid fuels to the marketplace.

We will hear today about proposed projects in the East, the Midwest, the South and the West.

We can be assured that a successful coal-to-liquids industry will play a significant role in helping to meet the national energy needs of the country.

During this hearing we will examine the potential for a set of technologies to create liquid fuels from a variety of feed stocks, including coal.

These technologies are sometimes known as "Fischer-Tropsch" after the two scientists who discovered the chemical reactions. Often this is simply abbreviated as "FT."

These are not new technologies and they are certainly not untried technologies. They were first developed in the 1920's and used by the Germans and the Japanese to make military fuels during the Second World War.

Following the war years, the United States continued to conduct research and to refine the technologies. What kept the technologies from being commercial in the early post-war years was the low cost of petroleum derived liquid transportation fuels.

Nonetheless, the government continued to conduct research in FT fuels.

In the years since the 1973 energy crisis, the federal government has invested $3.6 Billion on research aimed at improving the FT technology.

The ups and downs of oil prices during this time continued to discourage the commercial uses of FT fuels.

However, the current high price of petroleum has once again made FT fuels attractive, although the possibility of future price swings remains a concern.

The Energy Policy Act of 2005 contained provisions to encourage the commercialization of innovative fuels such as coal to liquids.

The Act continues the emphasis on FT research in Section 417 of the Energy Policy Act of 2005, committing $85 Million to the further study of producing FT-derived transportation fuels from Illinois Basin Coal.

Title XVII of The Energy Policy Act of 2005 authorizes loan guarantees for innovative technologies including coal-to-liquids projects.

I expect that these provisions of the Energy Policy Act will play a crucial role in expanding our ability to utilize these important domestic energy resources.

Before I conclude my remarks, I must note that even before there was Fischer-Tropsch technology, there was an earlier set of technologies that made "coal oil" from eastern U.S. coals.

Throughout the 1850s and the early 1860s oil produced from coal was a competitive source of fuel for lamps. Alas for this growing industry, Colonel Drake's well in northwestern Pennsylvania changed the economics of producing petroleum and coal oil was relegated to the research labs.

As we look at Fischer-Tropsch technology, we should be mindful that this is not a new or strange technology. Its commercial viability has been subject to price swings in the past and could be subject to price swings in the future.

And, in closing, I must note that like the character in the 1985 movie, we are going "Back to the Future" when we talk about commercializing coal-to-liquids technology.

I thank the witnesses for joining us today and I look forward to your testimony.

STATEMENT OF RAUL M. GRIJALVA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARIZONA

Mr. GRIJALVA. Thank you very much, Mr. Chairman, and I also join with you in welcoming our panel of expert witnesses today on this hearing to examine the role of clean coal technologies.

Today with $75 a barrel oil, record prices at the pump and an unstable world market it makes sense to look at the possibilities provided by clean coal technologies, along with other alternative fuel strategies.

In theory, coal can be liquified, turned into oil and eventually sold for approximately half of what we are paying now per barrel according to the Department of Energy. Liquids from coal could replace conventional fuels made from crude oil that are used for transportation, home heating, lubricants and other products. Overall, the expanded use of coal could allow the United States to reduce our dependency on dwindling supplies of oil and gas over the next several decades.

That said, we should be honest and acknowledge that a large coals to liquid program could have substantial effects on global warming, pollution, conventional air pollution and land damage from expanded coal production. For our own health and welfare and that of our children and future generations, we can just not continue to burn fossil fuels at the present rate.

I believe a combination of energy efficiency and renewable fuels such as wind or solar can reduce our oil consumption more effectively than just one solution.

In conclusion, I look forward to this informative discussion we are going to have today and at the outset, Mr. Chairman, extend my apologies to the witnesses. I have a conflicting hearing, and I will probably be leaving prior to the question and answer period. For that I extend the apologies.

Thank you, Mr. Chairman, for the time.

Mr. GIBBONS. Thank you, Mr. Grijalva.

We would like to welcome now our first panel. They include Brenda Pierce, USGS Energy Resources Program; Milt Copulos,

National Defense Council Foundation; David G. Hawkins, Natural Resources Defense Council; Fredrick Palmer, Peabody Energy.

If each of you would stand and raise your right hand as we always do, swearing in our witnesses?

[Witnesses sworn.]

Mr. GIBBONS. Let the record reflect that each of the witnesses answered in the affirmative.

The Chairman will now recognize Brenda Pierce. Brenda, welcome. Let me explain that we have a little clock and a timer in front of you. If you have never testified before, that represents a five-minute window which we ask because we have certain time limits on this committee to get everything in.

We would ask that if you wish you can summarize and expound upon your written testimony, which we will accept for the record without objection the full and complete testimony of each and every witness. Therefore, we will give you the five minutes. When you get much beyond five minutes we do sort of try to signal you without being obnoxious.

Brenda, welcome to the committee. We are happy to have you here. The floor is yours. We look forward to your testimony.

STATEMENT OF BRENDA PIERCE, PROGRAM COORDINATOR, ENERGY RESOURCES PROGRAM, U.S. GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR

Ms. PIERCE. Thank you. Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear here today to discuss the U.S. Geological Survey's role in studying, understanding and assessing the Nation's coal resources. My name is Brenda Pierce, and I am the program coordinator for the Energy Resources Program at the U.S. Geological Survey.

Coal is an important domestic energy resource in the United States. Currently more than half of the electric power generated in this country relies on coal as a fuel source. Energy is vital to the continued expansion of our economy and to the improvement in our quality of life.

However, an imbalance exists between our energy consumption and domestic energy production resulting in growing amounts of imported energy resources. One possible way to bridge this widening gap is to consider alternative technologies for coal use.

The USGS promotes and supports scientific investigations of geologically based energy resources. These research efforts include the geology of oil, gas and coal resources, emerging resources such as gas hydrates or underutilized resources such as geothermal. The USGS also researches the effects associated with energy resource occurrence, production and/or utilization.

The results of these investigations provide impartial, robust scientific information about energy resources and directly support the U.S. Department of Interior's mission of protecting and managing the Nation's natural resources. Collectively this information advances the scientific understanding of energy resources, contributes to plans for a balanced and secure energy future, and facilitates the evaluation and strategic use of resources.

Coal has been and will continue to be important to the U.S. standard of living. Coal is projected to continue to provide a

relatively inexpensive domestic fuel for electric power generation. The locations of major U.S. coal deposits and the relative in-ground resources of the major coal beds are generally well known. However, estimates of what portion of these in-place resources is technically and economically recoverable remain uncertain.

The USGS recently completed resource assessments of the five top coal producing regions in the U.S.—the Appalachian Basin, Gulf Coast, Illinois Basin, Colorado Plateau and the Northern Rocky Mountains and Great Plains. The assessments focused on 60 coal beds and coal zones within these regions because they are expected to supply the bulk of the U.S. coal production in the next few decades.

The USGS also conducted numerous local scale availability and recoverability studies through the 1990s. Results of several studies were compiled, and the volumes of coal that could be produced typically amounted to only 10 to 20 percent of the original in-place resource, an unexpected conclusion.

Because these studies were conducted on a local scale, the results may not be translatable to the scale of coal bearing basins. However, if subsequent research determines that similar results exist at the basin scale these results would significantly alter the perception of the U.S. coal reserve base.

Therefore, USGS has embarked on a systematic inventory of the U.S. coal reserve base representing a marked departure from previous in-place coal resource assessments. We have spent the last year revising our coal resource assessment methodology to determine the subset of in-place resources that is technically and economically recoverable on a basin wide scale. In other words, USGS will start assessing the reserve base of the United States.

The USGS will focus on research efforts working with agencies that have land and resource management responsibilities such as Bureau of Land Management and Office of Surface Mining and those agencies that use USGS resource projections for their mission work such as the Energy Information Administration so as to incorporate the needs of these customers into our products.

The USGS is now in the process of conducting a reserve estimate for the Gillette coal field of the Powder River Basin, the largest supplier of coal in the United States. The results of this effort are expected in winter of 2006, followed by the reserve estimates for the entire Powder River Basin for the end of 2007. Subsequent coal reserve base studies will be valuable in understanding how much of the domestic coal endowment is technologically available and currently economic to produce.

Studies of coal quality parameters are a core component of the USGS Energy Resources Program research portfolio. The USGS has recently focused its efforts on studies that examine the feed coals and coal combustion products from individual coal-fired power plants. Coal quality parameters that will be examined include elements in coal that can potentially have adverse effects on environmental quality and/or may be slated for regulation.

Given the increasing attention on the impacts of coal utilization, coal-quality research must address a more comprehensive suite of coal quality related issues beyond the fundamental coal quality parameters such as ash yield, sulfur content and heating value. This

more comprehensive approach is vital to future coal assessments and future use of coal in this country.

In conclusion, Mr. Chairman, coal is an important component of the Nation's energy portfolio, which powers our expanding economy. The U.S. Geological Survey is committed to better understanding our coal resource endowment, the quality of those resources and how those resources may contribute to our coal reserve base and the Nation's energy mix. We stand ready to respond to the ongoing need for energy development for a variety of sources and in new ways.

Thank you for the opportunity to highlight a few of the steps USGS has taken to improve the understanding of the Nation's coal resources. I am happy to answer any questions you may have.

[The prepared statement of Ms. Pierce follows:]

Statement of Brenda S. Pierce, Program Coordinator, Energy Resources Program, U.S. Geological Survey, U.S. Department of the Interior

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear here today to discuss with you the U.S. Geological Survey's role in studying, understanding, and assessing the Nation's coal resources.

Coal is an important domestic energy resource in the United States. Currently, more than half of the electric power generated in this country relies on coal as a fuel source. Energy is vital to the continued expansion of our economy and to the improvement of the quality of life for Americans. However, an imbalance exists between our energy consumption and domestic energy production, resulting in growing amounts of imported energy resources. One possible way to bridge this widening gap is to consider alternative technologies for coal use.

The U.S. Geological Survey (USGS) promotes and supports scientific investigations of geologically based energy resources. These research efforts include the geology of oil, gas, and coal resources, emerging resources such as gas hydrates or underutilized resources such as geothermal. The USGS also researches the effects associated with energy resource occurrence, production, and/or utilization. The results of these investigations provide impartial, robust scientific information about energy resources and directly support the U.S. Department of Interior (DOI) mission of protecting and managing the Nation's natural resources. Collectively, this information advances the scientific understanding of energy resources, contributes to plans for a balanced and secure energy future, and facilitates the evaluation and strategic use of resources.

Coal Resources

National and global energy demand and resource consumption are forecast to increase significantly over the next 20 to 30 years. The Energy Information Administration (EIA) projects that global energy consumption will grow by almost 50 percent by 2025. Most of these increases will manifest themselves through increased production of fossil fuels. As stated earlier, coal accounts for more than 50 percent of the electricity generated in this country. Coal has been and will continue to be important to the U.S. standard of living. Coal is projected to continue to provide a relatively inexpensive, domestic fuel for electric power generation. The locations of the major U.S. coal deposits and the relative in-ground resources of the major coal beds are generally well known. However, estimates of what portion of these in-place resources is technically and economically recoverable remain uncertain.

The USGS recently completed resource assessments of the five top coal producing regions in the U.S.—the Appalachian Basin, Gulf Coast, Illinois Basin, Colorado Plateau, and the Northern Rocky Mountains and Great Plains. The assessments focused on 60 coal beds and coal zones within these regions because they are expected to supply the bulk of U.S. coal production for the next few decades.

The USGS also conducted numerous local- to State-scale availability and recoverability studies throughout the 1990's. Results of several studies were compiled, and the volumes of coal that could be produced typically amounted to only 10 to 20% of the original in-place resource—an unexpected conclusion. Because these studies were conducted on a local scale, the results may not be translatable to the scale of coal-bearing basins. However, if subsequent research determines that similar results exist at the basin scale, these results would significantly alter the perception of the U.S. coal reserve base.

Therefore, USGS has embarked on a systematic inventory of the U.S. coal reserve base, representing a marked departure from previous in-place coal resource assessments. Although the terms "resource" and "reserve" are often used interchangeably, the two terms have distinctly different meanings. Coal resources are the volumes of the coal in beds with only minor restrictions placed upon the distribution and without regard to whether the deposits are economically extractable. The term "reserve" applies to that portion of the coal resource that can be recovered economically with the application of extraction technology available currently. The term "reserve" implies that an economic evaluation has been performed on the coal resource taking into account such factors as coal depth and thickness, coal quality, mining method, restrictions (environmental, mined out areas, and the like), and many other factors. Consequently, the reserve base is always much less than the in-place resources.

The USGS has spent the last year revising its coal resource assessment methodology to determine the subset of in-place resources that is technically and economically recoverable on a basin-wide scale. In other words, USGS will start assessing the reserve base of the United States. The USGS will focus on research efforts working with agencies that have land and resource management responsibilities, such as the Bureau of Land Management and Office of Surface Mining, and those agencies that use USGS resource projections for their mission work, such as the Energy Information Administration (EIA), so as to incorporate the needs of these customers into our products.

Once the development of the revised coal assessment methodology was completed, an external peer review of the methodology was conducted. The peer review consisted of experts from State agencies, other Federal agencies, and industry. With this input, the USGS further refined the methodology, and is now in the process of conducting a reserve estimate for the Gillette coal field of the Powder River Basin, the largest supplier of coal in the United States. The results of this effort are expected in winter of 2006, followed by reserve estimates for the entire Powder River Basin by the end of 2007. Subsequent coal reserve base studies will be valuable in understanding how much of the domestic coal endowment is technologically available and currently economic to produce.

The United States produces approximately one billion tons of coal per year, with production steadily rising over time. Almost all of this production is used for electric power generation. Our imports are still very small (a little over 30 million short tons in 2005), but they are increasing. The U.S. also exports coal (about 50 million short tons in 2005), mainly to Canada, but also Europe and other countries. The amount of coal exported is also increasing.

According to the EIA, 72% of the projected increase in coal demand in the reference case scenario between 2004 and 2030 is attributed to the electric power sector and 28% is for production of synthetic fuels from coal using coal-to-liquids (CTL) technologies. The use of coal gasification technologies can also produce alternative fuels, such as hydrogen, as well as synthesized gas for industrial applications. Competition for coal use among these technologies will merit consideration in decisions regarding our coal resources and coal reserve base.

Coal Quality

Studies of coal quality parameters have been a core component of the USGS Energy Resources Program research portfolio. The USGS has long conducted studies improving the understanding of the quality of the U.S. coal endowment. However, it is not an easy task to collect and analyze sufficient samples to fully understand this complex resource. Therefore, USGS has recently focused its efforts on studies that examine the feed coals and coal combustion products from individual coal-fired power plants (commonly referred to as "cradle-to-grave studies"). Coal quality parameters that will be examined include elements in coal that can potentially have adverse effects on environmental quality and/or may be slated for regulation. Given the increasing attention on the impacts of coal utilization, coal-quality research must address a more comprehensive suite of coal quality-related issues beyond the fundamental coal quality parameters such as ash yield, sulfur content, and heating value. This more comprehensive approach is vital to future coal assessments and future use of coal in this country.

Using available basic coal quality parameters, a reconnaissance-level survey can begin to identify coal resources that may have potential for use with various alternative technologies. However, additional process-specific parameters will be needed to more precisely evaluate and assess suitable resources. Working with experts in various conversion and combustion technologies, development of these parameters can be accomplished to determine the appropriate level of USGS contribution.

Conclusion

In conclusion, Mr. Chairman, coal is an important component of the Nation's energy portfolio, which powers our expanding economy. The U.S. Geological Survey has been working with other agencies and has taken steps in several scientific endeavors to better understand our coal resource endowment, the quality of those resources, and how those resources may contribute to our coal reserve base and the Nation's energy mix. We stand ready to respond to the ongoing need for energy development from a variety of sources and in new ways.

Thank you for the opportunity to highlight a few of the steps USGS has taken to improve the understanding of the Nation's coal resources. This concludes my testimony. I would be happy to answer any questions you may have.

Mr. GIBBONS. Actually, Brenda, that was remarkably well timed. [Laughter.]

Ms. PIERCE. Good. Thank you.

Mr. GIBBONS. You actually quit one second over. Let us hope that the men sitting to your left over there can do as well.

Actually you did very well. Thank you for your testimony. It was very enlightening.

We will turn now to Milt Copulos, National Defense Council Foundation. Milt, welcome back. We look forward to your testimony.

STATEMENT OF MILTON R. COPULOS, PRESIDENT, NATIONAL DEFENSE COUNCIL FOUNDATION

Mr. COPULOS. Thank you, Mr. Chairman. It is a privilege to be here. I must take a moment to commend the committee for its longstanding efforts to make people aware of our energy dilemma. You were talking about it long before the current crisis when few others were.

It is impossible to listen to a news broadcast or read a newspaper without seeing reports of our citizens outraged over high gas prices, but if they knew what they were really paying, the full cost of it, they would be even more exercised.

The simple fact is that what you pay at the pump does not include many of the actual costs that while they do not appear they are nonetheless real. As we discussed in 2003, the National Defense Council Foundation actually looked at these costs. We did the most comprehensive analysis that has ever been attempted. At that time we concluded that our country was spending $304.9 billion a year in hidden costs to support its oil import habit.

However, things have changed since then, and we decided it was long past time to take another look at it because we thought there would be some increase. I will have to say until we started crunching the numbers I had no idea of the magnitude of the change.

In our base year we spent $99 billion to buy imported oil. This year we will spend at least $320 billion. At least. In our base year, as I said, it was $304.9 billion. This year the hidden costs come to a total of $825.1 billion, which is almost twice as much as the Fiscal Year 2006 Defense Department authorization. That includes $132.8 billion in direct defense related costs and many, many others.

What that boils down to is it is the equivalent of adding $8.35 to the price of a gallon of gasoline. What that means is that if you have an average U.S. sedan, it is really costing $225 for a fill up and for an SUV $338.

There is a lot more at stake than just money because when we are talking about money flowing overseas we are talking about capital investment and, in the end, jobs because there is a human toll that it takes. In this case 2.24 million jobs.

The loss of these jobs means that there are families that will not buy homes, will not send their kids to college, cannot prepare for their retirement. We have to, looking at this, ask ourselves how did we get into this mess? Well, as Pogo said, we have met the enemy, and they are us.

The 1973 oil embargo warned us of the danger, but we did nothing. We are importing almost twice as much oil today on a percentage basis and more than twice as much on a volumetric basis than we did in 1973.

There is this obsession with finding the silver bullet, that single solution written large across the sky by the flaming finger of God. Well, there is no such animal. The fact is we do not have the luxury of selectivity, and now we also do not have the luxury of time.

It is projected in 2025 we are going to need 120 million barrels of oil a day to meet world demand, and I do not know where it is going to come from, so clearly we must do something. One of the things that we should do and can do is take advantage of our vast coal resources.

As the Chairman said, the technology is not new. It is over 80 years old. We know how to do it. South Africa produces 200,000 barrels a day of synthetic fuels from coal. It can be done in an environmentally safe fashion, and it can produce an environmentally superior fuel.

Moreover, from the Department of Defense's standpoint it is very important because DOD has gone to single fuel concept. They use nothing but JP-8. That is the plan. The trouble is no matter what you do to a barrel of oil, only 12.5 percent of it roughly is going to be jet fuel. That means that for each barrel of military fuel you require, you require eight barrels of oil to produce it. Using coal liquids could avoid this.

There are a number of things we can do, the most important of which I believe is to establish a floor price which is, by the way, fuel neutral and helps all alternatives. We should also look at DOD doing forward purchases. Finally, I think it is important for the committee to go on record and make its point to the Department of Defense that they should be looking into this.

Coal is not going to be enough by itself. We are going to have to do everything. We are going to have to conserve. We are going to have to produce. We are going to have to use all of the resources available. The reason is if we do not, we are going to be faced with a Hobson's choice between economic collapse and global resource war, and that would be the greatest environmental catastrophe of all.

Thank you.

[The prepared statement of Mr. Copulos follows:]

Statement of Milton R. Copulos, President, National Defense Council Foundation

My name is Milton R. Copulos, and I am President of the National Defense Council Foundation.

I would like to thank Chairman Gibbons for giving me the opportunity to speak with the Committee today and I would also like to commend him for his leadership addressing our nation's perilous energy dependence.

A Headlong Rush Into Disaster

America is rushing headlong into disaster. What is worse, however, is that it is a disaster of our own design.

More than three decades have passed since the 1973 Arab Oil Embargo first alerted the Nation to its growing oil import vulnerability. Yet, despite this warning, we are now importing more than twice as much oil in absolute terms than we did in 1973, and the proportion of our oil supplies accounted for by imports is nearly double what is was then. What makes this dependence even more dangerous than it was three decades ago is the fact that the global market has become a far more competitive place with the emerging economies of China, India and Eastern Europe creating burgeoning demand for increasingly scarce resources.

Indeed, over the past decade the Chinese economy has grown at a frenetic pace, officially estimated at 9.2 percent in 2005. India's growth rate for that year was 7.1 percent. In Eastern Europe, Belarus grew at 7.8 percent, the Czech Republic at 4.6 percent and the Ukraine at 4.4 percent. This compares with 3.5 percent for the United States, 2.1 percent for Japan and 1.7 percent for the European Union.

As a result of this explosive growth, oil consumption in the developing countries is expected to increase at a rate of 3 percent annually over the next two decades. But even this figure may severely understate the problem. Indeed, China alone has accounted for 40 percent of the total increase in world oil consumption over the past several years. India too is rapidly expanding its consumption with a 28 percent increase predicted over the next five years.

Moreover China plans to add 120 million vehicles to its automobile fleet over the next decade, ultimately requiring 11.7 million barrels per day of new crude oil supplies. Nor it is alone in expanding vehicle use. Consider this fact: in 1970, there were 246 million privately owned vehicles in the world. Today, there are 800 million and 60 million new cars are produced each year. As a result, even with retirements, by 2025, the global vehicle fleet is expected to reach 1.1 billion.

Given this burgeoning demand, even conservative estimates suggest that more than 30 million barrels per day of new oil supplies will be required by the year 2025 just to service the developing world's requirements. When Europe and the Americas are included the requirement is closer to 40 million barrels per day. As a result, EIA estimates that the world will consume over 120 million barrels of oil daily in 2025. It is doubtful that new supplies sufficient to meet this skyrocketing demand will be found from conventional sources.

Uncertain Suppliers

Nor is it just the potential physical shortfall of resources that is a source of concern. An even greater concern lies in the instability of U.S. sources of oil imports.

The top six sources of U.S. oil imports, Canada, Mexico, Saudi Arabia, Venezuela, Nigeria and Iraq account for 65.1 percent of all foreign crude reaching our shores and 38.9 percent of total domestic consumption. Of these, four, Saudi Arabia, Venezuela, Nigeria and Iraq provide 38.2 percent of oil imports and 22.6 percent of total consumption. For a variety of reasons, none of the four I just mentioned can be considered a reliable source of supply.

Venezuela's President Hugo Chavez is a vocal opponent of the United States who has twice threatened to cut off oil shipments to the U.S.

Nigeria's production has been repeatedly disrupted by civil unrest, and some 135,000 barrels of oil per day are lost to theft.

Last month, a terrorist attack on the massive Saudi oil processing facility at Abqaiq was barely thwarted, but not before two of the terrorist's explosive-laden cars were detonated. Moreover, this was not the only instance of an attempt to disrupt the flow of Saudi oil. In the summer of 2002, Saudi Interior Ministry forces blocked an al-Qaeda plot to attack and cripple the loading dock at Ras Tanura which handles 10 percent of the world's oil supplies.

Attacks on oil facilities in Iraq are a frequent occurrence.

Nor are the attacks on U.S. oil supplies a coincidence. In December of 2004, al-Qaeda issued a fatwa that said in part:

> "We call on the mujahideen in the Arabian Peninsula to unify their ranks and target the oil supplies that do not serve the Islamic nation but the enemies of this nation."

The fatwa went onto declare:

> "Be active and prevent them from getting hold of our oil and concentrate on it particularly in Iraq and the Gulf."

Clearly, given the instability that characterizes four of our top six sources of oil, the question is not whether we will experience a supply disruption, but rather when. The disruption could occur as a consequence of a terrorist act, or could result from a politically motivated embargo. In the end, it doesn't really matter why a disruption occurs, because the consequences would be identical, and severe.

The Consequences of Disruption

The supply disruptions of the 1970s cost the U.S. economy between $2.3 Trillion and $2.5 Trillion. Today, such an event could carry a price tag as high as $8 Trillion—a figure equal to 62.5 percent of our annual GDP or nearly $27,000 for every man, woman and child living in America.

But there is more cause for concern over such an event than just the economic toll. A supply disruption of significant magnitude, such as would occur should Saudi supplies be interdicted, would also dramatically undermine the Nation's ability to defend itself.

Oil has long been a vital military commodity, but today has taken on even more critical importance. Several examples illustrate this point:

- A contemporary U.S. Army Heavy Division uses more than twice as much oil on a daily basis as an entire World War II field army.
- The roughly 582,000 troops dispatched to the Persian Gulf used more than twice as much oil on a daily basis as the entire 2-million man Allied Expeditionary Force that liberated Europe in World War II.
- In Operation Iraqi Freedom, the oil requirement for our armed forces was 20 percent higher than in the first Gulf War, Operation Desert Storm, and now amount to one barrel of refined petroleum products per day for each deployed service member.

Moreover, the military's oil requirements will be even higher in the future.

Therefore, a shortage of global oil supplies not only holds the potential to devastate our economy, but could hamstring our armed forces as well.

The Hidden Cost of Imported Oil

While it is broadly acknowledged that our undue dependence on imported oil would pose a threat to the Nation's economic and military security in the event of a supply disruption, less well understood is the enormous economic toll that dependence takes on a daily basis.

The principal reason why we are not fully aware of the true economic cost of our import dependence is that it largely takes the form of what economists call "externalities," that is, costs or benefits caused by production or consumption of a specific item, but not reflected in its pricing. It is important to understand that even though external costs or benefits may not be reflected in the price of an item, they nonetheless are real.

In October of 2003, my organization, The National Defense Council Foundation, issued "America's Achilles Heel: The Hidden Costs of Imported Oil," a comprehensive analysis of the external costs of imported oil. The study entailed the review of literally hundreds of thousands of pages of documents, including the entire order of battle of America's armed forces and more than a year of effort. Its conclusions into divided the externalities into three basic categories: Direct and Indirect economic costs, Oil Supply Disruption Impacts and Military Expenditures.

Taken together, these costs totaled $304.9 billion annually, the equivalent of adding $3.68 to the price of a gallon of gasoline imported from the Persian Gulf.

As high as these costs were, however, they were based on a crude oil refiner acquisition cost of $26.92. Today, crude oil prices are hovering around $60 per barrel and could easily increase significantly. Indeed, whereas in 2003 we spent around $99 billion to purchase foreign crude oil and refined petroleum products, in 2005 we spent more than $251 billion, and this year we will spend at least $320 billion.

But skyrocketing crude oil prices were not the only factor affecting oil-related externalities. Defense expenditures also changed.

In 2003, our armed forces allocated $49.1 billion annually to maintaining the capability to assure the flow of oil from the Persian Gulf.

I should note that expenditures for this purpose are not new. Indeed, last year marked the 60th anniversary of the historic meeting between Saudi monarch King Abdul Aziz and U.S. President Franklin Roosevelt where he first committed our nation to assuring the flow of Persian Gulf oil—a promise that has been reaffirmed by every succeeding President, without regard to party.

In 1983 the implicit promise to protect Persian Gulf oil supplies became an explicit element of U.S. military doctrine with the creation of the United States Central Command, CENTCOM. CENTCOM's official history makes this clear stating in part:

"Today's command evolved as a practical solution to the problem of projecting U.S. military power to the Gulf region from halfway around the world."

I am stressing the long-standing nature of our commitment to the Gulf to underscore the fact that our estimates of military expenditures there are not intended as a criticism. Quite the opposite, in fact. Without oil our economy could not function, and therefore protecting our sources of oil is a legitimate defense mission, and the current military operation in Iraq is part of that mission.

To date, supplemental appropriations for the Iraq War come to more than $251 billion, or an average of $83.7 billion per year. As a result, when other costs are included, the total military expenditures related to oil now total $132.7 billion annually.

So, where does that leave us?

In 2003, as noted, we estimated that the "hidden cost" of imported oil totaled $304.9 billion. When we revisited the external costs, taking into account the higher prices for crude oil and increased defense expenditures we found that the "hidden cost" had skyrocketed to $779.5 billion in 2005. That would be equivalent to adding $4.10 to the price of a gallon of gasoline if amortized over the total volume of imports. For Persian Gulf imports, because of the enormous military costs associated with the region, the "hidden cost" was equal to adding $7.41 cents to the price of a gallon of gasoline. When the nominal cost is combined with this figure it yields a "true" cost of $9.53 per gallon, but that is just the start.

Because the price of crude oil is expected to remain at least within the $60 range this year, expenditures for imports are expected to be at least $320 billion this year. That amounts to an increase of $70 billion in spending for foreign oil in just one year. That increase would raise the total import premium or "hidden cost" to $825.1 billion, or almost twice the President's $419.3 billion defense budget request for Fiscal Year 2006. If all costs are amortized over the total volume of imports, that would be equivalent to adding $5.04 to the price of a gallon of gasoline. For Persian Gulf imports, the premium would be $8.35. This would bring the "real" price of a gallon of gasoline refined from Persian Gulf oil to $10.86. At these prices the "real" cost of filling up a family sedan is $217.20, and filling up a large SUV $325.80.

But, can anything be done about this enormous drain on our economy?

The answer to that question is yes. But first we must clearly understand what is needed.

Defining The Problem

The simple truth is that we do not suffer from a lack of energy resources. Rather, what we suffer from is a lack of the political will and public consensus to use them.

As Pogo said, "We have met the enemy and they is us."

What then can we do?

The first step is to recognize that the immediate problem we face is how to assure adequate fuel supplies for the 220 million privately owned vehicles on the road today and for the vehicles and aircraft upon which our military relies. Within the civilian fleet, vehicles have an average lifespan of 16.8 years. The average age of our civilian vehicle fleet is 8.5 years. Therefore we will require conventional fuels or their analogs for at least a decade, even if every new vehicle produced from this day forth runs on some alternative.

The military's tactical fleet presents an even more complex problem. DOD assigns a twenty-year service life to vehicles when they are initially acquired. Upon reaching the twenty-year mark, however, they are recapitalized, in essence adding an additional two decades to their expected service period. For example, the HUMMVV, one of the most basic vehicles was first introduced in 1985, and will be in service for the foreseeable future. Therefore, for all practical purposes we must assume that our tactical fleet will be around for at least forty years.

For aircraft, the service life can be even longer.

The venerable B-52 Stratofortress, was first introduced in 1955, and is expected to remain in service at least until 2040. The C-130, first introduced in 1956, is still in production today, 50 years later. The F-15 Eagle was introduced in 1976, thirty years ago, and the F-16 Fighting Falcon in 1978, twenty-eight years ago.

So, clearly, conventional fuels will remain a military necessity for decades to come.

But there is another problem associated with our military fuel requirements: the move to a single fuel.

Special Considerations for Military Use

In 1990, the Department of Defense initiated implementation of the "Single Fuel Concept," or SFC. The notion of going to a single fuel grew out of operational

problems encountered in Europe in the early 1980s. The idea was straightforward enough: simplify fuel logistics by having one type of fuel for all aircraft and ground vehicles. This would hopefully lower costs and improve performance. DOD selected JP8 as their choice as a single fuel.

The only problem with this decision is that it presumes adequate refinery capacity to produce JP8 in the required quantities. In peacetime operations, DOD uses around 277,000 barrels of motor fuel per day. In combat operations this figure will rise to 450,000 barrels per day or more. Unfortunately, in conventional refineries, only around one-eighth of a barrel of oil is converted into jet fuel. Therefore, some 3.6 million barrels of oil would have to be processed in order to produce the 450,000 barrels of JP8 the military is likely to use in a major regional conflict.

The potential impact of a sudden increase in the military's need for jet fuel was demonstrated dramatically during Operation Desert Storm when Saudi Arabia invoked force majure provisions of its contracts in order to divert all of its jet fuel production to the war effort. The ensuing global jet fuel shortage caused prices to spike sharply. As a result of the price increase, Eastern Airlines, which was already in financial trouble, could not sustain operations and on January 18, 1991, it closed its doors after 65 years in business.

So, how can we address the civilian and military need for conventional fuels in an ever-tightening market? One answer is to use one of our most abundant fuels: coal.

Coal is an Answer

America is the Saudi Arabia of coal. Our nation has 275 million tons of demonstrated recoverable reserves, 26 percent of the world total. Further, the technology to convert coal into useable motor fuel has existed since the 1920s and has been in widespread use since the 1930s.

During World War II, Germany, lacking domestic oil resources, initiated a massive program to produce synthetic fuels. At its peak, in 1944 Germany was operating 25 synthetic fuels plants that produced an average of 124,000 barrels of synthetic fuel per day to power its military.

Currently, South Africa produces around 200,000 barrels of synthetic fuel from coal per day, and has just won approval from British aviation authorities to use an aviation fuel that is a 50/50 blend of synthetic and natural products. In addition, Shell Oil is currently operating a 14,500 barrel per day Fischer-Tropsch gas-to-liquids plant in Malaysia, and plans to build three large facilities in Qatar have been announced. These include a 140,000 barrel per day plant being built by Shell, a 160,000 barrel per day plant being built by Conoco and a 120,000 barrel per day plant being built by Marathon. In total, some 1.7 million barrels per day of G–T–L capacity are under consideration worldwide.

The idea of using domestic coal to produce synthetic motor fuels is not new.

In June of 1942, the House Committee on Mines and Mining held hearings on the potential to produce gasoline, rubber and other products from coal. In August of the following year the Senate Committee on Public Lands and Surveys held additional hearings on the production of synthetic liquid fuels from coal. As a consequence of these hearings the Synthetic Liquid Fuels Act was approved on April 5, 1944 authorizing the expenditure of $30 million to fund a five-year synthetic fuels demonstration program.

In 1946, West Virginia Representative Jennings Randolph said:

> "We cannot survive a prolonged famine in liquid fuels. We must not rely on uncertain foreign sources. It is in the interest of national security, it is imperative that an American synthetic liquid-fuels industry be established as soon as possible before another national emergency."

Given this early interest, what happened?

The advent of cheap oil from the Middle East undercut the economic viability of synthetic fuels.

Unfortunately, this process would be repeated time and time again whenever it appeared that economic conditions would finally provide a favorable environment for synthetic fuel production.

Today it appears that the economic conditions necessary to permit using America's vast coal resources have finally materialized.

How then can accomplish the task of transforming coal into useful motor fuels?

Perhaps the easiest way would be to use what we know works: the Fischer-Tropsch process.

Making Liquid Fuels from Coal

The process of making synthetic liquid fuels begins with converting coal to a gas. This can be accomplished through a variety of methods, all of which heat coal to

create a char that reacts with carbon dioxide and steam to create what is called a "synthesis gas." This synthesis gas is a combination of hydrogen and carbon monoxide. The synthesis gas is then subjected to an iron or cobalt catalyst through the Fischer-Tropsch process to create a "syncrude" that can be refined into the desired fuel.

There was considerable interest in the United States during the late 1970s and early 1980s regarding the use of the Fischer-Tropsch process to produce synthetic fuels. At the time, however, it was estimated that a crude oil price of around $45 per barrel was required to make synthetic fuel competitive. Therefore, the collapse of oil prices in the mid-1980s undermined its economic viability and most projects were abandoned.

Since that time, there have been advances in the Fischer-Tropsch technology that have reduced costs significantly. More important, it is now likely that a floor for oil prices has been established at between $55 and $65 per barrel. At this level, the production of synthetic fuels from coal is clearly economic.

But there are factors other than the direct economic costs that make an investment in developing a synthetic fuels capability prudent.

First of all, unlike production of fuels from crude oil, the product mix derived from syncrude can be tailored to meet specific needs. For example, as noted earlier, the Department of Defense has moved to establish a uniform fuel for all of its vehicles and aircraft. It is possible to tailor synthetic fuel production to meet this specific need.

A second point lies in the economic impact of moving to a domestically-based source of liquid fuels. Our current import dependence has robbed the Nation of at least 2.4 million jobs as a consequence of the hemorrhage of capital flowing abroad. Not only would this capital outflow cease, but hundreds of thousands of additional high-paying jobs would be created within the domestic economy to build and operate the new synthetic fuels industry.

A third point is that fuels created through this process can be designed to have superior environmental qualities. Indeed, one of the major products of the Shell synthetic fuel plant in Malaysia is ultra-low sulfur diesel fuel.

Finally, it is important to remember that some portion of every dollar we spend on oil from abroad makes its way into the hands of individuals who wish us harm. The simple truth is that international terrorism stands on two financial pillars: oil and the drug trade. To the extent that we reduce the revenues generated by either of these activities, we hinder the ability of terrorists to operate.

Clearly, the creation of a domestic industry to manufacture synthetic motor fuel from coal will entail an enormous expenditure of capital and scientific and technical resources. This cost, however, pales when compared with the estimated $825.1 billion annual price tag of our profligate import dependence. Still there are factors which must be overcome to make the potential of coal liquids a reality. Among the most important is market uncertainty,

From the time of the earliest efforts to develop a domestic industry to produce motor fuels from coal, the uncertainty over oil prices has been a major barrier to obtaining the financing necessary for such an undertaking. In the period immediately following the Second World War, just as experiments were proving the practicality of producing liquid fuels from coal, the discovery of vast, inexpensive supplies of oil in the Middle East cooled interest in this research. When, in the wake of the 1973 Arab Oil Embargo and 1979 Iranian Oil Boycott, interest in coal liquids was renewed, predatory moves by Saudi Arabia to dramatically reduce prices again stopped efforts cold.

Today, it is doubtful that such a dramatic turn in prices will occur again, but fears of such an eventuality are hindering the investment climate. There are a number of things, however, that can be done to address this situation.

First, Congress could establish a floor price for oil at around $45. This has the advantage of being fuel-neutral. The simple fact is that virtually all alternative forms of motor fuel suffer from the same problem as coal liquids—they cannot compete with cheap oil. Yet, as I noted earlier, there are other "hidden costs" that are not accounted for but are nonetheless real. By creating a floor price, we guard against the prospect of a predatory move by the producing nations to destroy alternative fuel options in the early stages of their development.

A second thing that can be done is to help encourage the production of alternative fuels such as coal liquids by having the government enter into purchase agreements with guaranteed prices. If prices rise, and I believe they will, the government will actually save money with such a program. Should prices be deliberately crashed, in order to eliminate the competition coal liquids or other alternatives represent, the investors who risked their funds to give the Nation greater energy security would have some measure of protection.

A third thing that this Committee, specifically, could do would be to send a letter to the Department of Defense urging it to make fuels produced through the Fischer-Tropsch process a standard for DOD. This would at a minimum make defense planners take a serious look at the Fischer-Tropsch process as a means of assuring adequate fuels of a consistent quality.

A final incentive that might be considered would be to provide royalty relief for fuels produced for the Department of Defense from domestic coal resources.

Obviously, all of these options entail some sort of financial outlay or exposure. The level of exposure, however, is minimal when considered against the background of the enormous "hidden costs" and military vulnerability our current import dependence creates. The question, therefore, is not, whether we can afford such a program, rather it is whether we can afford any additional delay in its implementation.

The simple fact is that our nation is in dire peril due to its excessive dependence on imported oil. But the situation is far from hopeless. We have the resources necessary to provide our nation's energy needs if we can only find the political will to do so.

Mr. GIBBONS. Thank you very much, Mr. Copulos. We appreciate your testimony.

We will turn now to Mr. David G. Hawkins, Natural Resources Defense Council. Mr. Hawkins, welcome. The floor is yours.

STATEMENT OF DAVID G. HAWKINS, DIRECTOR, CLIMATE CENTER, NATURAL RESOURCES DEFENSE COUNCIL

Mr. HAWKINS. Thank you very much, Mr. Chairman, and I thank you for the invitation to testify. I am David Hawkins, Director of the Climate Center at Natural Resources Defense Council.

There are many realities that we have to confront. I want to focus on two of them. First, the United States and other countries have abundant coal resources that will continue to be used for decades to come. The second reality is that the U.S. and other countries will need to sharply reduce global warming emissions in the decades ahead, and the challenge for Congress, for industry and groups like my own is to work together to reconcile these two realities.

NRDC believes that it is possible to reconcile continued use of coal with protecting the climate, but to do it we need to grapple now with the implications of today's energy investments on the global warming emissions that will result.

Now, there are ways to use coal that can cut global warming emissions and ways to use it that would greatly increase those emissions. If we make it a priority today to pursue the coal technologies that can cut global warming emissions, we can make a huge difference in the world that we leave to our children.

Let us walk through a few of these alternatives. First, using coal to make electricity can achieve very large reductions in carbon dioxide emissions if the carbon dioxide from those power plants is captured and sequestered deep underground. Now, all of the elements of this type of technology are commercially demonstrated today, but to get them deployed in the real world we need new policies, new incentives, new performance standards to make this happen. It is doable, and it will make an enormous difference if we do it or if we fail to do it.

The second coal use that I would mention is to make fertilizer and other chemicals. As we know, the fertilizer industry in this country is shocked by the high and volatile natural gas prices, and coal technology can be used to make fertilizer. It can also be

compatible with cutting global warming emissions again if the carbon dioxide from those production plants is captured. That is not likely to happen except for niche opportunities for enhanced oil recovery unless we have policies that put a premium on keeping CO_2 out of the air.

The third area, using coal to make liquid fuels, which is the focus of today's hearing, is really much more problematic. Processing coal to make liquid fuel produces large amounts of CO_2, and burning the fuel produces additional CO_2, CO_2 being carbon dioxide.

If the CO_2 at a coal-to-liquids plant is released into the air, the available information we have indicates that total CO_2 emissions from the CO_2 fuel production and use will be about 80 percent higher than from producing and burning gasoline or diesel from crude oil.

If the CO_2 from a coal-to-liquids plant is captured and kept out of the air then emissions would be about the same as for the current crude oil based system since the carbon in the liquid fuels themselves is about the same.

That is the problem. That means that with today's technology a large, new coal-to-liquids program would not be compatible with the need to cut emission reductions. A decision today to pursue a large coal-to-liquids program could leave large stranded investments or impose higher compliance costs on others to meet any particular level of emission reductions that we and others act to adopt.

Now, coal can play a role in the transportation sector that is compatible with our need to cut global warming emissions, and it can do that by making electricity at plants equipped with CO_2 capture and storage. If it does that, that electricity can be supplied to fleets of hybrid vehicles that are capable of being plugged into the grid, and basically we can back out oil in that fashion.

To conclude, Mr. Chairman, I would say that the impact of a large program that could occur for global warming, for conventional air pollution and damage due to expanded coal production are very substantial. Fortunately, we have a number of options that we can pursue to reduce our oil dependence and to protect our environment at the same time.

We have outlined a number of measures in our report called Securing America that was produced by us and the Institute for the Analysis of Global Security that would cut oil dependence by more than three million barrels a day in 10 years and achieve cuts of more than 11 million barrels a day by 2025.

That concludes my testimony, Mr. Chairman.

[The prepared statement of Mr. Hawkins follows:]

Statement of David G. Hawkins, Director,
Climate Center, Natural Resources Defense Council

Thank you for the opportunity to testify today on the subject of the future of coal and its environmental impacts. My name is David Hawkins. I am director of the Climate Center at the Natural Resources Defense Council (NRDC). NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco.

One of the primary reasons that the electric power, chemical, and liquid fuels industries have become increasingly interested in coal gasification technology in the

last several years is the volatility and high cost of both natural gas and oil. Coal has the advantages of being a cheap, abundant, and a domestic resource compared with oil and natural gas. However, the disadvantages of conventional coal use cannot be ignored. From underground accidents and mountain top removal mining, to collisions at coal train crossings, to air emissions of acidic, toxic, and heat-trapping pollution from coal combustion, to water pollution from coal mining and combustion wastes, the conventional coal fuel cycle is among the most environmentally destructive activities on earth.

But we can do better with both production and use of coal. And because the world is likely to continue to use significant amounts of coal for some time to come, we must do better. Energy efficiency remains the cheapest, cleanest, and fastest way to meet our energy and environmental challenges, while renewable energy is the fastest growing supply option. Increasing energy efficiency and expanding renewable energy supplies must continue to be the top priority, but we have the tools to make coal more compatible with protecting public health and the environment. With the right standards and incentives we can fundamentally transform the way coal is produced and used in the United States and around the world.

In particular, coal use and climate protection do not need to be irreconcilable activities. While energy efficiency and greater use of renewable resources must remain core components of a comprehensive strategy to address global warming, development and use of technologies such as coal gasification in combination with carbon dioxide (CO_2) capture and permanent disposal in geologic repositories under certain circumstances could enhance our ability to avoid a dangerous build-up of this heat-trapping gas in the atmosphere while creating a future for continued coal use.

However, because of the long lifetime of carbon dioxide in the atmosphere and the slow turnover of large energy systems we must act without delay to start deploying these technologies. Current government policies are inadequate to drive the private sector to invest in carbon capture and storage systems in the time frame we need them. To accelerate the development of these systems and to create the market conditions for their use, we need to focus government funding more sharply on the most promising technologies. More importantly, we need to adopt reasonable binding measures to limit global warming emissions so that the private sector has a business rationale for prioritizing investment in this area.

Congress is now considering proposals to gasify coal as a replacement for natural gas and oil[1]. These proposals need to be evaluated in the context of the compelling need to reduce global warming emissions steadily and significantly, starting now and proceeding constantly throughout this century. Because today's coal mining and use also continues to impose a heavy toll on America's land, water, and air, damaging human health and the environment, it is also critical to examine the implications of a substantial coal gasification program on these values as well.

Reducing Natural Gas and Oil Demand

The nation's economy, our health and our quality of life depend on a reliable supply of affordable energy services. The most significant way in which we can achieve these national goals is to exploit the enormous scope to wring more services out of each unit of energy used and by aggressively promoting renewable resources. While coal gasification technology has been touted as the technology solution to supplement our natural gas and oil supply and reduce our dependence on natural gas and oil imports, the most effective way to lower natural gas and oil demand, and prices, is to waste less. America needs to first invest in energy efficiency and conservation to reduce demand, and to second promote renewable energy alternatives to supplement supply. Gasified coal may have a role to play, but in both the short-term and over the next two decades, efficiency and renewables are the lead actors in an effective strategy to moderate natural gas and oil prices and balance our demand with reasonable expectations of supply.

Natural Gas

We know that today's natural gas prices have had a particularly significant impact on the agricultural sector by raising the cost of making fertilizer among other products. We agree that effective steps should be taken to fix this problem. In our view a package of measures to increase the efficiency of current gas uses, substitution of renewable energy for other gas uses, and judicious use of coal gasification with CO_2 capture and disposal would be the most effective program. With respect to the coal gasification component of this policy package, it is important to address and prevent the additional harmful impacts to land and water that would result if incremental coal production were carried out with current mining and production practices. As pointed out in Appendix A, current practices are causing unacceptable and avoidable levels of damage to land, water and mining communities.

Increasing energy efficiency is far-and-away the most cost-effective way to reduce natural gas consumption, avoid emitting carbon dioxide and other damaging environmental impacts. Technologies range from efficient lighting, including emerging L.E.D. lamps, to advanced selective membranes which reduce industrial process energy needs. Critical national and state policies include appliance efficiency standards, performance-based tax incentives, utility-administered deployment programs, and innovative market transformation strategies that make more efficient designs standard industry practice.

Conservation and efficiency measures such as these can have dramatic impacts in terms of price and savings.[2] Moreover, all of these untapped gas efficiency "resources" will expand steadily, as a growing economy adds more opportunities to secure long-lived savings. California has a quarter century record of using comparable strategies to reduce both natural gas consumption and the accompanying utility bills. Recent studies commissioned by the Pacific Gas & Electric Company indicate that, by 2001, longstanding incentives and standards targeting natural gas equipment and use had cut statewide consumption for residential, commercial, and industrial purposes (excluding electric generation) by more than 20 percent.

Renewables can also play a key role in reducing natural gas prices. Adoption of a national renewable energy standard (RES) can significantly reduce the demand for natural gas, alleviating potential shortages. The Energy Information Administration (EIA) has found that a national 10 percent renewable energy standard could reduce gas consumption by 1.4 trillion cubic feet per year in 2020 compared to business as usual, or roughly 5 percent of annual demand.[3]

Studies have consistently shown that reducing demand for natural gas by increasing renewable energy use will reduce natural gas prices. According to a report released by the U.S. Department of Energy's Lawrence Berkeley National Laboratory, "studies generally show that each 1% reduction in national gas demand is likely to lead to a long-term (effectively permanent) average reduction in wellhead gas prices of 0.8% to 2%. Reductions in wellhead prices will reduce wholesale and retail electricity rates and will also reduce residential, commercial, and industrial gas bills."[4] EIA found that increasing renewable energy to 10 percent by 2020 would result in $4.9 billion cumulative present value savings for industrial gas consumers, $1.8 billion to commercial customers, and $2.4 billion to residential customers.[5] EIA also found that renewable energy can also reduce electricity bills.[6] Lower natural gas prices for electricity generators and other consumers offset the slightly higher cost of renewable electricity technology.[7]

Implementing effective energy efficiency measures is the fastest and most cost effective approach to balancing natural gas demand and supply. Renewable energy provides a critical mid-term to long-term supplement. Analysis by the Union of Concerned Scientists found that a combined efficiency and renewable energy scenario could reduce gas use by 31 percent and natural gas prices by 27 percent compared to business as usual in 2020.[8]

In contrast to these strategies, pursuing coal gasification implementation strategies that address only natural gas supply concerns, while ignoring impacts of coal, is a recipe for huge and costly mistakes. Fortunately, we have in our tool box energy resource options that can reduce natural gas demand and global warming emissions as well as protecting America's land, water, and air.

Oil

NRDC fully agrees that reducing oil dependence should be a national priority and that new policies and programs are needed to avert the mounting problems associated with today's dependence and the much greater dependence that lies ahead if we do not act. A critical issue is the path we pursue in reducing oil dependence: a "green" path that helps us address the urgent problem of global warming and our need to reduce the impacts of energy use on the environment and human health; or a "brown" path that would increase global warming emissions as well as other health and environmental damage. In deciding what role coal might play as a source of transportation fuel NRDC believes we must first assess whether it is possible to use coal to make liquid fuels without exacerbating the problems of global warming, conventional air pollution and impacts of coal production and transportation.

If coal were to play a significant role in displacing oil, it is clear that the enterprise would be huge, so the health and environmental stakes are correspondingly huge. The coal company Peabody Energy is promoting a vision that would call for production of 2.6 million barrels per day of synthetic transportation fuel from coal by 2025, about 10% of forecasted oil demand in that year. According to Peabody, using coal to achieve that amount of crude oil displacement would require construction of 33 very large coal-to-liquids plants, each plant consuming 14.4 million tons of coal per year to produce 80,000 barrels per day of liquid fuel. Each of these plants

would cost $6.4 billion to build. Total additional coal production required for this program would be 475 million tons of coal annually requiring an expansion of coal mining of 43% above today's level.[9]

This testimony does not attempt a thorough analysis of the impacts of a program of this scale. Rather, it will highlight the issues that should be addressed in a detailed assessment.

Environmental Impacts of Coal

Some call coal "clean." It is not and likely never will be compared to other energy options. Nonetheless, it appears inevitable that the U.S. and other countries will continue to rely heavily on coal for many years. The good news is that with the right standards and incentives it is possible to chart a future for coal that is compatible with protecting public health, preserving special places, and avoiding dangerous global warming. It may not be possible to make coal clean, but by transforming the way coal is produced and used, it is possible to make coal dramatically cleaner—and safer—than it is today.

Global Warming Pollution

To avoid catastrophic global warming the U.S. and other nations will need to deploy energy resources that result in much lower releases of CO_2 than today's use of oil, gas and coal. To keep global temperatures from rising to levels not seen since before the dawn of human civilization, the best expert opinion is that we need to get on a pathway now to allow us to cut global warming emissions by 60-80% from today's levels over the decades ahead. The technologies we choose to meet our future energy needs must have the potential to perform at these improved emission levels.

Most serious climate scientists now warn that there is a very short window of time for beginning serious emission reductions if we are to avoid truly dangerous greenhouse gas reductions without severe economic impact. Delay makes the job harder. The National Academy of Sciences recently stated: "Failure to implement significant reductions in net greenhouse gases will make the job much harder in the future—both in terms of stabilizing their atmospheric abundances and in terms of experiencing more significant impacts."[10]

In short, a slow start means a crash finish—the longer emissions growth continues, the steeper and more disruptive the cuts required later. To prevent dangerous global warming we need to stabilize atmospheric concentration at or below 450 ppm, which would keep total warming below 2 degrees Celsius (3.6 degrees Fahrenheit). If we start soon, we can stay on the 450 ppm path with an annual emission reduction rate that gradually ramps up to about 2.4% per year. But if we delay a serious start by 10 years and continue emission growth at the business-as-usual trajectory, the annual emission reduction rate required to stay on the 450 ppm pathway jumps almost 3-fold, to 6.9% per year. (See Figure 1, attached.) Even if you do not accept today that the 450 ppm path will be needed please consider this point. If we do not act to preserve our ability to get on this path we will foreclose the path not just for ourselves but for our children and their children. We are now going down a much riskier path and if we do not start reducing emissions soon neither we nor our children can turn back no matter how dangerous the path becomes.

In the past, some analysts have argued that the delay/crash action scenario is actually the cheaper course, because in the future (somehow) we will have developed breakthrough technologies. But it should be apparent that the crash reductions scenario is implausible for two reasons. First, reducing emissions by 6.9 percent per year would require deploying advanced low-emission technologies at least several times faster than conventional technologies have been deployed over recent decades. Second, the effort would require prematurely retiring billions of dollars in capital stock—high-emitting power plants, vehicles, etc. that will be built or bought during the next 10-20 years under in the absence of appropriate CO_2 emission limits.

It also goes without saying that U.S. leadership is critical. Preserving the 450 ppm pathway requires other developed countries to reduce emissions at similar rates, and requires the key developing countries to dramatically reduce and ultimately reverse their emissions growth. U.S. leadership can make that happen faster.

To assess the global warming implications of a large coal gasification program we need to carefully examine the total life-cycle emissions associated with the end product, whether electricity, synthetic gas, liquid fuels or chemicals, and to assess if the relevant industry sector will meet the emission reductions required to be consistent with the "green" pathway presented in Figure 1.

Electricity Sector

More than 90 percent of the U.S. coal supply is used to generate electricity in some 600 coal-fired power plants scattered around the country, with most of the remainder used for process heat in heavy industrial and in steel production. Coal is used for power production in all regions of the country, with the Southeast, Midwest, and Mountain states most reliant on coal-fired power. Texas uses more coal than any other state, followed by Indiana, Illinois, Ohio, and Pennsylvania.[11]

About half of the U.S. electricity supply is generated using coal-fired power plants. This share varies considerably from state to state, but even California, which uses very little coal to generate electricity within its borders, consumes a significant amount of electricity generated by coal in neighboring Arizona and Nevada, bringing coal's share of total electricity consumed in California to 20 percent.[12] National coal-fired capacity totals 330 billion watts (GW), with individual plants ranging in size from a few million watts (MW) to over 3000 MW. More than one-third of this capacity was built before 1970, and over 400 units built in the 1950s—with capacity equivalent to roughly 100 large modern plants (48 GW)—are still operating today.

The future of coal in the U.S. electric power sector is an uncertain one. The major cause of this uncertainty is the government's failure to define future requirements for limiting greenhouse gas emissions, especially carbon dioxide (CO_2). Coal is the fossil fuel with the highest uncontrolled CO_2 emission rate of any fuel and is responsible for 36 percent U.S. carbon dioxide emissions. Furthermore, coal power plants are expensive, long-lived investments. Key decision makers understand that the problem of global warming will need to be addressed within the time needed to recoup investments in power projects now in the planning stage. Since the status quo is unstable and future requirements for coal plants and other emission sources are inevitable but unclear, there will be increasing hesitation to commit the large amounts of capital required for new coal projects.

Electricity production is the largest source of global warming pollution in the U.S. today. In contrast to nitrogen and sulfur oxide emissions, which have declined significantly in recent years as a result of Clean Air Act standards, CO_2 emissions from power plants have increased by 27 percent since 1990. Any solution to global warming must include large reductions from the electric sector. Energy efficiency and renewable energy are well-known low-carbon methods that are essential to any climate protection strategy. But technology exists to create a more sustainable path for continued coal use in the electricity sector as well. Coal gasification can be compatible with significantly reducing global warming emissions in the electric sector if it replaces conventional coal combustion technologies, directly produces electricity in an integrated manner, and most importantly captures and disposes of the carbon in geologic formations. IGCC technology without CO_2 capture and disposal achieves only modest reductions in CO_2 emissions compared to conventional coal plants.

A coal integrated gasification combined cycle (IGCC) power plant with carbon capture and disposal can capture up to 90 percent of its emissions, thereby being part of the global warming solution. In addition to enabling lower-cost CO_2 capture, gasification technology has very low emissions of most conventional pollutants and can achieve high levels of mercury control with low-cost carbon-bed systems. However, it still does not address the other environmental impacts from coal production and transportation discussed in more detail in Appendix A.

The electric power industry has been slow to take up gasification technology but two commercial-scale units are operating in the U.S.—in Indiana and Florida. The Florida unit, owned by TECO, is reported by the company to be the most reliable and economic unit on its system. Two coal-based power companies, AEP and Cinergy, have announced their intention to build coal gasification units. BP also has announced plans to build a petroleum coke gasification plant that will capture and sequester CO_2.

Liquid Fuels

To assess the global warming implications of a large coal-to-liquids program we need to examine the total life-cycle or "well-to-wheel" emissions of these new fuels. Coal is a carbon-intensive fuel, containing double the amount of carbon per unit of energy compared to natural gas and about 20% more than petroleum. When coal is converted to liquid fuels, two streams of CO_2 are produced: one at the coal-to-liquids production plant and the second from the exhausts of the vehicles that burn the fuel. With the technology in hand today and on the horizon it is difficult to see how a large coal-to-liquids program can be compatible with the low-CO_2-emitting transportation system we need to design to prevent global warming.

Today, our system of refining crude oil to produce gasoline, diesel, jet fuel and other transportation fuels, results in a total "well to wheels" emission rate of about 27.5 pounds of CO_2 per gallon of fuel. Based on available information about coal-

to-liquids plants being proposed, the total well to wheels CO_2 emissions from such plants would be about 49.5 pounds of CO_2 per gallon, nearly twice as high as using crude oil, if the CO_2 from the coal-to-liquids plant is released to the atmosphere.[13] Obviously, introducing a new fuel system with double the CO_2 emissions of today's crude oil system would conflict with the need to reduce global warming emissions. If the CO_2 from coal-to-liquids plants is captured, then well-to-wheels CO_2 emissions would be reduced but would still be higher than emissions from today's crude oil system.[14]

This comparison indicates that using coal to produce a significant amount of liquids for transportation fuel would not be compatible with the need to develop a low-CO_2 emitting transportation sector unless technologies are developed to significantly reduce emissions from the overall process. But here one confronts the unavoidable fact that the liquid fuel from coal contains the same amount of carbon as is in gasoline or diesel made from crude. Thus, the potential for achieving significant CO_2 emission reductions compared to crude is inherently limited. This means that using a significant amount of coal to make liquid fuel for transportation needs would make the task of achieving any given level of global warming emission reduction much more difficult. Proceeding with coal-to-liquids plants now could leave those investments stranded or impose unnecessarily high abatement costs on the economy if the plants continue to operate.

Synthetic Gas

Another area that has received interest is coal gasification to produce synthetic natural gas as a direct method of supplementing our natural gas supply from domestic resources. However, without CO_2 capture and disposal this process results in more than twice as much CO_2 per 1000 cubic feet of natural gas consumed compared to conventional resources.[15] From a global warming perspective this is unacceptable. With capture and disposal the CO_2 emissions can be substantially reduced, but still remain 12 percent higher than natural gas.

In Beulah, North Dakota the Basin Electric owned Dakota Gasification Company's Great Plains Synfuels Plant is a 900MW facility which gasifies coal to produce synthetic "natural" gas. It can produce a 150 million cubic feet of synthetic gas per day and 11,000 tons of CO_2 per day. However, it no longer releases all of its CO_2 to the atmosphere, but captures most of it and pipes it 200 miles to an oil field near Weyburn, Saskatchewan. There the CO_2 is pumped underground into an aging oil field to recover more oil. EnCana, operator of this oil field, pays $2.5 million per month for the CO_2. They expect to sequester 20 million tons of CO_2 over the lifetime of this injection project.

A potential use for coal-produced synthetic gas would be to burn it in a gas turbine at another site for electricity generation. This approach would result in substantially higher CO_2 emissions than producing electricity in an integrated system at the coal gasification plant with CO_2 capture at the site (i.e., in an IGCC plant with carbon capture and disposal). Coal produced synthetic natural gas could also be used directly for home heating. As a distributed source of emissions the CO_2 would be prohibitive to capture with known technology.

Before producing synthetic pipeline gas from coal a careful assessment of the full fuel cycle emission implications and the emission reductions that are required from that sector must be carried out before decisions are made to invest in these systems.

Chemical Products

The chemical industry has also been looking carefully at coal gasification technology as a way to replace the natural gas feedstock used in chemical production. The motivator has been the escalating and volatile costs of natural gas in the last few years. A notable example in the U.S. of such a use is the Tennessee Eastman plant, which has been operating for more than 20 years using coal instead of natural gas to make chemicals and industrial feedstocks. If natural gas is replaced by coal gasification as a feedstock for the chemical industry, first and foremost CO_2 capture and disposal must be an integral part of such plants. In this case, the net global warming emissions will change relatively little from this sector. However, before such a transformation occurs a careful analysis of the life cycle emissions needs to be carried out along with an assessment of how future emissions reductions from this sector can be most effectively accomplished.

CO_2 Capture and Disposal

Methods to capture CO_2 from industrial gas streams have been in use for decades. In the U.S., for example, they are used to separate CO_2 from "sour gas" at natural gas processing plants and are even in use at a few coal-fired power plants to produce CO_2 for sale to the food and beverage industries. As previously mentioned, in North Dakota a large coal gasification plant captures CO_2 and ships it by pipeline

to an oil field in Saskatchewan, where it is injected to produce additional oil. In Wyoming, a large gas processing plant captures CO_2 for sale to oil field operators in that state and in Colorado. Smaller plants in Texas do the same thing to serve oil fields in the Permian Basin.

Once captured, the CO_2 must be disposed of and the currently viable approach is to inject the CO_2 into deep geologic formations that are capable of permanently retaining it. Geologic injection of CO_2 has been underway in the U.S. for a couple of decades as a method for producing additional oil from declining fields. Today, oil companies inject about 30 million tons annually into fields in the Permian Basin, Wyoming, Colorado and other states.

Because industrial sources can emit CO_2 for free under current U.S. policy, most of the injected CO_2 is supplied from natural CO_2 reservoirs, rather than being captured from emission sources. Ironically, due to the lack of emission limits and the limited number of natural CO_2 fields, a CO_2 supply shortage is currently constraining enhanced oil recovery from existing fields. There is, of course, a huge supply of CO_2 from power plants and other sources that would become available to supply this market, but that will not happen as long as CO_2 can be emitted at no cost.

Such enhanced oil recovery (EOR) operations are regulated to prevent releases that might endanger public health or safety but they are not monitored with any techniques that would be capable of detecting smaller leak rates. Small leak rates might pose no risk to the local surroundings but over time could undercut the effectiveness of geologic storage as a CO_2 control technique. Especially in EOR operations, the most likely pathways for leakage would be through existing wells penetrating the injection zone.

Much of the injected CO_2 is also brought back to the surface with the oil produced by this technique. That CO_2 is typically reinjected to recover additional oil, but when oil operations are completed it may be necessary to inject the CO_2 into a deeper geologic formation to ensure permanent storage.

In addition to these EOR operations, CO_2 is being injected in large amounts in several other projects around the world. The oldest of these involves injection of about 1 million tons per year of CO_2 from a natural gas platform into a geologic formation beneath the sea bed off the coast of Norway. The company decided to inject the CO_2 rather than vent it to avoid paying an emission charge adopted by the Norwegian government—a clear example of the ability of emission policies to produce the deployment of this technology. The Norwegian operation is intensively monitored and the results from over seven years of operation indicate the CO_2 is not migrating in a manner that would create a risk of leakage. Other large-scale carefully monitored operations are underway at the Weyburn oil field in Saskatchewan and the In Salah natural gas field in Algeria.

While additional experience with large-scale injection in various geologic formations is needed, we believe enough is known to expand these activities substantially under careful procedures for site selection, operating requirements and monitoring programs. The imperative of avoiding further carbon lock-in due to construction of conventional coal-fired power plants and the capabilities of CO_2 capture and disposal technologies today warrant policies to deploy these methods at coal gasification plants without further delay.

Conventional Air Pollution

Dramatic reductions in power plant emissions of criteria pollutants, toxic compounds, and global warming emissions are essential if coal is to remain a viable energy resource for the 21st Century. Such reductions are achievable in integrated gasification combined cycle (IGCC) systems, which enable cost-effective advanced pollution controls that can yield extremely low criteria pollutant and mercury emission rates and facilitates carbon dioxide capture and geologic disposal. Gasifying coal at high pressure facilitates removal of pollutants that would otherwise be released into the air such that these pollutant emissions are well below those from conventional pulverized coal power plants with post combustion cleanup.

Conventional air emissions from coal-to-liquids plants include sulfur oxides, nitrogen oxides, particulate matter, mercury and other hazardous metals and organics. While it appears that technologies exist to achieve high levels of control for all or most of these pollutants, the operating experience of coal-to-liquids plants in South Africa demonstrates that coal-to-liquids plants are not inherently "clean." If such plants are to operate with minimum emissions of conventional pollutants, performance standards will need to be written—standards that do not exist today in the U.S. as far as we are aware.

In addition, the various federal emission cap programs now in force would apply to few, if any, coal-to-liquids plants.[16]

Thus, we cannot say today that coal-to-liquids plants will be required to meet stringent emission performance standards adequate to prevent either significant localized impacts or regional emissions impacts.

Mining, Processing and Transporting Coal

The impacts of mining, processing, and transporting 1.1 billion tons of coal today on health, landscapes, and water are large. To understand the implications of continuing our current level of as well as expanding coal production, it is important to have a detailed understanding of the impacts from today's level of coal production. A summary is included in Appendix A. It is clear that we must find more effective ways to reduce the impacts of mining, processing and transporting coal before we follow a path that would result in even larger amounts of coal production and transportation.

"Carbon Capture Ready" and the "Energy Policy Act of 2005"

Among the various environmental concerns associated with coal use, the global warming emissions are particularly critical as coal fired power generation emits more carbon dioxide per unit of energy than any other power generating process. It is clear that for coal to remain a major source of electricity generation within a carbon constrained world, carbon capture and disposal technologies will have to be deployed in conjunction coal fired power plants.

The required elements of a coal-based CO_2 capture and disposal (CCD) system have all been demonstrated at commercial scale in numerous projects around the world. But there is large potential for optimization of each element to bring down costs and improve efficiency. In addition, the experience with large scale injection of CO_2 into geologic formations is still limited.

In the "Energy Policy Act of 2005" (EPACT05), while there are myriad incentives for deploying coal gasification technology, there are no requirements to include CO_2 capture and disposal. Scattered throughout the Act is language referring to the capability of coal gasification technology to capture its carbon emissions or to be "carbon capture ready". However, nothing requires the facilities to actually capture and dispose of their CO_2 emissions. Several examples are the following:

- Title IV—Coal—section 413 (b)(3) Western Integrated Coal Gasification Demonstration Project: "Shall be capable of removing and sequestering carbon dioxide emissions."
- Title VIII—Hydrogen—section 805(e)(1)(A) "Fossil fuel, which may include carbon capture and sequestration;"
- Title XIII—Energy Policy Tax Incentives—section 1307(b) "Sec. 48A. (c) Definitions (5) GREENHOUSE GAS CAPTURE CAPABILITY—The term 'greenhouse gas capture capability' means an integrated gasification combined cycle technology facility capable of adding components which can capture, separate on a long-term basis, isolate, remove, and sequester greenhouse gases which result from the generation of electricity."

  "Sec. 48B. (c) Definitions (5) CARBON CAPTURE CAPABILITY—The term 'carbon capture capability' means a gasification plant design which is determined by the Secretary to reflect reasonable consideration for, and be capable of, accommodating the equipment likely to be necessary to capture carbon dioxide from the gaseous stream, for later use or sequestration, which would otherwise be emitted in the flue gas from a project which uses a nonrenewable fuel."
- Title XVII—Incentives for Innovative Technologies—Section 1703(c)(1)(A)(ii) "that have a design that is determined by the Secretary to be capable of accommodating the equipment likely to be necessary to capture the carbon dioxide that would otherwise be emitted in flue gas from the plant;"

The issue I would like to address here is the definition of "carbon capture ready." Adding carbon capture capabilities to a coal gasification power plant is not a simple modification.[17] Without any current regulatory or economic incentives for these facilities to capture and dispose of their carbon emissions the extent of the capture modifications that will be incorporated into the gasification facilities remains extremely unclear. I would, in fact, argue that due to the vagueness of this term the result will be a "race to the bottom", a minimal effort to incorporate the necessary design elements and equipment that would allow coal gasification plants to qualify for EPACT05 incentives.

What are the required technical details associated with coupling coal gasification plants with carbon capture and disposal? Carbon capture in a coal gasification plant occurs after the coal gasification process. I will focus on the case for electricity generation (an IGCC plant) where the syngas produced then enters a gas turbine. It is at this stage that the chemical process can be inserted to separate and capture

the CO_2 and other pollutants from the syngas. Once the CO_2 is separated it can be transported to a disposal location.

In addition to adding the CO_2 separation and capture equipment, changes in other components are also necessary for electricity generation case. The removal of CO_2 prior to combustion in the turbine alters the composition of the gas to be burned, increasing the hydrogen content, which may affect the design or operational requirements of the turbine. In addition, the CO_2 capture process may alter the optimal design of the desulphurization and other gas clean-up processes. For these reasons, an IGCC plant built without consideration for CO_2 capture technology designed to produce power at a minimum cost and maximum efficiency will be significantly different than an IGCC plant designed to incorporate CO_2 capture technology.

"Three major technological components need to be added to a basic IGCC plant to allow for separation and capture of the CO_2: (1) the shift reactor to convert the CO in the syngas to CO_2, (2) the process to separate the CO_2 from the rest of the gas stream, and (3) a compressor to reduce the volume of separated CO_2 before it can be transported."[18] Furthermore, other components will require modification, as previously mentioned, including the gas turbine that will have to be capable of operating with a hydrogen enriched gas stream, the timing of the sulphur removal process, plus some scaling up to accommodate the larger quantities of coal needed to generate the same amount of power.

A further consideration is the CO_2 transportation and disposal. Once the CO_2 is captured and compressed at the plant it must be transported and injected into an underground geologic formation. Therefore, the location of the plant can also become a significant factor in the ease of transformation.

What should be clear from this listing of requirements for integrating capture and disposal of CO_2 into an existing IGCC plant is that the term "carbon capture ready" could encompass a whole host of definitions. Does it simply mean that one builds an IGCC plant? Does it mean that you leave space in the design for separation, capture and compression equipment? Does it mean you include the appropriate turbine to burn a high H2 gas stream? Does it mean you locate the plant within proximity to a geologic reservoir where the CO_2 can be disposed of? The list and variations of the possibilities could go on and on, calling into question whether the term "carbon capture ready" has any real meaning.

The likely result is that companies when taking advantage of the coal gasification incentives provided in the "Energy Policy Act of 2005" will follow the least cost option, i.e., build an IGCC plant with little or no design elements necessary for the future integration of CO_2 capture and disposal—unless there is a clear policy to reduce CO_2 emissions or if it is required that they include all the necessary equipment to capture their CO_2.

NRDC strongly advocates that all government funds that leverage the building of coal gasification plants should only go to those facilities that actually capture their CO_2. Subsidizing gasification by itself wastes taxpayers' money by subsidizing the wrong thing. Gasification is commercial and needs no subsidy but capture and storage is the primary policy objective and is likely to require subsidies pending adoption of CO_2 emission control requirements.

The first proposed coal gasification plant that will capture and dispose of its CO_2 was recently announced on February 10, 2006 by BP and Edison Mission Group. The plant will be built in Southern California and its CO_2 emissions will be pipelined to an oil field nearby and injected into the ground to recover domestic oil. BP's proposal shows the technologies are available now to cut global warming pollution and that integrated IGCC with CO_2 capture and disposal are commercially feasible.

The Path Forward

The impacts that a large coal gasification program could have on global warming pollution, conventional air pollution and environmental damage resulting from the mining, processing and transportation of the coal are substantial. Before deciding whether to invest scores, perhaps hundreds of billions of dollars in deploying this technology, we must have a program to manage our global warming pollution and other coal related impacts. Otherwise we will not be developing and deploying an optimal energy system.

One of the primary motivators for pushing coal gasification technologies has been to reduce natural gas prices. Fortunately, the U.S. can have a robust and effective program to reduce natural gas demand, and therefore prices, without rushing to embrace coal gasification technologies. A combination of efficiency and renewables can reduce our natural gas demand more quickly and more cleanly.

Implementing effective energy efficiency measures is the fastest and most cost effective approach to reducing natural gas demand. Efficiency standards,

performance-based tax incentives, utility-administered deployment programs, and innovative market transformation strategies will bring energy efficient technologies to market and make efficient designs standard industry practice.

Renewable energy provides a critical mid-term to long-term supplement to natural gas use. Potential renewable resources in the U.S. are significant and renewable electricity generation is expanding rapidly, with wind and biomass currently offering the most cost-effective power in both countries. Some 20 U.S. states have adopted renewable portfolio standards requiring electricity providers to obtain a minimum portion of their portfolio from renewable resources. Federal tax incentives have also played an important role, particularly for wind.

The other major motivator for the push to use coal gasification is to produce liquid fuels to reduce our oil dependence. The U.S. can have a robust and effective program to reduce oil dependence without rushing into an embrace of coal-to-liquids technologies. A combination of more efficient cars, trucks and planes, biofuels, and "smart growth" transportation options outlined in report "Securing America," produced by NRDC and the Institute for the Analysis of Global Security, can cut oil dependence by more than 3 million barrels a day in 10 years, and achieve cuts of more than 11 million barrels a day by 2025, far outstripping the 2.6 million barrel a day program being promoted by Peabody.[19] For further details see Appendix B.

To reduce our dependence on natural gas and oil we should follow a simple rule: start with the measures that will produce the quickest, cleanest and least expensive reductions in natural gas use; measures that will put us on track to achieve the reductions in global warming emissions we need to protect the climate. If we are thoughtful about the actions we take, our country can pursue an energy path that enhances our security, our economy, and our environment.

With current coal and oil consumption trends, we are headed for a doubling of CO_2 concentrations by mid-century if we don't redirect energy investments away from carbon based fuels and toward new climate friendly energy technologies.

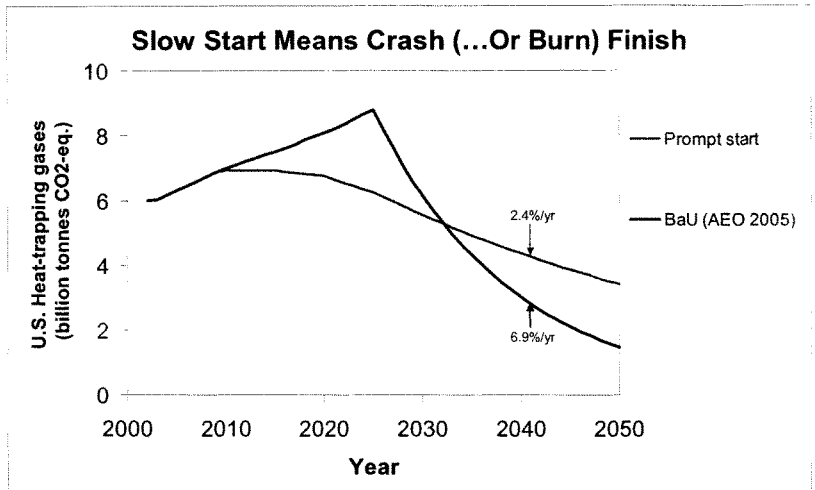
We have to accelerate the progress underway and adopt policies in the next few years to turn the corner on our global warming emissions, if we are to avoid locking ourselves and future generations into a dangerously disrupted climate. Scientists are very concerned that we are very near this threshold now. Most say we must keep atmosphere concentrations of CO_2 below 450 parts per million, which would keep total warming below 2 degrees Celsius (3.6 degrees Fahrenheit). Beyond this point we risk severe impacts, including the irreversible collapse of the Greenland Ice Sheet and dramatic sea level rise. With CO_2 concentrations now rising at a rate of 1.5 to 2 parts per million per year, we will pass the 450ppm threshold within two or three decades unless we change course soon.

In the United States, a national program to limit carbon dioxide emissions must be enacted soon to create the market incentives necessary to shift investment into the least-polluting energy technologies on the scale and timetable that is needed. There is growing agreement between business and policy experts that quantifiable and enforceable limits on global warming emissions are needed and inevitable. To ensure the most cost-effective reductions are made, these limits can then be allocated to major pollution sources and traded between companies, as is currently the practice with sulfur emissions that cause acid rain. Targeted energy efficiency and renewable energy policies are critical to achieving CO_2 limits at the lowest possible cost, but they are no substitute for explicit caps on emissions.

A coal integrated gasification combined cycle (IGCC) power plant with carbon capture and disposal can also be part of a sustainable path that reduces both natural gas demand and global warming emissions in the electricity sector. Methods to capture CO_2 from coal gasification plants are commercially demonstrated, as is the injection of CO_2 into geologic formations for disposal. On the other hand, coal gasification to produce a significant amount of liquids for transportation fuel would not be compatible with the need to develop a low-CO_2 emitting transportation sector. Finally, gasifying coal to produce synthetic pipeline gas or chemical products needs a careful assessment of the full life cycle emission implications and the emission reductions that are required from those sectors before decisions are made to invest in these systems.

In the absence of a program that requires limits on CO_2 emissions IGCC systems with carbon capture and disposal will not be brought to market in time. We need to combine CO_2 limits with financial incentives to start building these integrated plants now, because industry is already building and designing the power plants that we will rely on for the next 40-80 years.

Figure 1



Total cumulative emissions (2002-2050) for all scenarios are 75 billion tonnes carbon-equivalent (GtC). This budget is an indicative U.S. share (20%) of the global emissions budget required for stabilizing the concentration of CO_2 in the atmosphere at 450 ppm. The "Prompt start" (green) curve follows the emission reduction schedule proposed above. With reductions starting in 2016, emissions need to decline by 2.4%/year from 2026-2050 to result in total cumulative emissions of 75 GtC over the period. The black curve shows the emissions reduction pathway that would be required if we followed a business-as-usual (BAU) scenario out to 2025. To meet the same 75 GtC emissions budget, emissions must decline, by 6.9%/yr, from 2026-2050.

ENDNOTES

[1]David Hawkins, Testimony before the Senate Energy and Natural Resources Committee, "Coal Liquefaction and Gasification", April 24th, 2006. http://docs.nrdc.org/globalwarming/glo—06042401a.pdf; Antonia Herzog, Testimony before the Senate Energy and Natural Resources Committee, "Coal Gasification", May 1, 2006.

[2]American Council for an Energy-Efficient Economy (ACEEE), Fall 2004 Update on Natural Gas Markets, November 3, 2004. See also Consumer Federation of America, "Responding to Turmoil in Natural Gas Markets: The Consumer Case for Aggressive Policies to Balance Supply and Demand," December 2004, pp. 28, 11 ("[V]igorous efforts to improve efficiency" should be the first policy option pursued, because even small reductions in natural gas consumption can have a significant downward impact on prices.)

[3]EIA, Impacts of a 10-Percent Renewable Portfolio Standard, SR/OIAF/2002-03, February 2002. EIA, Analysis of a 10-Percent Renewable Portfolio Standard, SR/OIAF/2003-01, May 2003. Union of Concerned Scientists, Clean Energy Blueprint: A Smarter National Energy Policy for Today and the Future, October 2001.

[4]U.S. Department of Energy, Lawrence Berkeley National Laboratory, Easing the Natural Gas Crisis: Reducing Natural Gas Prices Through Increased Deployment of Renewable Energy and Energy Efficiency, January, 2005, p. 13.

[5]EIA, Impacts of a 10-Percent Renewable Portfolio Standard, SR/OIAF/2002-03, February 2002.

[6]Id. at Figure 3.

[7]UCS, Renewable Energy Can Help Alleviate Natural Gas Crisis, June 2003, at 2.

[8]UCS, Clean Energy Blueprint: A Smarter National Energy Policy for Today and the Future, October 2001.

[9]Peabody's "Eight-Point Plan" calls for a total of 1.3 billion tons of additional coal production by 2025, proposing that coal be used to produce synthetic pipeline gas, additional coal-fired electricity, hydrogen, and fuel for ethanol plants. The entire program would more than double U.S. coal mining and consumption.

[10]National Academy of Sciences, Understanding and Responding to Climate Change: Highlights of National Academies Reports, p.16 (October 2005), http://dels.nas.edu/dels/rpt—briefs/climate-change-final.pdf.

[11]http://www.eia.doe.gov/cneaf/coal/page/acr/table26.html

[12]California Energy Commission, 2005. 2004 Net System Power Calculation (April.) Table 3: Gross System Power. http://www.energy.ca.gov/2005publications/CEC-300-2005-004/CEC-300-2005-004.PDF

[13]Calculated well to wheel CO_2 emissions for coal-based "Fischer-Tropsch" are about 1.8 greater than producing and consuming gasoline or diesel fuel from crude oil. If the coal-to-liquids plant makes electricity as well, the relative emissions from the liquid fuels depends on the amount of electricity produced and what is assumed about the emissions of from an alternative source of electricity.

[14]Capturing 90 percent of the emissions from coal-to-liquid plants reduces the emissions from the plant to levels close to those from petroleum production and refining while emissions from the vehicle are equivalent to those from a gasoline vehicle. With such CO_2 capture, well to wheels emissions from coal-to-liquids fuels would be 8 percent higher than for petroleum.

[15]The National Coal Council, "Coal: America's Energy Future," March 22, 2006. This report actually assumes a less efficient coal to synthetic gas conversion process of 50% leading to three times as much CO_2 per 1000 cubic feet of natural gas consumed compared to conventional resources.

[16]The sulfur and nitrogen caps in EPA's "Clean Air Interstate Rule" ("CAIR") may cover emissions from coal-to-liquids plants built in the eastern states covered by the rule but would not apply to plants built in the western states. Neither the national "acid rain" caps nor EPA's mercury rule would apply to coal-to-liquids plants.

[17]Jennie Stephens, "Coupling CO_2 capture and Storage with Coal Gasification: Defining 'Sequestration-Ready' IGCC", BCSIA Discussion Paper 2005-09, Energy technology Innovation Project, Kennedy School of Government, Harvard University, 2005.

[18]Id. p.3.

[19]"Securing America: Solving our Oil Dependence through Innovation", NRDC and IAGS report, February 2005. http://www.nrdc.org/air/transportation/oilsecurity/plan.pdf.

APPENDIX A

Mining, Processing and Transporting Coal

The impacts of mining, processing, and transporting 1.1 billion tons of coal today on health, landscapes, and water are large. To understand the implications of continuing our current level of as well as expanding coal production, it is important to have a detailed understanding of the impacts from today's level of coal production. The summary that follows makes it clear that we must find more effective ways to reduce these impacts before we follow a path that would result in even larger amounts of coal production and transportation.

Health and Safety

Coal mining is one of the U.S.'s most dangerous professions. The yearly fatality rate in the industry is 0.23 per thousand workers, making the industry about five times as hazardous as the average private workplace.[1] The industry had 27 fatalities in 2002, an all-time low,[2] and there were 55 deaths in 2004 and 57 deaths in 2005.[3] The first month of 2006 was particularly deadly, however, with 18 fatalities through February 1st. Sixteen of these deaths occurred in West Virginia mines, leading the Governor to call for an unprecedented suspension of production while safety checks were conducted. Coal miners also suffer from many non-fatal injuries and diseases, most notably black lung disease (also known as pneumoconiosis) caused by inhaling coal dust. Although the 1969 Coal Mine Health and Safety Act seeks to eliminate black lung disease, the United Mine Workers estimate that 1500 former miners die of black lung each year.[4]

Terrestrial Habitats

Coal mining—and particularly surface or strip mining—poses one of the most significant threats to terrestrial habitats in the United States. The Appalachian

region[5], for example, which produces over 35% of our nation's coal[6], is one of the most biologically diverse forested regions in the country. But during surface mining activities, trees are clearcut and habitat is fragmented, destroying natural areas that were home to hundreds of unique species of plants and animals. Even where forests are left standing, fragmentation is of significant concern because a decrease in patch size is correlated with a decrease in biodiversity as the ratio of interior habitat to edge habitat decreases. This is of particular concern to certain bird species that require large tracts of interior forest habitat, such as the black-and-white warbler and black-throated blue warbler.

After mining is complete, these once-forested regions in the Southeast are typically reclaimed as grasslands, although grasslands are not a naturally occurring habitat type in this region. Grasslands that replace the original ecosystems in areas that were surface mined are generally categorized by less-developed soil structure[7] and lower species diversity[8] compared to natural forests in the region. Reclaimed grasslands are generally characterized by a high degree of soil compaction that tends to limit the ability of native tree and plant species to take root. Reclamation practices limit the overall ecological health of sites, and it has been estimated that the natural return of forests to reclaimed sites may take hundreds of years.[9] According to the USEPA, the loss of vegetation and alteration of topography associated with surface mining can lead to increased soil erosion and may lead to an increased probability of flooding after rainstorms.[10]

The destruction of forested habitat not only degrades the quality of the natural environment, it also destroys the aesthetic values of the Appalachian region that make it such a popular tourist destination. An estimated one million acres of West Virginia Mountains were subject to strip mining and mountaintop removal mining between 1939 and 2005.[11] Many of these mines have yet to be reclaimed so that where there were once forested mountains, there now stand bare mounds of sand and gravel.

The terrestrial impacts of coal mining in the Appalachian region are considerable, but for sheer size they cannot compare to the impacts in the western United States.[12] As of September 30, 2004, 470,000 acres were under federal coal leases or other authorizations to mine.[13] Unlike the East, much of the West—including much of the region's principal coal areas "is arid and predominantly unforested. In the West, as in the East, surface mining activities cause severe environmental damage as huge machines strip, rip apart and scrape aside vegetation, soils, wildlife habitat and drastically reshape existing land forms and the affected area's ecology to reach the subsurface coal. Strip mining results in industrialization of once quiet open space along with displacement of wildlife, increased soil erosion, loss of recreational opportunities, degradation of wilderness values, and destruction of scenic beauty.[14] Reclamation can be problematic both because of climate and soil quality. As in the East, reclamation of surface mined areas does not necessarily restore premining wildlife habitat and may require scarce water resources be used for irrigation.[15] Forty-six western national parks are located within ten miles of an identified coal basin, and these parks could be significantly affected by future surface mining in the region.[16]

Water Pollution

Coal production causes negative physical and chemical changes to nearby waters. In all surface mining, the overburden (earth layers above the coal seams) is removed and deposited on the surface as waste rock. The most significant physical effect on water occurs from valley fills, the waste rock associated with mountaintop removal (MTR) mining. Since MTR mining started in the United States in the early 70's, studies estimate that over 700 miles of streams have been buried from valley fills, and 1200 additional miles have been directly impacted from valley fills through sedimentation or chemistry alteration.[17] Together, the waterways harmed by valley fills are about 80 percent as long as the Mississippi River. Valley fills bury the headwaters of streams, which in the southeastern U.S. support diverse and unique habitats, and regulate nutrients, water quality, and flow quantity. The elimination of headwaters therefore has long-reaching impacts many miles downstream.[18]

Coal mining can also lead to increased sedimentation, which affects both water chemistry and stream flow, and negatively impacts aquatic habitat. Valley fills in the eastern U.S., as well as waste rock from strip mines in the west add sediment to streams, as does the construction and use of roads in the mining complex. A final physical impact of mining on water is to the hydrology of aquifers. MTR and valley fills remove upper drainage basins, and often connect two previously separate aquifers, altering the surrounding groundwater recharge scheme.[19]

Acid mine drainage (AMD) is the most significant form of chemical pollution produced from coal mining operations. In both underground and surface mining,

sulfur-bearing minerals common in coal mining areas are brought up to the surface in waste rock. When these minerals come in contact with precipitation and groundwater, an acidic leachate is formed. This leachate picks up heavy metals and carries these toxins into streams or groundwater. Waters affected by AMD often exhibit increased levels of sulfate, total dissolved solids, calcium, selenium, magnesium, manganese, conductivity, acidity, sodium, nitrate, and nitrite. This drastically changes stream and groundwater chemistry.[20] The degraded water becomes less habitable, non potable, and unfit for recreational purposes. The acidity and metals can also corrode structures such as culverts and bridges.[21] In the eastern U.S., estimates of the damage from AMD range from four to eleven thousand miles of streams.[22] In the West, estimates are between five and ten thousand miles of streams polluted. The effects of AMD can be diminished through addition of alkaline substances to counteract the acid, but recent studies have found that the addition of alkaline material can increase the mobilization of both selenium and arsenic.[23] AMD is costly to mitigate, requiring over $40 million annually in Kentucky, Tennessee, Virginia, and West Virginia alone.[24]

Air Pollution

There are two main sources of air pollution during the coal production process. The first is methane emissions from the mines. Methane is a powerful heat-trapping gas and is the second most important contributor to global warming after carbon dioxide. Methane emissions from coal mines make up between 10 and 15% of anthropogenic methane emissions in the U.S. According to the most recent official inventory of U.S. global warming emissions, coal mining results in the release of 3 million tons of methane per year, which is equivalent to 68 million tons of carbon dioxide.[25]

The second significant form of air pollution from coal mining is particulate matter (PM) emissions. While methane emissions are largely due to eastern underground mines, PM emissions are particularly serious at western surface mines. The arid, open and frequently windy region allows for the creation and transport of significant amounts of particulate matter in connection with mining operations. Fugitive dust emissions occur during nearly every phase of coal strip mining in the west. The most significant sources of these emissions are removal of the overburden through blasting and use of draglines, truck haulage of the overburden and mined coal, road grading, and wind erosion of reclaimed areas. PM emissions from diesel trucks and equipment used in mining are also significant. PM can cause serious respiratory damage as well as premature death.[26] In 2002, one of Wyoming's coal producing counties, Campbell County, exceeded its ambient air quality threshold several times, almost earning non-attainment status.[27] Coal dust problems in the West are likely to get worse if the Administration finalizes its January 2006 proposal to exempt mining (and other activities) from controls aimed at meeting the coarse PM standard.[28]

Coal Mine Wastes

Coal mining leaves a legacy of wastes long after mining operations cease. One significant waste is the sludge that is produced from washing coal. There are currently over 700 sludge impoundments located throughout mining regions, and this number continues to grow. These impoundment ponds pose a potential threat to the environment and human life. If an impoundment fails, the result can be disastrous. In 1972 an impoundment break in West Virginia released a flood of coal sludge that killed 125 people. In the year 2000 an impoundment break in Kentucky involving more than 300 million gallons of slurry (30 times the size of the Exxon Valdez spill) killed all aquatic life in a 20 mile diameter, destroyed homes, and contaminated much of the drinking water in the eastern part of the state.[29]

Another waste from coal mining is the solid waste rock left behind from tunneling or blasting. This can result in a number of environmental impacts previously discussed, including acid mine drainage (AMD). A common problem with coal mine legacies is the fact that if a mine is abandoned or a mining company goes out of business, the former owner is under no legal obligation to cleanup and monitor the environmental wastes, leaving the responsibility in the hands of the state.[30]

Effects on Communities

Coal mining can also have serious impacts on nearby communities. In addition to noise and dust, residents have reported that dynamite blasts can crack the foundations of homes[31], and many cases of subsidence due to the collapse of underground mines have been documented. Subsidence can cause serious damage to houses, roads, bridges, and any other structure in the area. Blasting can also cause damage to wells, and changes in the topography and structure of aquifers can cause these wells to run dry.

Transportation of Coal

Transporting coal from where it is mined to where it will be burned also produces significant quantities of air pollution and other environmental harms. Diesel-burning trucks, trains, and barges that transport coal release NO_x, SO_x, PM, VOCs (Volatile Organic Chemicals), CO, and CO_2 into the earth's atmosphere. Trucks and trains (barge pollution data are unavailable) transporting coal release over 600,000 tons of NO_x, and over 50,000 tons of PM10 into the air annually.[32,33] In addition to health risks, black carbon from diesel combustion is another contributor to global warming.[34] Land disturbance from trucks entering and leaving the mine complex and coal dust along the transport route also release particles into the air.[35] For example, in Sylvester, West Virginia, a Massey Energy coal processing plant and the trucks associated with it spread so much dust around the town that "Sylvester's residents had to clean their windows and porches and cars every day, and keep the windows shut."[36] Even after a lawsuit and a court victory, residents—who now call themselves "Dustbusters"—still "wipe down their windows and porches and cars."[37]

Almost 60 percent of coal in the U.S. is transported at least in part by train and coal transportation accounts for 44% of rail freight ton-miles.[38] Some coal trains reach more than two miles in length, causing railroad-crossing collisions and pedestrian accidents (there are approximately 3000 such collisions and 900 pedestrian accidents every year), and interruption in traffic flow (including emergency responders such as police, ambulance services, and fire departments). Local communities also have concerns about coal trucks, both because of their size and the dust they can leave behind. According to one report, in a Kentucky town, coal trucks weighing 120 tons with their loads were used, and "the Department of Transportation signs stating a thirty-ton carrying capacity of each bridge had disappeared."[39] Although the coal company there has now adopted a different route for its trucks, community representatives in Appalachia believe that coal trucks should be limited to 40 tons.[40]

Coal is also sometimes transported in a coal slurry pipeline, such as the one used at the Black Mesa Mine in Arizona. In this process the coal is ground up and mixed with water in a roughly 50:50 ratio. The resulting slurry is transported to a power station through a pipeline. This requires large amounts of fresh groundwater. To transport coal from the Black Mesa Mine in Arizona to the Mohave Generating Station in Nevada, Peabody Coal pumped over one billion gallons of water from an aquifer near the mine each year. This water came from the same aquifer used for drinking water and irrigation by members of the Navajo and Hopi Nations in the area. Water used for coal transport has led to a major depletion of the aquifer, with more than a 100 foot drop in water level in some wells. In the West, coal transport through a slurry pipeline places additional stress on an already stressed water supply. Maintenance of the pipe requires washing, which uses still more fresh water. Not only does slurry-pipeline transport result in a loss of freshwater, it can also lead to water pollution when the pipe fails and coal slurry is discharged into ground or surface water.[41] The Peabody pipe failed 12 times between 1994 and 1999. The Black Mesa mine closed as of January 2006. Its sole customer, the Mohave Generating Station, was shut down because its emissions exceeded current air pollution standards.

ENDNOTES

[1] Congressional Research Service, U.S. Coal: A Primer on the Major Issues, at 30 (Mar. 25, 2003).

[2] Id.

[3] Melissa Drosjack, FoxNews.com, Congress to Examine Mine Safety (Jan. 20, 2006), online at "http://www.foxnews.com/story/0,2933,182276,00.html" (visited Feb. 1, 2006).

[4] http://www.umwa.org/blacklung/blacklung.shtml

[5] Alabama, Georgia, Eastern Kentucky, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.

[6] Energy Information Administration. Annual Coal Report, 2004.

[7] Sencindiver, et al. "Soil Health of Mountaintop Removal Mines in Southern West Virginia". 2001.

[8] Handel, Steven. Mountaintop Removal Mining/Valley Fill Environmental Impact Statement Technical Study, Project Report for Terrestrial Studies. October, 2002.

[9] Id.

[10] EPA. Mountaintop Mining/Valley Fills in Appalachia: Draft Programmatic Environmental Impact Statement. 2003

[11] Julian Martin, West Virginia Highlands Conservancy, Personal Communication, February 2, 2006.

[12] Alaska, Arizona, Colorado, Montana, New Mexico, North Dakota, Utah, Washington, and Wyoming.
[13] Bureau of Land Management, Public Land Statistics 2004, Table 3-18
[14] See, e.g., U.S. Department of the Interior, Bureau of Land Management, 1985 Federal Coal Management Program/Final Environmental Impact Statement, pp. 210-211, 230-231, 241-242, 282 (water quality and quantity), 241, 251, 257
[15] Bureau of Land Management. 3809 Surface Management Regulations, Draft Environmental Impact Statement. 1999
[16] National Park Service, DOI. "Coal Development Overview". 2003.
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[18] Id.
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[20] EPA Office of Solid Waste: Acid Mine Drainage Prediction Technical Document. December, 1994.
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[22] EPA. Mid-Atlantic Integrated Assessment: Coal Mining. http://www.epa.gov/maia/html/coal-mining.html
[23] EPA. Mountaintop Mining/Valley Fills in Appalachia: Final Programmatic Environmental Impact Statement. 2005
[24] Id.
[25] DOE/EIA, 2005. Emissions of Greenhouse Gases in the United States 2004. (December).
[26] EPA. Particle Pollution and Your Health. 2003
[27] Casper [WY] Star Tribune, January 24, 2005.
[28] National Ambient Air Quality Standards for Particulate Matter, Proposed Rule, 71 Fed. Reg. 2620 (January 17, 2006); Revisions to Ambient Air Monitoring Regulations, Proposed Rule, 71 Fed. Reg. 2710 (January 17, 2006).
[29] Frazier, Ian. "Coal Country." On Earth. NRDC. Spring, 2003.
[30] Reece, Erik. "Death of a Mountain." Harper's Magazine. April, 2005.
[31] Id.
[32] DOT Federal Highway Administration. Assessing the Effects of Freight Movement on Air Quality, Final Report. April, 2005
[33] Energy Information Administration: Coal Transportation Statistics.
[34] Hill, Bruce. "An Analysis of Diesel Air Pollution and Public Health in America." Clean Air Task Force, Boston. February, 2005.
[35] EPA. Mountaintop Mining/Valley Fills in Appalachia: Draft Programmatic Environmental Impact Statement. 2003
[36] Michael Schnayerson, "The Rape of Appalachia," Vanity Fair, 157 (May 2006).
[37] Id.
[38] http://nationalatlas.gov/articles/transportation/a—freightrr.html
[39] Erik Reece, Lost Mountain: A Year in the Vanishing Wilderness 112 (2006).
[40] Personal communication from Hillary Hosta and Julia Bonds, Coal River Mountain Watch (Apr. 7, 2006).
[41] NRDC. Drawdown: Groundwater Mining on Black Mesa.

APPENDIX B

Reducing Oil Dependence—Securing America Program

The Securing America program [1] is made up of these sensible steps that will cut oil dependence, cut global warming emissions, and reduce other harmful impacts of today's energy production and consumption patterns:

Accelerate oil savings in passenger vehicles by:

- establishing tax credits for manufacturers to retool existing factories so they can build fuel-efficient vehicles and engineer advanced technologies, and
- establishing tax credits for consumers to purchase the next generation of fuel-efficient vehicles; and raising federal fuel economy standards for cars and light trucks in regular steps.

Accelerate oil savings in motor vehicles through the following:

- requiring replacement tires and motor oil to be at least as fuel efficient as original equipment tires and motor oil;
- requiring efficiency improvements in heavy-duty trucks; and
- supporting smart growth and better transportation choices.

Accelerate oil savings in industrial, aviation, and residential building sectors through the following:

- expanding industrial efficiency programs to focus on oil use reduction and adopting standards for petroleum heating;
- replacing chemical feedstocks with bioproducts through research and development and government procurement of bioproducts;
- upgrading air traffic management systems so aircraft follow the most-efficient routes; and
- promoting residential energy savings with a focus on oil-heat.

Encourage growth of the biofuels industry through the following:

- requiring all new cars and trucks to be capable of operating on biofuels or other non-petroleum fuels by 2015; and
- allocating $2 billion in federal funding over the next 10 years to help the cellulosic biofuels industry expand production capacity to 1 billion gallons per year and become self-sufficient by 2015.

Technologically Achievable Oil Savings (million barrels per day)

Oil Savings Measures	2015	2025
Raise fuel efficiency in new passenger vehicles through tax credits and standards	1.6	4.9
Accelerate oil savings in motor vehicles through		
fuel efficient replacement tires and motor oil	0.5	0.6
efficiency improvements in heavy-duty trucks	0.5	1.1
Accelerate oil savings in industrial, aviation, and residential sectors	0.3	0.7
Encourage growth of biofuels industry through demonstration and standards	0.3	3.9
Total Oil Saved	**3.2**	**11.2**

[1] "Securing America: Solving our Oil Dependence through Innovation", NRDC and IAGS report, February 2005. http://www.nrdc.org/air/transportation/oilsecurity/plan.pdf.

Mr. GIBBONS. Thank you very much, Mr. Hawkins. We appreciate your testimony. Thank you for being here and taking time out of your day to help us better understand this issue.

We turn now to Mr. Fredrick Palmer, Peabody Energy Corporation. Mr. Palmer, welcome. The floor is yours.

STATEMENT OF FREDRICK D. PALMER, SENIOR VICE PRESIDENT, GOVERNMENT RELATIONS, PEABODY ENERGY

Mr. PALMER. Thank you very much.

Mr. GIBBONS. Mr. Palmer, would you begin again and turn your mike on? Thank you.

Mr. PALMER. Thank you, Mr. Chairman. It is an honor to be here. My name is Fred Palmer. I am Senior Vice President, Government Relations, for Peabody.

I also chair the Coal Policy Committee of the National Coal Council and served as chair of the Technical Work Group for the recent study, Coal: America's Energy Future. Greg Boyce, Peabody's CEO, served as chair of the study.

We are proud of the work of the National Coal Council. This comprehensive report involves 54 members meeting on three separate drafting occasions before finally adopting the report and presenting it to Secretary Bodman on March 22.

Many different council members prepared separate parts of the report. All of us shared a common vision: America's abundant coal resources can and must be more fully utilized to meet our growing energy needs to improve the quality of life for all Americans and to enhance our national security.

We are here today to focus on the alternative use of coal to create alternative energy resources. In my prepared testimony I detail the findings of the National Coal Council, which examines the many different energy applications our coal resources can be devoted to.

Coal to liquids, coal to natural gas, electricity generation, ethanol, hydrogen, enhanced oil recovery and economic growth attending a more than doubling of U.S. coal production by 2025 are all discussed in depth in the report, and I would respectfully request that the Members read this report because I do think it is important.

Because of recent events, however, I would like to spend my brief period focusing on one aspect of our energy crisis that needs urgent attention. Iran sits astride the world's most important oil reserves and the largest single reserve of natural gas. It is capable of closing the Strait of Hormuz or destroying Saudi oil export facilities on a moment's notice.

Many in our country believe a sound energy policy should be based on liquefying Middle East natural gas to supply America's energy needs. I believe such a policy is misguided. Importing LNG from the Middle East is an extension of our current reliance on Middle Eastern oil with all of the attendant negatives of that reliance.

Military conflict, adverse balance of payment impacts and environmental harm are but a few of the negatives associated with our reliance on Middle Eastern oil that would be magnified if we looked to Middle Eastern natural gas for a substantial portion of our future energy needs.

Iran threatens the eradication of Israel. Iran threatens terrorist acts against the United States. Iran has developed a torpedo capable of reaching 200 miles an hour. Iran has tested missiles capable of reaching Eastern Europe.

Iran is clearly dedicated to developing nuclear weapons with no other purpose in mind that holding the world hostage to its own distorted notions of how society should be formed and governed. Energy is its weapon in this effort to extort changes in policies by the industrialized west. Middle East oil and natural gas are a part of that weaponry.

The Department of Defense recognizes our peril. DOD has created the Office of the Secretary of Defense Initiative designed to catalyze a commercial energy industry to produce clean fuel for the military from secure domestic oil shale and coal. DOD believes the U.S. to be the new Middle East of energy with the equivalent of 1.9 trillion barrels of oil reserves in our coal and oil shale deposits.

Congress has the opportunity right now to put in place a legislative framework that will trigger creation of the energy manufacturing industry envisioned by the Defense Department by taking three simple steps:

First, give DOD authority independent of the appropriations process to enter into long-term—20 years—offtake agreements from alternative energy producers with guaranteed floor prices and an adjustable mechanism giving a discount to future market prices. Approximately half of the DOD's 300,000 barrels per day appetite for fuel would be appropriate or 150,000 barrels per day of several projects scattered around the country.

Two, extend the 50 cents per gallon tax credit for coal derived fuels found in the Transportation Act until 2020.

Three, allow 100 percent depreciation for each dollar of investment made on coal-to-liquid refineries placed in service prior to 2020.

With current oil prices, coal-to-liquid facilities are clearly economical. The barriers are the large capital investment required, regulatory delay in completing projects and a risk of future decline in crude oil prices.

By lowering the risk profile of capital invested and providing a secure market for liquids produced, Congress will enhance national security by jump-starting a robust coal-to-liquids industry and leaving the world a better place for our children and their children.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Palmer follows:]

Statement of Fredrick D. Palmer, Senior Vice President—Government Relations, Peabody Energy

Thank you, Mr. Chairman, Distinguished Members and guests. I'm Fred Palmer, Chair of the Technical Work Group for the National Coal Council. It is a pleasure to be here today to share the National Coal Council's perspective. We believe the United States can use clean coal and clean coal technologies to provide a more secure and affordable energy future for the American people. Coal represents the key to U.S. energy security—abundant energy—lower consumer prices...and more jobs.

As you know, last year the Secretary of Energy asked the National Coal Council to study the potential of coal BTU Conversion technologies to meet future U.S. energy needs.

The report process was comprehensive, featuring input from 54 members over nine months.

Out of that effort grew an eight-point plan that represents a dramatic step forward in America's search for energy independence. The Report was presented to the Secretary in March 2006. The Report, ''Coal: America's Energy Future,'' can be found on www.nationalcoalcouncil.org.

The Report sets forth an ambitious plan to add 1.3 billion tons per year of U.S. coal production by 2025 to meet the Nation's growing energy needs while improving the environment through deployment of cutting edge clean coal technology. This increased production, which is more than double today's levels, will be deployed to produce coal-to-liquids, coal-to-natural-gas, coal for increased electricity generation, coal-to-hydrogen, coal for ethanol production, and enhanced oil and gas recovery utilizing CO_2 emissions from coal combustion.

The needed investment identified by the Report will be large, but the payback will be even larger. Over $500 billion in capital expenditures will be required over the 20-year period. This, in turn, will require cooperation by the federal government in the form of a capital friendly legislative framework to unleash the genius of American industry in the creation of an energy manufacturing industry. According to the Report, the payback to the country will exceed $3 trillion in cumulative GDP gains and the creation of an additional 1.4 million new jobs per year.

When the Report was issued, eyebrows were raised over the scope of the Council's vision. Some in the environmental community were critical over the Council's call to establish a new energy manufacturing industry in the United States, notwithstanding the Council's in-depth discussion and examination of available clean coal technologies and notwithstanding the energy supply crisis confronting our country.

For too long, the United States has been losing manufacturing jobs overseas. At the same time, our increased reliance on foreign oil and now liquefied natural gas has given tremendous leverage to countries that are overtly hostile to us and to our way of life. The National Coal Council firmly believes that we can address both problems by reindustrializing the U.S. economy while at the same time securing our own destiny by utilizing our own energy resources.

Events in the last four months, and some within the last month, underscore the timeliness of the Report and the clarity of the Council's vision. Here are a few items that have been in the headlines on an almost daily basis:

- IRAN—Oil prices increased by $2 the day Iran tested its new weapons in the Strait of Hormuz. Reports in the western media indicated some Iranian officials threatened to close the Strait to tanker traffic.
- NORWAY—projected a 5% decline in oil production in 2006
- RUSSIA—Pravda reported the growth rate of Russian oil production would fall below 2% in 2006, versus 10% in 2004. In April, the IEA confirmed Russian exports would be lower than previously expected.
- NIGERIA—In April, civil unrest kept over 450,000 barrels per day offline.
- BRITAIN—is now importing 10% of its natural gas; by 2010 it will import 40% and by 2020 90%
- MEXICO—Canterell field accounts for 60% of oil production. Output will decline by 28% by 2008.
- VENEZUELA—seized control of 32 private oil fields on January 1, 2006, and in March threatened to divert supplies away from U.S.
- FRANCE—In discussing IEA projection of 121 million barrels of oil per day in 2030, the Head of Exploration at TOTAL stated: "Numbers like 120...will never be met, never."
- AUSTRALIA—crude oil production projected to be 30% lower in 2006 than in 2000; Australia may soon be importing half of its oil.
- UNITED STATES—LNG imports in the first quarter were down more than 30%. Europe and Asia are bidding cargos away from U.S.—in some cases, loaded tankers have departed the Gulf of Mexico to go to Europe.

The situation we now confront in the world does not mean we should withdraw from the world economy and look only to "Fortress America." It does mean that we need a more robust development of all of America's energy resources to strengthen our ability to both compete in the global economy and to cope with the overt military threats to American interests abroad and natural resources that the world's economy depends upon. In this context, coal moves front and center because it alone can provide the fuel we need in the volumes required of the quality required at an economical price, all with environmental excellence to secure America's future and, therefore, the future of the world community.

The Department of Defense (DoD) has recognized the danger of our growing dependence on foreign oil. The DoD is aggressively pursuing a strategy to catalyze commercial production of fuels from alternative energy resources by 2010. Their goal is to eliminate dependence on foreign sources and mega-refineries for strategic fuel supplies. Another goal is to develop a Battlefield Use Fuel of the Future (BUFF) by evaluating, demonstrating and certifying turbine fuels from alternative energy resources for use in tactical vehicles, aircraft and ships.

DoD needs about 300,000 barrels a day, with jet fuel a major component. Coal-to-liquids (CTL) can play a crucial role in this area. Fuel produced through the Fischer-Tropsch process yields more energy per pound than traditional fuels, has virtually no sulfur and is less subject to freezing. Further, CTL products even have a significant advantage over bio-fuels such as ethanol because they provide more Btus per unit.

Your hearings on the role coal, especially federal coal, can play in providing alternative fuels for transportation, industry and residential use are important to our nation. About 60 percent of the area underlain with coal-bearing rocks in the coterminous United States is under federal surface. Federal lands account for over 40 percent of all coal production. Thus, federal coal is already making an important contribution to our energy needs and has the potential to do much more.

NCC FINDINGS INDICATE COAL CAN PROVIDE IMPORTANT LIQUID FUELS

The findings from the NCC Report demonstrate that coal can help alleviate liquid fuel problems along three distinct lines:

1. Coal can be liquefied. Our analysis indicates that we can increase product supply by 2.6 million barrels per day by using 475 million tons of coal per year. This additional clean fuel would be fungible with petroleum products. Coal-to-liquids (CTL) is a proven technology. The Department of Energy has stated: "The current coal-to-liquids technology is well defined in terms of cost and performance. It can be used domestically in the United States to limit our exposure to oil price increases."

   In his Senate testimony on April 24, Clarence Miller, from the DOE's Office of Fossil Energy, gave a thorough evaluation of how we can utilize CTL technologies to our country's advantage. Coal-to-liquids plants can be built near coal fields if the infrastructure for liquid fuel distribution is available or the coal can be shipped to plants built near fuel markets.

2. Coal can be the heat source for ethanol. The United States is committed to using ethanol to displace a significant amount of foreign oil. With the nation under Congressional mandate to increase ethanol production from the current 4.4 billion gallons per year to 7.5 billion, it is difficult to imagine how this 70 percent increase can be accomplished without the expanded use of coal. While natural gas has been the typical heat source in ethanol production, prices have increased 150 percent in just the last four years. Coal is much less expensive and has far less price volatility. In 2005, for example, the cost of producing electricity from natural gas was $8.33 per million Btu. The cost for coal was only $1.54 per million Btu. No wonder the ethanol industry is already embracing coal for new plants in states such as Iowa, Nebraska, Missouri, North Dakota and Illinois.

   We found that coal use could increase by 40 million tons per year to support ethanol production of one million barrels per day.

3. Coal can provide for expanded domestic Enhanced Oil Recovery (EOR) and coalbed methane recovery (ECBM) using captured CO_2. The U.K. and Europe have shown that Kyoto-type carbon caps don't work and punish society and economies in the process. Technology is the proper path to address climate concerns, and technologies can enable carbon capture and storage. Transferring carbon dioxide back into the ground can allow additional oil and coalbed methane production. We believe that enhanced oil recovery could lead to an added 2-3 million barrels per day of oil production from existing oil producing basins.

In essence, then, the NCC Report found that clean coal can increase our liquid fuel supply by over 6 million barrels per day—25 percent of EIA projected demand in 2020. These processes would require 515 million tons of coal per year—well within our production capacity.

The NCC Report also found that coal could be:

(a) gasified to produce up to 4 Tcf of natural gas equivalents, thereby meeting 15 percent of our future requirements and virtually eliminating the need to rely on expensive imported liquefied natural gas (LNG).

(b) used to fuel over 100 Gigawatts (GW) of additional coal-based electricity generation. Indeed, based on data from the National Energy Technology Laboratory (NETL), over 90 GW of new coal-based generation are currently being planned.

(c) used to produce hydrogen. FutureGen is the world's largest global private/public initiative. Coal can satisfy at least 10 percent of our transportation needs at Freedom Car efficiencies.

Specific recommendations to implement the findings are extensively discussed in the NCC Report. A key objective of these recommendations is to assure that private capital can be attracted to make the necessary investments in our energy future.

Further, in addition to increasing domestic energy supply, the steps proposed in the NCC Report would have social and economic benefits for all Americans. An independent analysis conducted at Penn State University found that increasing annual coal production by 1.3 billion tons for BTU Conversion would mean:

- energy prices would be reduced by one-third from the business-as-usual case
- the annual GDP would be more than $600 billion higher in 2025
- the net present value of the benefit is $3 trillion, increasing to $4 trillion with enhanced oil recovery, and
- employment would be increased by 1.4 million per year by 2025.

By 2025, new capital expenditures of only $515 billion (present value of $350 billion) would be required—a tremendous investment in America's future.

Of course, what is the value of added national security and freedom from the yoke of energy dependence? These economic gains are greatly enhanced by the strengthening of U.S. energy security.

I would now like to take a few minutes to delineate why we should proceed immediately to pursue the BTU Conversion technologies discussed in the NCC Report:

1. Energy demand is increasing. The EIA has projected that by 2030 our energy consumption will grow from 100 quadrillion Btu to 127 quads—an increase more than the annual energy consumption of France and Germany combined. And these increases in demand are occurring around the world. China's energy needs, for instance, are stunning. Their population of 1.3 billion will reach over 1.5 billion by 2020. China plans to increase annual coal production from 1.7 billion tons to 3.2 billion by 2020. Electricity generating capacity will double to 1,000 GW. By 2010, China could have 50 coal gasification plants, and they have announced a $20 billion commitment to build coal-to-liquids facilities. China regards BTU Conversion as a strategic imperative.

   India is close behind. Their population of 1.1 billion will reach 1.3 billion by 2025—and some day India will be the most populated nation. India's rate of

growth in oil demand is one of the highest in the world. Yet India has paltry oil reserves of less than 6 barrels per person, compared with over 70 in the United States.

It took the United States a century to move through booms in industrialization...urbanization...transportation...and information. China and India are experiencing these sea changes at the same time.

2. Dependence on imports is growing. The EIA projects that by 2030 we will be importing 62 percent of our oil and 21 percent of our natural gas.

   This imported energy will come at a staggering cost—at today's prices the cost of imported energy would reach $2.5 trillion over the next decade—$25,000 for every household in the United States.

3. The problem is getting worse. Domestic oil production declined 11 percent just between 2001 and 2005. EIA projections indicate demand for petroleum will increase by almost 7 million barrels per day by 2030. Yet domestic crude production will drop by 18 percent, requiring ever more imports and consigning the next generation to even greater dependence on unstable and hostile nations. And oil is not our only problem along these lines. As we look to the future, we should note that 42 percent of the world's natural gas is in Iran and Russia.
4. Coal is the only domestic fuel with the flexibility and reserve base to balance this increasingly lopsided energy equation. U.S. oil and natural gas production peaked in the 1970s, but we have enough coal to last well over 100 years even at elevated levels of consumption. America has 27 percent of global coal reserves, and coal is found in more than half of the states. Some people call the U.S. the Saudi Arabia of coal—but that doesn't really do us justice. America has more coal than any nation has any single energy resource. Just the State of Illinois has more coal resources than all the oil in Saudi Arabia, Iran, Iraq and Kuwait combined.
5. Coal is the epitome of a secure energy source. We know where the coal is. We know it's within our shores. We know that other countries won't nationalize it...halt its shipments to pursue nuclear ambitions...shut off its supplies due to price disputes...kidnap its workers...or use it as leverage to compromise our national security.
6. Coal is increasingly clean. Environmental progress in mining and coal combustion over the past 20 years has been spectacular. Coal power plants, for example, produce three times as much electricity than in 1970, but emissions have declined by one-third and are heading lower as clean coal technologies propel continuous improvement.

NCC RECOMMENDATIONS

The National Coal Council found that the mining industry and transportation infrastructure can be expanded to accommodate growth in coal production from 1.1 billion tons per year today to 2.4 billion tons per year in 2025. As I have documented here today, this new coal supply can be converted to Btus across the energy spectrum.

Our emerging energy needs are massive. And our response must be proportionate in magnitude to meet those needs.

The National Coal Council's recommendations are tantamount to the creation of an entirely new energy manufacturing industry in the United States. The initial expenditures to jumpstart this new energy manufacturing industry will require a significant investment of capital. The risk associated with such an undertaking will be perceived as substantial given the historic volatility of oil prices and, more recently, the price of natural gas. The most significant contribution government can make to this endeavor is to lower the risk profile of investment. The National Coal Council recommends that capital funding policies be implemented to encourage the private sector to step forward on a massive scale. The specific fiscal, tax, financial, and regulatory recommendations presented here are all designed to encourage private sector commitments to seize this opportunity and secure America's energy future.

Many of the approaches recommended build on existing law and recent federal enactments, including the American Jobs Creation Act of 2004 (AJCAct2004); the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU 2005); the Energy Policy Act of 2005 (EPAct2005); and the President's Advanced Energy Initiative.

In order to remove potential barriers to expanded coal production and use, the DOE, acting in coordination with other federal agencies and states, should:

Accelerate research, development and demonstration of advanced technology by:

- urging Congress to appropriate full funding for all clean coal programs authorized, including FutureGen and the Clean Coal Power Initiative (CCPI), with the

goal of developing at least 100 GW of clean coal power plants by 2025. Congress has recognized that a full portfolio of energy technologies is needed, including both coal gasification and combustion-based generation. The Department should take steps to assure U.S. energy policy achieves these goals.

Improve the ability of the industry to attract private capital for new facilities by:

- providing for 100 percent expensing in the year of outlay for any coal-to-liquids (CTL) plant begun by 2020
- providing for 100 percent expensing in the year of outlay for coal-to-gas (CTG) plants operated to displace NG usage in existing combined cycle units, space heating and industrial application
- providing for a federal loan facility of $100 billion with the ability to provide loan guarantees for the initial commercial scale CTL and CTG plants (see EPAct2005, Title XVII)

Provide market certainty for products by:

- guaranteeing federal government purchases of coal-to-liquids products by either the Strategic Petroleum Reserve or the Department of Defense. These purchases should be based on long-term contracts with floor prices.
- extending the coal-to-liquids excise tax exemption to 2020 (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, SAFETEA-LU 2005 extension)
- extending the temporary expensing for equipment used in refining to 100 percent of any required additions to existing refineries needed to handle coal-to-liquids products (see EPAct2005, § 1323)
- involving the Environmental Protection Agency (EPA) in the research on fuel performance characteristics to assure the broadest applicability in commercial use
- involving the Department of Defense in testing fuels to optimize plant and process design for the Air Force (jet fuel), Army (arctic diesel), and Navy (marine diesel) requirements

Assure coal incentives for all alternative technologies by:

- providing for 100 percent expensing in the year of outlay for converting ethanol plants currently using natural gas to coal combined heat and power if the new plant is in service by 2010

Minimize operating costs for new alternative fuel plants by:

- providing royalty (federal and state) relief for coal used to produce either liquids or gas

Reduce permitting delays and regulatory uncertainty by:

- expediting permitting with a joint federal and state process, including Advanced Clean Coal power plants
- using, where appropriate, federal sites, including Base Realignment And Closure (BRAC) sites
- exempting initial coal-to-liquids and coal-to-gas plants from New Source Review (NSR) and National Ambient Air Quality Standards (NAAQS) offset requirements
- where it has not been done, implementing the recommendations proposed by the National Coal Council in the 2004 report, "Opportunities to Expedite the Construction of New Coal-Based Power Plants."

Assure that enhanced oil recovery in new basins using CO_2 extracted from coal plants is an attractive investment by:

- increasing Section 43 investment tax credit to 50 percent
- creating an explicit exemption from the Alternative Minimum Tax (AMT) for new production from Enhanced Oil Recovery using CO_2
- providing federal and state royalty and severance tax relief for oil produced until capital payout (see EPAct2005 § 354)

Provide incentives for upgrading the transportation infrastructure by:

- providing federal tax incentives to support taxpayers who invest in railroad infrastructure capacity
- urging Congress to appropriate funds for the upgrade of the inland waterway system, including barge access

Ensure that all existing, identified U.S. economically recoverable reserves remain a part of the resource base by:

- seeking balance between precautionary protectionist policies and energy security
- supporting active enforcement of existing laws, including The Clean Water Act, the Endangered Species Act, the Surface Mining Control and Reclamation Act, and the Wilderness Act

- actively involving the DOE in addressing energy security in any policymaking that would "sterilize" significant coal reserves
- opposing overlapping and additional regulation that needlessly reduces access to the United States' most abundant energy resource—coal. Recent examples would be the last-minute inclusion of the Kaiparowits Plateau in the Grand Staircase-Escalante National Monument designation and the Forest Service's recently extended Roadless Forest Protection to July 16, 2007.

Continuing to support the provisions of the Mine Safety and Health Act by:

- ensuring a progressive approach to the important issue of enhancing mine safety and working to provide enhanced funding for mine safety research by the National Institute for Occupational Safety and Health (NIOSH)

Conduct a thorough and updated survey of U.S. coal reserves.

- The National Coal Council has conducted an in-depth analysis of coal mining and transportation infrastructure, but the resources of the federal government are required for a thorough analysis of our nation's vast reserves of coal.

SUMMARY

This is an aggressive plan, and its benefit to Americans is enormous. Even as this town shows friction on a number of issues, there is growing bipartisan interest in turning U.S. coal into other energy forms, especially liquid fuels.

Here's what Pennsylvania's Democratic Governor Ed Rendell said several months ago:

> *"Clean coal is a sound policy that unites public and private interests. Instead of becoming more dependent on the Middle East for our fuels, we can increase our dependency on Middle America, and that makes sense to me. I call for an American Energy Harvest."*

And here's what U.S. Energy Secretary Bodman said just several weeks ago:

> *"While our traditional clean coal programs are focused on producing electricity and, in the case of FutureGen, hydrogen, I believe that our abundant coal reserves could do even more to meet our nation's energy needs. One of the most exciting areas, I believe, is the technology for turning coal into diesel and jet fuel."*

I noted earlier that China and India are called developing nations. America, too, is a growing nation.

Last year we added almost 3 million people to the population, built over 1 million new homes, started over 3 million new small businesses and flew over 800 trillion air passenger miles. And America continued its above-trend economic growth.

Coal is the only domestic energy resource that can meet the scale of such a massive increase in energy required to serve this growth—and the proper policies will insure we meet the needs of a dynamic nation.

Clean coal can do all this—more jobs, higher incomes, new businesses, lower energy costs, a reduced trade deficit, enhanced national security and a major step toward less dependence on foreign suppliers. For the last decade, we have been shipping millions of manufacturing jobs overseas. We now spend over $250 billion per year on energy purchases from foreign suppliers. As liquefaction facilities, gasification units and ethanol plants are built across the nation, we can take control of our own energy destiny and follow a new clarion call to the future: "Coal—Made in America."

That is why, while some people have called coal a bridge to the future, we say: Coal is the future. Thank you.

Mr. GIBBONS. Thank you very much, Mr. Palmer. I appreciate your presence today. I appreciate your testimony. It certainly is very important for our committee to hear the remarks you have given. Thank you for taking the time.

I know that we have just a few Members of our committee still here today, but I want to tell you that the testimony that all of you have given and the other panel that will follow you is very important to the understanding of Congress.

We need to do something now. We need to know what those solutions may be. Each of you have offered solutions which are greatly appreciated, and from a congressional policy standpoint it is important.

We are going to turn now to the question and answer period.

First of all, I want to turn to Ms. Pierce. Thank you very much for your testimony today. Basically how long do you think it is going to take the USGS to complete its assessment of the coal resources in the United States? What is your projected timeline for that completion?

Ms. PIERCE. Well, we will do the first basin this year, the Gillette coal field, and then the whole Powder River Basin next year.

I think these are the most difficult because there is a tremendous amount of data available from all the coal bed methane drilling there. I think the others will then speed up, so several years without trying to be evasive, but several years.

Mr. GIBBONS. Several being five?

Ms. PIERCE. As a good approximation, yes.

Mr. GIBBONS. OK.

Ms. PIERCE. So a basin per year.

Mr. GIBBONS. What part of the inventory would you guess or would you estimate that will be included or not included in the coal inventory that is currently off limits to some constriction, whether it is a wilderness area, whether it is a park area, whether it is a wilderness study area?

Do you include those coal resources, first of all, I should ask? If you do, what part do you anticipate that will be of the total coal resource?

Ms. PIERCE. If it is a major coal-bearing area, even under those lands, we will include it; and then it will be off limits so it will be part of the restriction.

If it is not a major coal-bearing area, and by that I mean a certain tonnage, a certain thickness, a certain depth, we will not include it, but we will include those off limit areas. That will be within the process that we assess.

Mr. GIBBONS. For example, in the Grand Staircase-Escalante area you will include the coal resources in that area?

Ms. PIERCE. Yes.

Mr. GIBBONS. OK. For the edification of the committee, why do you not tell us or discuss with us some of the coal research projects that are being conducted now? How long will the new technologies that you are looking at be available, or when will they be available I should say?

Ms. PIERCE. Sure. Our biggest effort right now is this coal assessment.

As I mentioned, we have spent the last year revising our assessment methodology to change from our traditional approach of in-place resources, everything in the ground, to look at what the reserves are so that portion of the in-place resource that is those technically recoverable by today's technology and societal restrictions and then what portion of that is then economically recoverable with today's prices, market, transportation, et cetera. We have spent most of our efforts in the past year, year and a half, revising that and then working on the Gillette coal field as our first implementation.

We do have coal quality projects, and traditionally we have looked at those, the coal quality projects, as coal, ash yield, sulfur

content, the big ones. We have realized that what we want to help provide is something that might be predictive.

If we could predict what is in the ground and what then might be in the air emissions, if we can look at what is in the ground and follow some of those elements of concern through the whole process—what is mined, what is cleaned and what is burned—are some of those of concern? Are some of those not? Will some of those elements be cleaned out? We just wanted to get a more robust scientific value to some of those studies.

Mr. GIBBONS. Mr. Copulos, thank you very much for being here as well.

You know, we had a hearing just last Saturday on some of the renewable resources—wind, solar, geothermal, et cetera. In your mind, from your perspective and the work you have done, can wind or solar energy displace fossil fuels used for the transportation industry?

Mr. COPULOS. No. That is not even remotely possible. There are renewable energy technologies that have value, but, as I have said many times—I have an article in the current issue of American Legion magazine that goes into this—we can resolve our problem, but we can only do it if we use all of the resources, both conventional and renewable, at our disposal.

You know, the thing is that time is running out. There is an article. As a matter of fact, Mr. Chairman, I might ask that we be allowed to put that in the record.

Mr. GIBBONS. Without objection.

Mr. COPULOS. OK.

[NOTE: The article submitted for the record by Mr. Copulos has been retained in the Committee's official files.]

Mr. GIBBONS. Any documentation that you want to submit for the committee will be accepted without objection.

Mr. COPULOS. Thank you, sir. We are talking two of our people at the Foundation have in today's Washington Times talking about Venezuela and the problem there. When you look at where oil is around the world, at least 40 percent of our imports come from governments that are utterly unstable and directly hostile to our interest.

A first order of business is to eliminate imports from those areas as a national security issue. You cannot do it with just renewables and certainly not with solar or wind. You can do it. Now, there are some excellent biofuels out there. There is some stunning research being done.

There is also the issue of non-transportation fuels. Now, two-thirds of our fuel goes to transportation. That means a third does not. That third could be addressed. In the end what really we need more than anything else is political will.

One other point I need to make. When we look at this issue we should not forget that you cannot just produce energy. You have to have hard rock minerals and other commodities to be able to build the equipment and provide the catalyst. We are in almost as serious a position regarding our mineral imports as we are concerning our energy imports.

Mr. GIBBONS. Speaking of time running out, my time has run out. I appreciate that, and we will have another round and hopefully be able to get some questions to our other two witnesses.

I will turn now to Mr. Pearce for questions you may have.

Mr. PEARCE. Thank you, Mr. Chairman.

Mr. Palmer, you had stated on page 6 that coal is a clean technology, and that differs somewhat from the testimony that Mr. Hawkins has given. Would you care to sort of bring those two concepts more in focus?

Mr. PALMER. Yes, sir. There is no doubt that clean coal technology exists today to remove 100 percent of criteria pollutants, and by that I mean SO_x, NO_x. Mercury is in the developing stage. I should not say that. That exists today, but it is being developed today.

There is no question in my mind that over time that whether through gasification or advanced clean coal technologies on super critical pulverized coal units that criteria pollutants are not and should not be a long-term concern for the American people as we increase our production and utilization of coal.

I think where David and I differ, and I have the highest admiration for David and the ball that they have moved as they see the playing field at NRDC over the years. We have had this discussion off and on, and we probably will in the future with respect to the issue of carbon.

Peabody is a part of a future gen project, and I served on the Future Gen Alliance Board for Peabody. Future gen is a project that is designed to perfect CO_2 sequestration technology in advanced power generation, and we are proud of that, but to jump-start the kind of industry that we are talking about today it cannot be carbon first, supply second. It has to be supply first, carbon second.

I believe it is fair to state that the environmental community believes the biggest problem the world faces is climate change and global warming. From our standpoint as energy suppliers, we believe the biggest problem the world faces is energy supply and the potential for military conflict over energy supply in exchange of nuclear weapons over energy supply. That is where we come from.

Mr. PEARCE. Sure.

Mr. PALMER. Now, we need to work on carbon at the same time, and in that regard I do agree with David and we need to push the envelope, but we cannot hold up the further development of coal utilization because of concerns over carbon.

If we do, we will become more and more reliant on Middle Eastern oil and natural gas because the American people are going to demand energy, and they are going to get it, so we need to turn to coal today even while we pursue a technology path that President Bush has outlined, which we fully identify with and support and congratulate him for his leadership.

Mr. PEARCE. Thank you.

Mr. Hawkins, Mr. Palmer stated that it appeared to be your primary motivator, the greenhouse gases, and you sort of ease up to this in your written testimony on page 6. You talk about there being inherent limitations when you compare the CO_2 emissions from crude oil to liquified coal.

Is there a level of gas price at which you would ever say that that draw, that equivalent—it appears your testimony does not say that it is worse; that it is at least equivalent. The value from many points of view is that if we are able to supplement our fossil fuels that we are able to then lower the cost of gas at the pump.

Is there any price of gas at the pump at which you would personally say I believe I will take that 50 percent tradeoff; I believe I will take that equivalent because we could then have another source begin to address some of the questions that Mr. Palmer raises about the national defense?

Mr. HAWKINS. Thank you, Mr. Pearce. If coal were the only tool in the tool box I am sure I could come up with a number, but——

Mr. PEARCE. I did not ask if. We are talking here about the liquification. I do not care about the other technologies. I am just saying is there a point at which you would say I believe it is worthwhile to go ahead and explore?

Mr. HAWKINS. There is a point at which I would say that we need to pursue alternatives to petroleum, and that point is today.

Mr. PEARCE. I did not ask that question. My question is we are talking about the liquification of coal in this testimony, in this hearing today.

Mr. HAWKINS. And if you are asking me, sir, whether there is a point at which I would say that we should pursue coal before we pursue these other resources, the answer is no because these other resources are abundant, and they are available more quickly and with less environmental damage.

Mr. PEARCE. They have been abundant throughout your lifetime or mine, sir, and they still do not appear to be economic. That is the problem.

The price of gasoline is at $3, moving toward $4 I suspect, and when it hits $4 it is going to move toward $5 if the Chinese and India continue their consumption curve. There is not a ceiling currently on it.

I am just telling you that the alternatives are not nearly as accessible or as close as the liquification, and that is the reason we are having the hearing on this today. You are saying never, and that was what I would like to have on the record.

I would like to go to the second round. I see my time has expired, Mr. Chairman.

Mr. GIBBONS. Thank you.

Mrs. Drake?

Mrs. DRAKE. Thank you, Mr. Chairman.

I would like to thank each of you for being here. I think this is a fascinating discussion, and it was very fascinating reading your written testimony last night because you know where we are here in Congress. This is the thing America is angry about as the price has creeped up.

Mr. Copulos, I think you made a very important statement that I wish everybody would hear and incorporate, and that is that we are either going to look at economic collapse or a global resource war.

Since I have been a Member of Congress, which has only been just over a year now, everything that I have heard is that we will likely be at war with China in the next 10 to 15 years, to which

my question has been why are we not using these 10 to 15 years to not be at war with China? Why would we be at war with them? The answer is always resources.

I appreciate what you have just said and laid it out just so simply, and I wish people would listen to that, but I guess my questions go first to sort of the bigger picture in trying to understand how liquid coal would work to us in the area of transportation.

Would the properties of this be more like a gasoline type of fuel, or would it be more like a biodiesel type of fuel? What will it take for the auto makers? You know, there are going to be different types of engines based on the fuels that you want, or are they going to be interchangeable?

Even if we were pulling this out of the ground today, how am I as the American consumer going to get what I need? I guess I am just trying to figure out how the whole picture comes together because it sounds like this technology is there. It is being done in other nations. How would it work here?

Mr. COPULOS. Well, to begin with you can produce just about any kind of fuel you want to depending on the catalytic process. That is one of the reasons I have pointed out that from a defense standpoint one specific interest there is that with the single fuel concept they need a lot of JP-8. Everything, whether the Abrams tank runs on it, Humvees, everything runs on JP-8.

You can tailor a Fischer-Tropsch plant to get pretty much a specific fuel, so instead of needing that eight barrels of oil to get one barrel of jet fuel you can produce more directly the fuels that you need. You can produce gasoline.

Britain just approved aviation fuel that is half synthetic and half from petroleum that South Africa is producing, and the only reason it is half and half is that they do not have enough of it to make it 100 percent jet fuel, so you are getting fuels that are identical to what you get from petroleum.

Now, the other thing that you can do with this process is clean up the fuel whereas fuel coming from conventional petroleum may have SO_x and NO_x and all sorts of other criteria pollutants. You can tailor your process so they are eliminated on the front end, and you get a very clean burning fuel.

In terms of how you do it, like everything else, you know, a journey of 10,000 miles starts with the first step. The first thing we do is decide we want to do it. Once that decision is made, I would strongly recommend that Congress establish a floor price for oil.

Now, this is not just for synthetic fuels from coal. That concept is fuel neutral. It means ethanol, it means biodiesel, it means anything you want to produce is protected against the predatory moves that we have seen in the past from OPEC.

You know, we had almost eliminated our imports from Saudi Arabia in 1985. In 1986, they crashed the price of oil and put most of our independent oil industry out of business and so on, so we need to provide an environment where investors are secure in the knowledge that they are not going to be subjected to monopolistic price manipulation.

Having said that, you know, the next thing is deciding to do it and allow the private sector to move forward because I am sure that they will.

Mrs. DRAKE. So if I understand you correctly then, we could be using liquid coal today in vehicles that could take diesel today?

Mr. COPULOS. Yes. Now, the fuels you get out of a coal-to-liquids process are identical to their petroleum analogs. You could produce diesel. You could produce gasoline. You could produce methanol for E-85 or to be a source of hydrogen fuel. There is a whole range of things you could produce from coal.

Mrs. DRAKE. So the distribution would be not a problem with coal?

Mr. COPULOS. Once it is turned into fuel there is no problem. You have pipelines that would run the fuel just as they do anything else.

Mrs. DRAKE. Mr. Palmer, for you, and I guess too for all of you, are there two or three things that Congress could do?

First of all, you passed my problem of how does the consumer get it. You have said the floor, but, Mr. Palmer, do you have any suggestions of what Congress should do, two or three things that we could do to bring this on line? I mean, it almost sounds like a miracle product.

Mr. PALMER. It is a miracle product in that the technology exists. It has been overlooked, and most people are not aware of it, but it is there and readily available and useable.

Particularly, I think the most important short-term thing we need to do is to make the Department of Defense secure in terms of the 300,000 barrels of day of refined products they use. That is a bunch.

Mrs. DRAKE. Right.

Mr. PALMER. Their budget is going north. The refinery bill did not pass last week because of a point of order. You need to pass that, and the Senate needs to pass it. That has fast track authority for refineries and has coal-to-liquid refineries in it.

Giving DOD the permanent authority, without having to come back every year for appropriations, to enter into long-term offtake contracts from coal-to-liquid facilities with a price floor that is needed and a discount to future market and some sort of a floating mechanism I think is something that you should look at and do. That is 20 years.

There are two other things. One is the Transportation Act fuel credit. It is 50 cents a barrel. I am sorry. Fifty cents a gallon for alternative fuels, including coal to liquids. That expires in 2009.

It has no value to anybody under any circumstances because plants cannot be built by then. Of course, it did not score. I am sure that is the reason why it did not score, but that needs to be put out and made effective for a long enough period of time to get these plants up and running, and I say 2020.

Finally, I would allow 100 percent depreciation of any dollar invested in any coal refinery put in. Fifty percent is in the Energy Policy Act that passed last year. That expires in 2009 and has no value to anybody, or not very much. That needs to be extended to 2020. I would do that.

If you did those four things, I promise you you will have an industry up and running within a five-year period on a very large scale.

Mrs. DRAKE. Thank you very much. Thank you, Mr. Chairman.

Mr. GIBBONS. Thank you, Ms. Drake.

Mr. Costa?

Mr. COSTA. I have nothing right now.

Mr. GIBBONS. Mr. Holden has joined us on the dais. Welcome, Mr. Holden, to the committee. Do you have any questions for the panel here?

Mr. HOLDEN. No questions.

Mr. GIBBONS. Let me take a few minutes and kind of wrap up some questions I have with this panel, and then we will give others a second chance as well.

I just want to throw this out there and see what your answers will be. Our distribution system today of fuels that go from state to state for transportation fuels is privately held, privately constructed and in private investment. How do we dictate to those privately owned companies that they must carry alternative products in those pipelines that they do not and have not made themselves?

It is sort of like the same conundrum we are in too when we have the electrical transmission lines that are owned by a power company, and you have a renewable resource power company that generates electricity that has to get into that system so that it can be used and incorporated, but that has an effect on the bottom line profitability of the company who has invested in the pipeline or the company who has invested in the pipeline and has the refinery.

How do we get past that? Anybody have an idea? This is big government——

Mr. HAWKINS. I do not know the field, but certainly there is a precedent for assigning common carrier status to critical infrastructure investments. To the extent that today's pipeline systems do not have that common carrier status an obvious policy fix would be to clarify that and to establish it.

Mr. GIBBONS. So we would give an incentive to those companies to carry alternative fuels? Tax breaks or something of that nature?

Mr. HAWKINS. Well, I think it is a non-discrimination requirement that a company that operates that kind of capacity is not allowed to discriminate, but has to serve as a common carrier.

Mr. GIBBONS. You would still have a takings issue though.

Mr. HAWKINS. Yes, you would.

Mr. PALMER. Mr. Chairman, I think the answer to that is to try to go in a path that uses what we have in place to the maximum extent that we can with incremental additions to pipelines and common facilities using the footprint of what exists there today.

In our space, in the National Coal Council study, when we talk about coal to natural gas you could make a pipeline quality gas that could go in a pipeline. You can blend it. Not a problem. You use what exists there today.

If you make a fuel gas you can make the fuel gas, which is a lower BTU quality gas, specifically at what I call cold iron power plants, which are the combined cycle natural gas units that are not running. You can blend it there, and you can use it there or in an industrial facility like Eastman Chemical does.

On coal to liquids, when making a refined diesel product that is environmentally superior to existing diesel, you can use the infrastructure that is in place for the transport of that, whether pipelines, rail cars, et cetera. It is ready to go, and to put in a car I think from a fuel efficiency standpoint diesel is clearly better. I think the Fischer-Tropsch diesel passes any of the California standards, and that is the path I would go.

Mr. GIBBONS. Let me ask another question and just throw it out there for consideration as well because it is one that troubles or puzzles me.

We have Federal regulatory environments which put restrictions out there, barriers and obstacles, but we also have state controls, state regulations, state barriers. What incentives do we give states to enable or promote this kind of alternative fuel either in the construction—how do we get them to take an interested role in this to promote this on a state level?

We can do this at the Federal level, but you always know that states have the right to make laws that are more restrictive than the Federal side of it. What do we do there?

Mr. PALMER. To get buy-in on this, the bids on future gen are due today. We expect to have 23 or 22 bids from nine different states for this $1 billion clean coal technology demonstration plant. There is a lot of interest in it and a lot of enthusiasm over it.

If you created a similar environment with DOD plants—let us say we are going to have five Fischer-Tropsch 50,000 barrel or three 50,000 barrel a day plants. We are going to set up a bidding criteria. Who wants these where?

You would get state buy-in in a big way to come in and help pay for these plants, put them in, liquify coal, supply the Department of Defense with the fuels that they need on a regional basis and create a coalition that way using the future gen as a model for that.

Mr. GIBBONS. Anyone else have something different they want to add? Yes, Mr. Hawkins?

Mr. HAWKINS. Yes. I think a critical element is to make sure that these new technologies are designed so that they are regarded as good neighbors, good neighbors by the communities where they are going to be located and good neighbors in terms of meeting the Nation's environmental goals because it will be shortsighted to offer a lot of money for something that is going to be controversial because it is not designed to be a good neighbor environmentally.

Mr. GIBBONS. Anyone else?

[No response.]

Mr. GIBBONS. Mr. Pearce?

Mr. PEARCE. Thank you. Mr. Copulos, your report has a lot of numbers, and I appreciate that. Do you have any ballpark figure of what it would take per gallon to liquify if we were doing that today under current technology and regulatory? What would the price of diesel cost?

Mr. COPULOS. We have an expert panel to follow us who are going to answer that question, and I am going to stick around and listen.

Mr. PEARCE. Just approximately?

Mr. PALMER. I have seen $35 to $40 a barrel equivalent crude oil.

Mr. COPULOS. Yes. We have actually looked at that number of $35 to $40. We have also looked at the cost of construction.

According to what Sasol's latest numbers are, it is about $25,000 per installed barrel of capacity so actually when you look at it compared to drilling for oil and building a refinery and so on it is quite competitive and quite economical on that side.

The fact is that this can be done economically, and the other thing we have to bear in mind is that when you create an industry like that here at home you are kind of getting a double whammy economically. You are not having a loss of investment overseas.

You are getting the creation of jobs and so on here at home, so it is quite an economic spur in addition to which you eliminate the uncertainties that we currently function under because of our dependence on imported oil. You know, you have Venezuela threatening to cut us off and everything else.

Mr. PEARCE. Yes. Yes. Are there other technologies? In other words, you describe in your report from a national security point of view that we are rushing toward disaster, one of our own making, and if we are going to expeditiously begin to have sources of energy other than this just without embellishing just name them. List them if you would.

Mr. COPULOS. Well, in addition to the Fischer-Tropsch made coal do you mean other resources? You can use Fischer-Tropsch with natural gas. You can use a fast pyrolysis on cellulosic waste that will make a very nice No. 6 fuel oil.

Obviously we have a variety of ethanol processes out there. There is no lack of technologies. There are a lot of technologies. What we need to look at though is the time horizon. How quick can we do some of these things?

In looking at what you can do quickly, you look at what you know works. That is one reason Fischer-Tropsch—and Fischer-Tropsch is not limited to coal. You can do natural gas. You can do a whole bunch of different things.

That is why people focus on that. They know it works. They know it produces clean fuel. We know how to do it. It uses an iron catalyst or cobalt catalyst so you do not have some of the materials issues.

Mr. PEARCE. Sure. Mr. Palmer, just very short because I have a couple more questions here. If you have the tax incentive, the things that you had talked about as being necessary, how long would it take to have an impact in the marketplace if we were to use——

Mr. PALMER. I think the prospect of it would have an impact on the marketplace when these projects started. When steel got on the ground let us say two years from now——

Mr. PEARCE. Two years from now?

Mr. PALMER.—I think that would have an effect on the marketplace.

Mr. PEARCE. That would have an effect? Yes.

Mr. PALMER. Maybe a year from now. If you pass this, in a week.

Mr. PEARCE. Sure. OK.

Mr. PALMER. If you go put it in, it would have an effect.

Mr. PEARCE. It may be a two-year process.

Mr. PALMER. No question it would have an impact in my mind.

Mr. PEARCE. Mr. Hawkins, you had wanted to list the renewables that you felt like were sufficient, and I was driving at a different point. If you could just list those renewables in the order that you think they are accessible and available?

Mr. HAWKINS. It is efficiency and renewables, and the first one is to improve the efficiency of the new car fleet. We have tremendous opportunities there technologically.

Mr. PEARCE. List them out.

Mr. HAWKINS. That is one.

Mr. PEARCE. Yes.

Mr. HAWKINS. OK. The second is very mundane. Replacement tires. Make replacement tires be as fuel efficient as the original equipment tires on the vehicles.

Third is efficiency improvements in the heavy duty truck side. Then biofuels can be accelerated more rapidly than they are today, and also wind power in the grid serving plug-in hybrids is another way that renewables can contribute to backing out oil.

Mr. PEARCE. OK. I appreciate that. My last question, Mr. Chairman, would be, Mr. Hawkins, you were pretty straightforward on where you were on your desire not to convert over to liquified coal.

Since petroleum products produce about the same carbon emissions would you, if you had it within your power, make policy that would cause a conversion immediately from that source that is putting equal amounts of carbon into the air as you kind of oppose to coal?

Mr. HAWKINS. Not immediately because that would be impracticable, but I do agree with the President that the country is addicted to oil, and I agree with the initiatives that he has proposed to reduce our dependence on oil.

That, if it is done correctly, will also have the benefit of reducing the global warming emissions from oil. We have to do it gradually, and because we have to do it gradually we need to get started now.

Mr. PEARCE. With your permission, Mr. Chairman, I know I am over, but you would not do it immediately. Could you give me some time frame for what you think is rational and gradual implementation?

Mr. HAWKINS. Well, as I mentioned in my testimony, we have laid out a program in our report called Securing America that would reduce oil consumption by 2025 by 11 million barrels a day.

Mr. PEARCE. OK. Thank you, Mr. Chairman.

Mr. GIBBONS. Ms. Drake?

Mrs. DRAKE. Thank you, Mr. Chairman.

Mr. Copulos, I found it fascinating when you were talking about the full cost of a gallon of gas, and I wondered if you could repeat that and expand on it, you know, the cost including everything else that is built in and how are we paying that cost?

Mr. COPULOS. Well, some of it we pay directly, some of it indirectly. When we look at the elements we included we looked at, first of all, what were the defense costs. That was most obvious. In 2003 we were spending $49.1 billion a year to defend the flow of oil from the Persian Gulf. I should note that this is a longstanding commitment we have had since 1945.

It is perfectly legitimate to protect our oil sources, but people just do not realize that that is in the defense budget. This was derived through a very painstaking and detailed analysis, which I will not bore you with, where it is an accurate figure. This year that figure has gone up to $132.8 billion because we are actively engaged in the region.

We looked at direct and indirect costs. When you send a dollar overseas, that means it is not invested here. It does not create jobs here and so forth. That was $159.9 billion in 2003. I do not have the specific figure in front of me here, but it is several times that today.

We looked at also the question of oil shocks, oil supply disruptions. We had that the cost of the oil shocks of the 1970s was between $2.2 trillion and $2.5 trillion. Before anyone says that sounds high, I should note that Oak Ridge puts it at between $4 trillion and $8 trillion, so we are very conservative.

We chose to amortize that over 30 years because the effect extends, you know, beyond the actual event. Right now we are seeing effects of an oil shock on our economy even as we speak with the price going up, so we think that is a legitimate figure.

You pay directly your defense costs. You pay directly in some cases through higher interest charges, unemployment and so on. Part of the economic cost is an opportunity cost—lost employment, wages and so on and loss in GDP. That is how we derive these figures.

As I said, if you want to amortize across the entire volume of oil it is $5.04 a gallon. We believe that you also have to consider the Persian Gulf imports separately in terms of the defense costs because we are not spending money to defend oil from Canada or the North Sea. We are defending the Persian Gulf. When you attribute that directly the hidden cost is $8.35.

Mrs. DRAKE. We had a hearing recently with the military and Federal lands and some of the alternative fuels that they are using, so I am wondering. The Department of Defense, are they very receptive to what you are proposing?

Mr. COPULOS. DOD is very—in fact, the TAC Automotive and Armor Command is way ahead of DOE and the other departments in terms of their R&D and to alternative fuels.

They just announced they have this heavy equipment—it is a tow truck for an Abrams, a 70 ton Abrams tank that is a diesel/electric hybrid. I actually rode in one. They have a whole range of alternatives they are looking at and for good reason.

Seventy percent to 80 percent of the cargo carried in the battlefield is fuel, 10 percent is water and 10 percent is everything else from bullets to beings, so obviously fuel is an enormous issue, logistical issue, and it is an enormous cost. I have seen numbers all over the chart, but as best as we can tell a gallon of fuel delivered in the field costs about $13.

As such, to the extent that you can reduce the need for fuel, reduce consumption, you are ahead of the game. Also, you know, if you take a look at the contemporary battlefield in the Gulf War the 582,000 troops we sent used more than twice as much oil on a daily basis as the entire 2-million-man Allied expeditionary force that invaded Europe.

Between the Gulf War and Operation Iraqi Freedom, our requirement per deployed soldier increased 20 percent. It is now one barrel of refined product for every service member we have in the field. It is an enormous number, and it is going to go up even more in the future when we look at the Stryker Brigade combat teams and all the other very fuel-intensive systems we have.

Mrs. DRAKE. Right.

Mr. COPULOS. It is critical. That is one reason we looked in particular at DOD and why they are looking at all sorts of alternatives because they know they are going to need it and not always be able to get it.

Mrs. DRAKE. Right. Thank you.

I yield back, Mr. Chairman.

Mr. GIBBONS. Thank you very much.

Mr. Costa?

Mr. COSTA. Thank you very much, Mr. Chairman.

Mr. Hawkins, I understand that last month you appeared before the Senate Energy and Natural Resources Committee and stated that fortunately you can have a robust and effective program to reduce oil dependency without rushing to embrace coal-to-liquid technologies.

Could you explain to us how you expect to get there? I mean, are there proposals to reduce this dependency absent a significant coal-to-liquids program? I mean, we all clearly remember 1973 with the first gas lines and President Nixon's proposal for energy independence and to relieve our sources of foreign oil. I believe every President since President Nixon has come up with their own branded energy program.

In those days we were about 30 percent dependent upon foreign sources of energy. Today we are almost 60 percent, notwithstanding all those programs or proposals, and I know we are competing against India and China for those resources.

You talked about the President's strategy, but I would like you to elaborate.

Mr. HAWKINS. Certainly. As I mentioned, the report, Securing America, that we and the International Agency for Global Security developed, lays out a program that would save more oil more quickly than the program that Mr. Palmer described in the National Coal Council.

That program called for a 2.6 million barrel a day savings by 2025, as I recall. We have laid out a program that pursues efficiency and renewable energies that would save three million barrels a day by 2015 and over 10 million barrels a day by 2025, and it would do it with a system of technologies that are robust for the world that we have to prepare for.

That is our basic point that it makes no sense to build a large, new industry that ignores the global warming problem and that makes it worse if you do not capture the CO_2.

That is all we are asking this committee to look at is to consider not just today, but tomorrow, and all the investments that the American taxpayers are perhaps going to be asked to subsidize. Are they robust? Will they be a lasting industry, or will they lock us into global warming emissions which ultimately are going to come out of other people's pockets because we are going to have to cut

back on those emissions, so our view is we need to find strategies and energy resources that both cut our dependence on foreign oil and cut our dependence on high carbon emissions to the atmosphere.

Fortunately we have a good set of alternatives. In terms of time to deployment, there is not a barrel of Fischer-Tropsch fuel supplying American needs today, but there are four million gallons a year of ethanol, and we are going to go up to eight billion.

Mr. COSTA. And I am an advocate of the biofuels and ethanol. You know, in California we for several decades tried to use a multitude of strategies in terms of renewables with varying degrees of success, and I do believe that there are a multitude of strategies that we can employ in terms of our energy toolbox, but what seems to be lacking is a consistent plan that can pragmatically be implemented using the market forces and providing incentives at the right place.

I mean, we can look back clearly at our history over the last three decades of what has not gone right or where the lack of right has been. You know, maybe this, and I do not think we are going to see in the foreseeable future cheap fuel any more in terms of the dollars, of what a barrel of oil costs.

That having been said, is this crisis going to be the one that finally allows us to come together as a country and get serious about this?

Mr. HAWKINS. Well, I certainly hope it is. I think that there are some very interesting parallels between the oil dependency crisis and the global warming crisis. Both of them take a long time to develop. Both of them are entirely entangled with our energy supplies, and both of them take a long time to solve, which means we need action today.

All we are saying is let us make this an integrated program. Let us not solve one problem and make the other one worse.

Mr. COSTA. Excuse me. I know I am out of time, Mr. Chairman, but with the Science Committee with the Chairman in January from Antarctica there is obviously a large testimony of evidence to indicate that whether or not the hockey stick effect is real or not. It is clear that we are having dramatic changes in our climate, and I believe we are partially responsible for those changes, and we have to address that.

I am not convinced that we have a strategy that has buy-in from all the key sectors to allow us to do both the energy changes we need to make, as well as to deal with our air quality, but I hope you are right. I hope we are moving in that direction.

Mr. GIBBONS. Thank you, Mr. Costa.

To the first panel, I want to thank you very much for being here today. It is clear that we have to do everything to meet the needs of energy for the future, as well as what we need to do to work on to make sure we do it cleanly and acceptably.

I think there are a lot of interesting proposals that have been presented today, and we certainly appreciate the testimony. We will excuse our first panel with again a thanks from the committee.

[Panel excused.]

Mr. GIBBONS. We will call up our second panel, which consists of Mr. John Rich from Waste Management and Processors, Inc.;

Hunt Ramsbottom of Rentech, Inc.; John Ward from Headwaters Inc.; Robert Kelly, DKRW Energy; and Garry Anselmo, Silverado Green Fuels.

Gentlemen, if you would be so kind as to take the appropriate seat up there? Actually, before you have a chance to sit and then stand up again, we have an oath to give you, so when you are ready. I think we are going to have to get real comfortable. We have five people on this panel.

You know, the technical problems we are working on. That will work, but, as you can tell, we only have four microphones so we are going to have to share. Can we figure out where everybody is sitting? You know, this is not really that complicated. This is what leadership is all about, right? Let us get this settled.

Gentlemen, welcome. Before we hear from each of you we have a requirement from the committee to swear you in, so if you would all raise your right hands?

[Witnesses sworn.]

Mr. GIBBONS. Let the record reflect that the witnesses, each of them, answered in the affirmative.

I would like to turn now to Mr. Tim Holden from Pennsylvania to introduce his guests and constituents. Mr. Holden?

Mr. HOLDEN. Thank you, Mr. Chairman, and thank you for allowing me to be with you today.

Mr. Chairman, first of all, thank you for having this hearing on the future of coal. I represent the majority of the anthracite coal fields of Pennsylvania, along with Paul Kanjorski and Don Sherwood.

Mr. Chairman, as you and I had the opportunity to speak yesterday, we have more recoverable coal in this country than the rest of the world has in recoverable oil, and we need to find a way to take advantage of this natural resource.

Mr. Chairman, thank you for allowing me to introduce my constituent and my friend, John Rich, who has I was going to say dedicated his entire adult life to the coal-to-liquid project, but at least the last 14 years I know he has dedicated that I have served in this Congress. You will hear from the energy and enthusiasm and conviction of his testimony how involved he and his company are in this process and how they are moving forward.

Finally, Mr. Chairman, I would just like to leave you with that this is a project that the Federal government through two Administrations has been a true partner. In the Clinton Administration we were able to secure the initial $9 million. Two Pennsylvania Senators and the Bush Administration have been able to receive I believe, and John can correct me if I am wrong, a $90 million investment and also a loan guarantee for this project.

We are having a little trouble with the Department of Energy working through the bureaucracy on the guarantee so, Mr. Chairman, maybe with your help and Mr. Pombo and Mr. Rahall and our two Senators maybe we can try to move that along.

Again, Mr. Chairman, thank you for allowing me to introduce my constituent and friend, Mr. John Rich. Thank you.

Mr. GIBBONS. Mr. Holden, we are happy to have you here present today. We are happy to have your constituent, and, believe me, we

are very interested in making sure that what we can do as a Congress helps answer some of these energy problems.

With that we will turn to our witnesses. Again, each of you, welcome. We will start with Mr. John Rich from Waste Management and Processors, Inc.

Mr. Rich, you have had a glowing introduction. The floor is yours. We look forward to your testimony and hope you can live up to Mr. Holden's kind comments.

Mr. Rich?

STATEMENT OF JOHN W. RICH, JR., PRESIDENT, WMPI PTY., LLC

Mr. RICH. All right. Thank you, Mr. Chairman, members of the Subcommittee and my good friend, Congressman Holden.

I commend you for holding this hearing this morning. Coal to liquids is the most important resource topic and technology you could focus on and over the next decade the most important technology to ensure U.S. energy and economic security.

My name is John Rich, President of WMPI, a privately held Gilberton, Pennsylvania, based company engaged in developing and subsequently operating the Gilberton Waste Coal to Ultraclean Transportation Fuels plant. We first started investigating coal to liquids in the late 1980s and initiated a concerted effort in developing the project in the mid 1990s.

The Gilberton coal-to-liquids plant will convert abundant anthracite coal waste into zero sulfur, high cetane, ultraclean transportation fuels and electric power. Simultaneously, WMPI will reclaim large areas of abandoned mine lands.

The plant will gasify the coal wastes to produce a gas which will then be converted into liquid fuels via Fischer-Tropsch synthesis. Part of the gas will also be used to provide up to 41 megawatts of clean electric power and steam.

Our progress to date includes the Pennsylvania Department of Environmental Protection having issued the air permit, the Susquehanna River Basin Commission having issued the water withdrawal permit. The environmental impact statement is in the final stages of review. The site, the feedstock, the infrastructure is available to WMPI and under our control.

Among the project participants are Nexant, an affiliate of the Bechtel Company; Shell Global Solutions U.S., who will be providing the front end technology, gasification technology. Sasol Technology, Ltd., the world leader in FT synthesis, will provide the essential technology that converts to gas into wax. Chevron Lummus Global will provide the technology that converts the wax into zero sulfur transportation fuels.

WMPI has engaged Uhde and Black & Veatch, both global engineering companies, to design, build and startup the plant, and WMPI has engaged Morgan Stanley and United Bank of Switzerland as financial advisors and underwriters to guide us in securing the financing.

WMPI is in the final stages of concluding an offtake agreement offered by Pennsylvania Governor Rendell for the diesel fuel produced. The Commonwealth of Pennsylvania has provided a trans-

ferable investment tax credit which will fund approximately seven percent of the capital cost of the project.

Two competitively awarded Department of Energy programs, the Early Entrance Co-Production solicitation and the Clean Coal Power Initiative solicitation, have been awarded to WMPI and have been essential to the success of the project.

The benefits of this are many. The United States will be taking meaningful steps toward reducing its dependence on imported oil. Our plant feedstock is not subject to foreign manipulation as is the situation today with OPEC oil. The Gilberton plant will provide 1,000 construction jobs and during operation 600 primary and secondary jobs, all new jobs.

Successful commercialization of the technology throughout the U.S. will bring substantial socioeconomic benefits to the Nation's coal regions by trapping a portion of dollars that currently are being exported to purchase foreign oil. Moreover, the Gilberton plant will cause the cleanup of millions of tons of waste coal and the reclamation of abandoned mine land.

The facility will provide superior transportation fuels—the naphtha, the kerosene, the diesel fuels that are virtually free of sulfur. The FT naphtha can be upgraded to a high octane, clean reformulated gasoline. The FT diesel or the FT kerosene is low in smoke point and has special applications as a military jet fuel.

WMPI has had material similar to what we will be producing in Gilberton shipped from South Africa to Wright-Patterson Air Force Base which was tested by the DOD for its single battlefield fuel applications with very positive results.

The FT diesel can be incorporated and distributed through the existing infrastructure and exceeds all government fuel specifications.

What can Congress do? These plants are very complex. The individual components are developed and commercial, but no one has integrated the Shell entrained flow gasifier with Sasol FT technology. Investors are reluctant to invest in first-of-kind approaches.

Furthermore, China is moving ahead with an aggressive coal-to-liquids effort, and daily we are competing for limited resources such as shop space, engineering expertise, et cetera. Time is definitely against us.

With that in mind, Senator Santorum and Senator Specter included a provision in the Energy Policy Act of 2005 for DOE to provide a loan guarantee for our project. If Congress would expedite this guarantee, WMPI could close financing and start construction this year.

If Congress would expedite DOD entering into long-term offtake agreements, this would facilitate our efforts to finance future projects while simultaneously reducing the uncertainty in DOD costs and availability of fuel.

Finally, streamlining the environmental permit review for defense-related contracts would speed up the financing, construction and operation of these facilities, expediting not only the ultraclean transportation fuels commercialization generally, but making the country more secure specifically.

Within the next several years, WMPI and other companies plan to expand their operations into western Pennsylvania, West

Virginia, Kentucky and other western states and could produce up to 20 percent of the domestic transportation fuels that we are currently importing.

Thank you for this opportunity, and I welcome any questions.

[The prepared statement of Mr. Rich follows:]

Statement of John W. Rich, Jr., President, WMPI Pty. LLC

Introduction

Thank you, Mr. Chairman, Members of the Subcommittee and Congressman Holden. I commend you for holding this hearing this morning. Coal-to-liquids is the most important resources topic and technology you could focus on and, over the next decade, the most important technology to insure U.S. energy and economic security.

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The Gilberton Coal to Liquids plant will convert abundant anthracite coal waste into zero sulfur, high Cetane, ultraclean transportation fuels and electric power. Simultaneously, WMPI will reclaim large areas of abandoned mine lands. The plant will gasify the coal wastes to produce a gas which will then be converted into liquid fuels via Fischer-Tropsch ("FT") synthesis. Part of the gas will also be used to provide up to 41MW of electric power and steam.

To Date:

1. The Pennsylvania Department of Environmental Protection has issued the air permit; the Susquehanna River Basin Commission has issued the water withdrawal permit; the Environmental Impact Statement is in the final stages of review.
2. The site, feedstock and infrastructure is available to WMPI.
3. Among the project participants are:
   - Nexant, Inc., an affiliate of Bechtel Corporation;
   - Shell Global Solutions U.S., who will be providing the front end gasification technology;
   - SASOL Technology Ltd., the world leader in FT Synthesis will provide the essential technology that converts the gas into a wax;
   - ChevronLummus Global, will provide the technology which converts the wax into zero sulfur transportation fuel;
   - WMPI has engaged Uhde and Black & Veatch, both global engineering companies, to design, build and startup the Gilberton Plant;
   - WMPI has engaged Morgan Stanley and UBS as financial advisors and underwriters to guide us it in securing the financing.
4. WMPI is in the final stages of concluding an offtake agreement offered by Pennsylvania Governor Rendell for the diesel fuel produced.
5. The Commonwealth of Pennsylvania has provided a Transferable Investment Tax Credit which will fund approximately 7% of the project cost.
6. Two competitively awarded Department of Energy programs, the Early Entrance Co-Production solicitation and Clean Coal Power Initiative solicitation have been awarded to WMPI and have been essential to the success of the project.

Benefits are Many

1. The United States will be taking meaningful steps toward reducing its dependence on foreign oil. Our plant feedstock is not subject to foreign manipulation as is today's situation with OPEC oil.
2. The Gilberton Plant will provide 1000 construction jobs and during operation approximately 600 primary and secondary jobs.
3. Successful commercialization of the technology throughout the U.S. will bring substantial socioeconomic benefits to the Nation's coal regions by trapping a portion of the dollars currently being exported to purchase foreign oil.
4. Moreover, the Gilberton Plant will cause the cleanup of millions of tons of waste coal and reclamation of abandoned mine land.
5. The facility will provide superior transportation fuels—the naphtha, kerosene and diesel fuels which are virtually free of sulfur, low in particulates and aromatics.

- The FT naphtha can be upgraded to a high-Octane, clean reformulated gasoline.
- FT kerosene is low in smoke point and has special application as military jet fuel. WMPI has had material similar, to what will be produced in Gilberton, shipped from South Africa to Wright-Paterson Air Force Base which was tested by the DOD for its Single Battlefield Fuel of the Future Program with positive results.
- The FT diesel can be incorporated and distributed through the existing infrastructure and exceeds all government fuel specifications.

What Can Congress Do?

These plants are very complex. The individual components are developed and commercial, but no one has integrated the Shell entrained flow gasifier with the Sasol FT technology. Investors are reluctant to invest in first-of-kind approaches. Furthermore, China is moving ahead with an aggressive coal-to-liquids effort and, daily, we are competing for limited resources such as shop space, engineering expertise, etc. Time is against us. With that in mind, Senator Santorum and Specter included a provision in the Energy Policy Act of 2005 for DOE to provide a loan guarantee for our project.

1. If Congress would expedite this guarantee, WMPI can close financing and start construction this year.
2. If Congress would expedite DOD entering into long-term offtake agreements, this would facilitate our efforts to finance future projects while simultaneously reducing the uncertainty in DOD costs and availability of fuel.
3. Finally, streamlining the environmental permit review for defense related contracts would speed up the financing, construction and operation of these facilities, expediting not only the ultraclean transportation fuels commercialization generally but making the country more secure specifically.

Within the next several years WMPI and other companies plan to expand their operations into western Pennsylvania, West Virginia, Kentucky and other western states and could produce up to 20% of the domestic transportation fuels that we are currently importing.

I thank you for giving me the opportunity to discuss these issues and I am ready to answer any questions which you might have.

Mr. GIBBONS. Thank you very much, Mr. Rich. We appreciate you being here and look forward to the question and response period later on.

I turn now to Hunt Ramsbottom from Rentech, Inc. Mr. Ramsbottom, welcome. The floor is yours.

STATEMENT OF D. HUNT RAMSBOTTOM, CEO AND PRESIDENT, RENTECH, INC.

Mr. RAMSBOTTOM. Thank you, Mr. Chairman, distinguished Members and guests. I am Hunt Ramsbottom, President and CEO of Rentech. We are a publicly held company listed on the American Stock Exchange. For 25 years, Rentech has engaged in research and development on ultraclean fuels that can be produced from coal and petroleum coke.

I am passing around—I think you have up there—a sample of our clean fuels. It is very different from petroleum diesel. It is clear, refined to a high degree of purity and extremely low in particulates and sulfur.

Rentech's fuel does not require engine modification. It can be used in trucks, buses, barges, blended with petroleum diesel or blended with other alternative fuels, including biodiesel. It can also be processed into jet fuel as discussed earlier.

We currently hold 20 U.S. patents on our process. We have tested our innovations in six pilot plants for over 20 years. Our seventh process demonstration unit is scheduled to be operating the

first half of 2007 for further demonstration, analysis and training on our products.

We are on track to have a fully commercial plant up and running by 2010. Our focus is making transportation fuels in the U.S. from coal and petroleum coke. We can locate our plants anywhere with access to these resources.

We are environmentally friendly both in our fuel and our manufacturing process. As we manufacture our fuel we remove the most harmful regulated pollutants. Sulfur and mercury, for example, drop out as elements in the gasification stage. We are also working to reduce unregulated emissions of greenhouse gases.

Our current proposed plant in Mississippi offers the opportunity for 100 percent carbon capture and storage. Local oil fields would use our carbon monoxide to force out additional oil in the region and trap our carbon underground. Our fuel also runs cleaner than petroleum diesel, has a longer shelf life and is biodegradable.

Clean fuel is currently economically competitive. We can produce our finished fuels for $36 to $42 per barrel, the equivalent of raw crude at $30 to $35 per barrel. It does take commitment and capital to start a new industry, as we discussed today. As many keen observers point out, everyone wants to build a second plant. Building a commercial industry requires a first plant.

To overcome the financial hurdles, Rentech has developed a five point strategy for commercialization. First, we are jump-starting deployment of our Rentech process by pairing it with gasification technology in our new East Dubuque facility. Second, we are pursuing multiple strategic projects throughout the U.S.

Third, we are developing repeatable and scalable design to produce up to 50,000 barrels per day. Fourth, we are continuing to invest heavily in our research and development as we have done historically. Fifth, we are looking at selected licensing opportunities of our process throughout the United States.

Our first clean fuels plant is underway right now. Last week we purchased a fertilizer plant in East Dubuque. We will convert that facility from extensive natural gas to affordable Illinois coal to produce fuels, fertilizer and electricity. By 2010, it will produce 1,800 barrels per day in Phase 1. A year later it will produce 6,800 barrels per day in Phase 2.

Our second plant in Mississippi will produce 11,000 barrels per day in Phase 1, and we are looking at additional opportunities across the U.S., including discussions with major coal companies, to produce plants up to 50,000 barrels per day near their mines.

Today the U.S. produces and consumes over two million barrels per day of diesel with demand projected to double in the next 20 years, so a thriving clean fuels industry is vital to our future.

As we launch this industry, Rentech plans to make full use of the EPACT 2005 incentives. Thank you for you efforts in making them available. Illinois and Mississippi have also been exceptionally helpful.

Rentech is not asking the government to subsidize clean fuels. We need your help to create a climate where we can use private sector funding to establish a fully commercial industry. There are four ways that you can help us jump-start this industry:

First, support appropriate investment tax credits. We will apply for the industrial tax credit, and efforts to raise the current $350 million cap to $850 million would help even more. You should consider lifting the cap altogether. A separate clean fuels tax credit would do even more to get production going.

Second, make the fuel excise tax credit available to clean fuels by extending the 50 cents per gallon credit from 2009 when no plants would be operating to at least 2014.

Third, fully fund and implement the Federal loan guarantees. We will apply for the self-pay guarantees in the first quarter of 2007 as we convert our first plant.

Fourth, support military consideration for clean fuels. Long-term DOD contracts for diesel or jet fuel would assist greatly with the financing of these facilities.

This combination of incentives and contracts will provide the initial climate and stability needed to propel private investment. We are excited about clean fuel that can help meet our national energy needs, foster energy independence, preserve our energy security and protect our environment.

Thank you for your help. Thank you for your support today.

[The prepared statement of Mr. Ramsbottom follows:]

Statement of D. Hunt Ramsbottom,
CEO and President, Rentech, Inc.

Thank you, Mr. Chairman. Distinguished Members of Congress and guests, I am Hunt Ramsbottom, the President and CEO of Rentech, Inc. Rentech is a publicly held, Denver-based firm listed on the American Stock Exchange. For 25 years, Rentech has engaged in research and development, focusing on enhancing the production of ultra-clean fuels made from coal, petroleum coke and natural gas.

Rentech's Clean Diesel

I am passing around a sample of Rentech's ultra-clean fuel—in this case, our diesel. As you can see, it is very different from petroleum diesel. It is clear, refined to a high degree of purity and extremely low in both particulates and sulfur. The familiar belching cloud you see when a diesel truck or bus starts to accelerate is caused by particulates, and recent studies have shown that they potentially have long-term harm to human and environmental health—but our fuel eliminates most of that concern. When the Air Force tested our fuels and similar fuels made by competitors, the tests showed reductions in particulates of up to and over 80%. The Rentech fuel is also extremely low in sulfur—less than 1 part per million, far under the new EPA standard of 15 ppm.

Rentech's fuel doesn't require any engine modifications. It can be used as is as the operating fuel for trucks, buses and barges. It can also be blended with petroleum diesel or alternative fuels such as biodiesel. It can even be processed into jet fuel.

The basic chemistry behind our fuel products has been known for 7 decades. The basic technology has been developed and used extensively in other countries. Rentech currently holds 20 U.S. and 4 foreign patents making the process more efficient and effective. We have tested our innovations in six pilot plants over the past 20 years.

The 7th pilot, our Process Demonstration Unit (PDU), is scheduled to be operating by the first half of 2007. It will produce 10 barrels per day (bpd) for demonstration, analysis and training by potential end users. And it will allow us to optimize our technology for variations in coal and other site-specific factors. We now have developed our technology extensively around Coal-to-Liquids—or CTL—gasification, and for Rentech, the future of CTL in the United States is no longer a theoretical, what-if, conversation. We plan to have a fully commercial, fully operational CTL plant up and running by 2010.

Our focus as a company is now on making clean transportation fuels in the U.S., from U.S. resources for U.S. consumption. We are targeting our commercial investments to production based on coal and petroleum coke (a byproduct of oil refining)

feedstocks. We can locate plants anywhere with sufficient access to these resources, from coal-producing states to Hawaii (which has petroleum coke from its refinery).

Environmental Benefits

You should also smell the product. It has none of the typical odor of diesel. There are two other critical differences between this and typical diesel. Our fuel has a shelf-life of at least 8 years, rather than 3-4 months for petroleum diesel—meaning that for the strategic reserve, for emergency first-responders, and the military, our fuel has incredible advantages. Next, our fuel is biodegradable. If it spills, it does not cause extensive or irreparable damage to waterways or wells.

Let me take a moment to highlight the environmental policies that we intend to pursue. Rentech is committed to being environmentally friendly—and both our production and fuels have environmental benefits.

As we manufacture our fuel, we remove most of the harmful regulated pollutants in the gasification stage. Sulfur and mercury come out as elements—they do not go up a smokestack to be scrubbed out, and do not leak into the environment. We are also working to reduce unregulated emissions, such as greenhouse gases. Our proposal for a second plant, to be located in Natchez, Mississippi, offers the opportunity for 100% carbon capture and storage. Our carbon dioxide output would be pumped into nearby older oil well fields, both helping to produce additional oil by forcing out additional supplies and trapping the carbon underground.

Additionally, our fuel runs cleaner than petroleum diesel. Diesel itself has significant advantages over gasoline, providing greater power with fewer emissions—and using Rentech's diesel keeps the power advantage and reduces emissions even further.

Economic Challenges

At the moment, a number of trends are converging to jump-start the clean fuels industry in the United States. You are all familiar with the recently soaring price of gas, of the very real concerns about America's energy dependence and energy security, and of the challenges posed by both the geopolitical and global environmental situations. Our fuel is part of the solution for each of these concerns.

With oil prices at historic highs, our fuel is also economically competitive. Including the financing and development costs, we can produce finished fuels for $36 to $42 per barrel, the equivalent of buying raw crude at $30 to $35 per barrel.

To start this industry however, you need to open the first plant in the U.S. Each successive plant will build on the economies of scale, improve on the lessons learned at previous plants, and expand the market. It is very capital intensive to build the industry, and one plant is only the start. You have to build second, third, fourth, and then successive plants. But, as the Governor of Montana likes to note, everyone wants to build the second plant. Nobody wants to finance the first in the U.S., even though these plants exist in several other countries.

Rentech has developed a five-point strategy for commercialization, designed specifically to overcome the financial hurdles of getting started in the U.S. First, we are jump-starting the deployment of our proprietary Rentech process by pairing off-the-shelf gasification and finishing plant technologies with our Rentech Reactor. Second, we are aggressively pursuing multiple strategic projects in the U.S., with the goal of getting plants up and running at several sites very quickly.

Third, we are developing a repeatable and scalable design that allows for expansion of production up to 50,000 bpd per plant that will provide for a very rapid expansion of the industry once the first plants are operational and proved out. Fourth, we are continuing to invest heavily in research and development, to push the optimization of our technologies even farther. And fifth, we are examining selected licensing opportunities to expand use of our process and our proprietary technologies.

East Dubuque, Illinois: The First Clean Fuels Production Plant in the U.S.

Our first clean fuels plant is underway right now. Last week, Rentech purchased a fertilizer plant in East Dubuque, Illinois, and we plant to convert it in phases to CTL poly-generation over the next 3 to 4 years. By poly-generation, I mean that we will ultimately produce 3 core products: ultra-clean transportation fuels, ammonia fertilizer and electricity.

The plant currently makes ammonia fertilizer from natural gas, and it already incorporates basic technologies that are critical to successfully implementing CTL. The conversion will include changing the feedstock from expensive natural gas to affordable Illinois coal. In phase one, we will add a coal gasification unit to the fertilizer production line, generating syngas which is the first step in each of the products that will ultimately be generated.

Fertilizer will still be made in large quantities. As I'm sure all of you know from our friends in the farm states, domestic fertilizer plants are shutting down rapidly

because of high natural gas prices—the current primary feedstock for fertilizer. Since 1999, the U.S. has switched from producing all its own fertilizer to becoming a net importer. We will demonstrate that fertilizer production can still be a thriving domestic industry using clean coal technologies.

Electricity will also be produced, primarily for the plant's own use. A small surplus, however, will be provided to the local grid. But our primary focus is the production of our fuels. So in later stages of our first phase, we will add a Rentech Reactor and a finishing plant, allowing production of 1,800 bpd of our diesel. Those additions will be on-line and producing in 2010.

Later, in phase two of our East Dubuque build-out, we will add a second gasifier. That will allow us to raise fuel production up to 6,800 bpd. Under our timeline, the East Dubuque plant will be first commercial plant in the U.S. to produce marketable quantities of clean fuels from CTL.

Looking Ahead

Rentech is also pursuing a second larger scale plant in Natchez, Mississippi—the Natchez Adams Strategic Fuels Center—which would produce up to 11,000 bpd in phase one. We were invited by the local community to consider the possibility after Hurricane Katrina when Mississippi ran disastrously low on diesel. At Natchez, we can use two feedstocks—both coal and petroleum coke, a byproduct of the local petroleum industry. And as I have mentioned, there is the very real possibility of capturing and storing 100% of the carbon dioxide emissions through enhanced oil recovery in nearby oil fields. To our knowledge, this would be the first large-scale U.S. commercial capture and storage of man-made carbon emissions. Carbon dioxide injection is already being used in this oil-producing basin, but additional supplies are need.

Looking even further ahead, we are considering several development opportunities in various regions of the U.S., including discussions with coal companies to utilize a replicable, iterative plant model at the mouths of mines. There, we would size a basic plant model that could be expanded. For twenty years, Rentech has researched and optimized its technology. We have refined our process to make it more effective and more environmentally-friendly. Now we are commercializing it.

Today, the U.S. produces and consumes over 2 million barrels per day of diesel, and many experts project demand to double in the next twenty years. A thriving clean fuels industry is vital to our nation's future, both for our energy security and our environmental sustainability.

What the Government Can Do

As we launch this industry, we are planning to make full use of the EPACT 2005 incentives that the Congress designed to jump-start clean fuels. Thank you for those efforts. Let me also note that the States are also lending their assistance. The State of Illinois has been extraordinarily helpful—they helped us to complete feasibility studies, engineering studies and provided grants to assist with conversion to coal. The State of Mississippi has also been exceptionally supportive of the possibility of our second plant being located in Natchez, and they just passed a $15 million bond bill for the proposal.

We are not asking the government to subsidize clean fuels. We need your help to create a climate where we can use private-sector funding to establish a fully commercial industry. There are four ways than you can help us jump-start the industry.

A Four-Point Plan to Jump-Start the Clean Fuels Industry

1) Support Appropriate Investment Tax Credits. To meet our aggressive timeline, we will apply for the industrial gasification investment tax credit provided by the Energy Bill. Recent initiatives to raise the current $350 million cap to $850 million would help even more. If Congress is serious about trying to reduce our dependence on foreign oil import then allow me to offer an observation. Maintaining the current cap of $350M could slow the rollout of industrial gasification using coal to the point where the U.S. winds up losing more industry. Even an $850M cap will assist the development and deployment of only 3 to 4 more plants—hardly the creation of a full-fledged industry. At $75 per barrel, the price of oil last week, the U.S. is paying $850 million to foreign countries for oil every two days. To create a real incentive, it might be better to lift the caps altogether. Another proposal, for an investment tax credit specific to clean fuels, would do even more to accelerate production

2) Make the Fuel Excise Tax Credit Available to Clean Fuels. There is another way for the federal government to help, by making the 50 cent-per-gallon fuel excise tax credit provided in the Highway Bill available to CTL fuels. To do that, you could extend the expiration of the current credit from 2009, when no CTL plants will yet be operational in the U.S., to at least 2014.

3) Fully Fund and Implement the Federal Loan Guarantees. We will also apply for the self-pay guarantees that the Congress initiated at the Department of Energy (DOE). This program is absolutely vital to our efforts. We understand that DOE's implementation has begun and we commend the Department and the Secretary of Energy for quickly moving to implement the authorized programs. We appreciate and hope you will continue your efforts to ensure that both of the DOE loan programs are fully funded and implemented expeditiously. And,

4) Support Military Consideration of Clean Fuels. The final idea for the government to help catalyze commercial deployment of the CTL industry is to examine usage of clean fuels for military applications. Long-term contracts for military use of diesel and jet fuel would assist greatly with private-sector financing of the first plants.

The Energy Information Administration's AEO 2006 projected long-term oil costs at $50 and above. The same forecast shows CTL production growing to 700,000 barrels per day by 2030. To get there, the first plants must be financed and built, paving the way for the industry to flourish. This 4-point combination of incentives and contracts would provide the initial climate and stability needed to propel private investment.

Conclusion

I think the great potential of clean fuels, especially using CTL, is that American resources, American know-how, and American innovation will help create environmentally-friendly energy and sustain American jobs. A robust clean-fuels sector can help us meet the challenge of our national energy needs, foster greater energy independence, and preserve a full measure of our energy security. At Rentech, we are moving today to produce clean fuels for America's future.

Thank you for all that you have already done to allow a jump-start of CTL and clean fuels in the Energy Policy Act of 2005. We intend to make use of your help to do just that—jump-start full scale utilization of CTL, and jump-start a new clean fuel manufacturing industry. Thank you as well for your time today.

Mr. GIBBONS. Thank you very much, Mr. Ramsbottom. We enjoyed your testimony. It was very informative to us.

We will turn now to Mr. John Ward from Headwaters Inc. Mr. Ward, thank you for taking time out of your day. The floor is yours. We look forward to your testimony.

STATEMENT OF JOHN N. WARD, VICE PRESIDENT, MARKETING & GOVERNMENT AFFAIRS, HEADWATERS INC.

Mr. WARD. Thank you, Mr. Chairman, honorable Members of the committee. I am John Ward, Vice President of Headwaters Inc., on whose behalf I am testifying today. I also serve as President of the American Coal Council and as a member of the National Coal Council appointed by the Secretary of Energy.

Headwaters is a New York Stock Exchange company that provides an array of energy services. We are a leading provider of precombustion clean coal technologies for power generation such as coal cleaning, upgrading and treatment. We are the largest manager of coal combustion products, marketing coal ash from more than 100 power plants across the United States.

We have built a large construction materials manufacturing business and have incorporated coal ash into many of those products. We are currently commercializing technologies for upgrading heavy oil, and we are also entering the ethanol fuels market by constructing our first ethanol production facility in North Dakota using waste heat from a coal-fired power plant as process energy. Finally, we are active as both a technology provider and a project developer in the coal-to-liquid fuels area.

Other witnesses will testify regarding the technologies associated with converting coal into liquid fuels and with the superior per-

formance and environmental characteristics of the fuels themselves. I will focus my remarks on what it will take to successfully deploy these technologies in the United States. To do that, a little historical perspective may be helpful.

Headwaters and its predecessors have been engaged in coal-to-liquids technologies since the late 1940s. Our Alternative Fuels Group is comprised of the former research and development arm of Husky Oil. In the late 1940s, that group designed the first high temperature Fischer-Tropsch plant which produced 7,000 barrels a day of liquid fuels in Texas from 1950 to 1955. It shut down when cheap oil was discovered in Saudi Arabia.

The Arab oil embargo in 1973 reignited interest in domestic energy resources such as coal to be used for liquid fuels. From 1975 to 2000, our researchers were prime developers of direct coal liquification technology, utilizing more than $3 billion worth of DOE funding. That effort culminated in the completion of an 1,800 barrel per day demonstration facility in Kentucky, but full commercial deployment of the technology was halted when oil prices went down.

Today our nation finds itself in another energy crisis. Oil costs $75 a barrel and comes from unstable parts of the world. There is little spare production and refining capacity. Our refineries are concentrated in areas susceptible to natural disasters and terrorist attacks. Once again we are considering coal-to-liquid fuels. The question is what can we do this time to make sure that the technologies are fully deployed?

To begin, considering how coal-to-liquids deployment is being approached in different parts of the world. In China, the government has already committed more than $30 billion to commercialization of coal gasification and liquification technologies.

Headwaters has licensed its direct coal liquification technology to a Chinese company that is currently constructing a 17,000 barrel per day facility in Inner Mongolia. We have additional technology and licensing and feasibility studies underway in India, the Philippines and another Asian country. In all of those locations, the central government recognizes that they have an important role to play in stimulating the creation of a coal-to-liquids industry.

Here in the United States, Headwaters is pursing development of coal-to-liquids projects using private sector financing. Here at home we are not pursuing direct coal liquification projects because they have not yet been demonstrated at a commercial scale and therefore are not likely to be financed in private markets.

Even indirect coal liquification or Fischer-Tropsch technology of the type commercially used in South Africa for decades is viewed by American financial markets as new and, therefore, riskier technologies.

One of the projects we are pursuing in the United States is located in North Dakota. The project features ample coal reserves, highly qualified development partners and substantial existing infrastructure to supply the facility. The State of North Dakota has been exceptionally supportive and stands ready to contribute significant resources to development of the project.

The project's viability is by no means certain. The task of raising between $1 billion and $4 billion for one of America's first coal-to-

liquids refineries is daunting, especially for a small company like our own.

Headwaters does not advocate abandoning America's open and efficient financial markets for a centralized system like China's, but the United States should recognize that just because a technology is no longer a research project does not mean that the free market is ready to fully embrace it.

If Congress desires creation of a coal-to-liquids industry to enhance energy security, boost economic development and improve environmental performance of fuels, then Congress must help industry overcome the substantial risks associated with deploying the fuels.

In my written testimony, Headwaters recommends five specific steps that are very similar to what you are hearing from the other witnesses as far as government support to catalyze this industry. Combined with support from the states and local communities anxious to see development or coal resources, these actions will help private industry bridge the deployment gap and establish a coal-to-liquids capability for our nation.

Dollars we now send overseas to buy oil will be kept at home to develop American jobs utilizing American resources. We would expand and diversify our liquid fuels production and refining capacity. We would produce clean burning fuels that can be distributed through our existing pipelines and service stations to fuel our existing vehicles with no modifications to the engines. We would take a real and immediate step toward greater energy security.

Thank you for your interest.

[The prepared statement of Mr. Ward follows:]

Statement of John N. Ward, Vice President, Marketing & Government Affairs, Headwaters Incorporated

Thank you Mr. Chairman. Honorable Members of the Committee, I am John Ward, Vice President of Headwaters Incorporated, on whose behalf I am testifying today. I also serve as President of the American Coal Council and as a member of the National Coal Council as appointed by the Secretary of Energy.

Headwaters Incorporated is a New York Stock Exchange company that provides an array of energy services. We are a leading provider of pre-combustion clean coal technologies for power generation, including coal cleaning, upgrading and treatment. We are the Nation's largest manager of coal combustion products, marketing coal ash from more than 100 power plants nationwide. We have built a large construction materials manufacturing business and incorporated coal ash in many of our products. We are currently commercializing technologies for upgrading heavy oil and we are entering the ethanol fuels market by constructing our first ethanol production facility in North Dakota. And we are active as both a technology provider and a project developer in the field of coal-to-liquid fuels.

Other witnesses will testify regarding the technologies associated with converting coal into liquid transportation fuels and the superior performance and environmental characteristics of the fuels themselves. I will focus my remarks on what it will take to successfully deploy these technologies in the United States. To do that, a historical perspective may be helpful.

Headwaters and its predecessors have been engaged in coal-to-liquids technologies since the late 1940s. Our alternative fuels division is comprised of the former research and development arm of Husky Oil and holds approximately two dozen patents and patents pending related to coal-to-liquids technologies.

In the late 1940s, this group designed the first high temperature Fischer Tropsch conversion plant which operated from 1950 to 1955 in Brownsville, Texas. It produced liquid fuels commercially at a rate of 7,000 barrels per day. Why did it shut down? The discovery of oil in Saudi Arabia.

The Arab oil embargo of 1973 reignited interest in using domestic energy resources such as coal for producing transportation fuels. From 1975 to 2000, our re-

searchers were prime developers of direct coal liquefaction technology. This effort, which received more than $3 billion of federal research funding, led to the completion of an1,800 barrel per day demonstration plant in Catlettsburg, Kentucky. Why did deployment activities cease there? OPEC drove oil prices to lows that left new technologies unable to enter the market and compete.

Today, our nation finds itself in another energy crisis. Oil costs $75 per barrel and comes from unstable parts of the world. There is little spare production and refining capacity and our refineries are concentrated in areas susceptible to natural disasters or terrorist attacks. And once again, our nation is considering coal as a source for liquid transportation fuels. The question is: What can we do this time to ensure that the technologies are fully deployed?

To begin, consider how coal-to-liquids deployment is being approached in different parts of the world.

In China, the government has already committed more than $30 billion to commercialization of coal gasification and liquefaction technologies. Headwaters has licensed its direct coal liquefaction technology to a Chinese company that is currently constructing a 17,000 barrel per day facility in Inner Mongolia. We have additional technology licensing and feasibility study activities under way in India, the Philippines, and another Asian country. In all of those locations, the central governments recognize that they have an important role to play in stimulating the creation of a new coal-to-liquids industry.

In the United States, Headwaters is pursuing development of coal-to-liquids projects using private sector financing. Here at home, we are not pursuing direct coal liquefaction projects because they have not yet been demonstrated at commercial scale and therefore are not likely to be financed in private markets. Even indirect coal liquefaction technology of the type used commercially in South Africa for decades is viewed by American financial markets as "new," and therefore riskier, technology.

One of the projects we are pursuing in the United States is located in North Dakota. The project features ample coal reserves, highly qualified development partners, and substantial existing infrastructure to support the facility. The State of North Dakota has been exceptionally supportive and stands ready to contribute significant resources to the development of the project. But the project's viability is by no means certain. The task of raising between $1 billion and $4 billion to build one of the first American coal-to-liquids refineries is daunting—especially for smaller companies like ours.

Headwaters does not advocate abandoning America's open and efficient financial markets for a centralized system like China's. But the United States should recognize that just because a technology is no longer a research project does not mean that the free market is ready to fully embrace it.

If Congress desires creation of a coal-to-liquids industry to enhance energy security, boost domestic economic development, and improve environmental performance of fuels, then Congress must help industry overcome the substantial risks associated with deploying the first plants.

Headwaters recommends five specific federal actions to help overcome deployment barriers:

1. Provide funding, through non-recourse loans or grants, for Front End Engineering and Design (FEED) activities. These activities are necessary to define projects sufficiently to seek project financing in the private sector. FEED for a billion dollar project can cost upwards of $50 million.
2. Provide markets for the fuel produced by the first coal-to-liquids plants. Federal agencies like the Department of Defense are major consumers of liquid fuels. By agreeing to purchase coal derived fuels at market value, but not lower than a prescribed minimum price, the government can remove the risk of reductions in oil prices that could stop development of this industry.
3. Extend excise tax credit treatment for coal derived fuels. Last year's Transportation Bill extended to coal-derived fuels the approximately 50 cents per gallon excise tax credit that was originally created as an incentive for ethanol production. But the provision as now enacted will expire before any coal-to-liquids facilities could be placed in service.
4. Appropriate funds for loan guarantees authorized in the Energy Policy Act of 2005 and ensure that those funds are made available to coal-to-liquids projects.
5. Ensure that industrial gasification tax credits authorized in the Energy Policy Act of 2005 are also extended to coal-to-liquids projects.

Combined with support from states and local communities anxious to see development of coal resources, these actions would help private industry bridge the deployment gap and establish a coal-to-liquids capability for our nation. Some of the dollars we now send overseas to buy oil would be kept at home to develop American

jobs utilizing American energy resources. We would expand and diversify our liquid fuels production and refining capacity. We would produce clean-burning fuels that can be distributed through our existing pipelines and service stations to fuel our existing vehicles with no modifications to their engines. We would take a real and immediate step toward greater energy security.

Thank you for your interest. I would be happy to answer any questions.

Mr. GIBBONS. Mr. Ward, thank you very much for your testimony, and thank you for what you are doing to help us solve the energy problems not only here in America, but around the globe as well.

We will turn now to Mr. Robert Kelly, DKRW Energy. Mr. Kelly, if you want to help me understand the acronym DKRW, you are more than welcome to help me. The floor is yours. I look forward to your testimony.

STATEMENT OF ROBERT C. KELLY, PARTNER, DKRW ENERGY, LLC

Mr. KELLY. Mr. Chairman, it is the initials of the four founding partners. I am the K, so that is a head start.

Mr. GIBBONS. I assumed that was part of it, but that is all right.

Mr. KELLY. Thank you, Mr. Chairman, distinguished Members and guests. I am Bob Kelly, a partner of DKRW Energy, LLC. We are a private held, Houston-based energy company currently developing one of the first major coal-to-liquids facilities in the United States in Medicine Bow, Wyoming.

As the President outlined in the State of the Union Address, we are facing a serious energy crisis in the U.S. as our domestic production of oil declines and our domestic demand continues to grow. We believe that CTL technology can have a major impact in helping to meet the future demand for energy in the U.S. in an environmentally acceptable way.

Our company's objective over the next 10 years is to finance and build CTL facilities in the U.S. totaling 110,000 barrels per day of capacity. Over a 30 year period, these facilities can produce over 1.2 billion barrels of liquid transport fuels from domestic U.S. coal reserves.

We believe that our efforts, along with those of others in our industry, are vital to achieving U.S. energy independence and to keeping the price of fuels in the U.S. at reasonable levels for American consumers.

We have spent the last three years developing the Medicine Bow CTL project into what we believe will be one of the first major commercial coal-to-liquids facilities in the U.S. The initial phase of the project is designed to produce 11,000 barrels per day of ultra low sulfur diesel and naphtha transportation fuels.

The CTL technology, as others have said here, we employ at Medicine Bow is not new. The process was used by the Germans. It is currently used by the South Africans to produce liquid fuels.

The technology involves basically two key steps. In the first step, coal is converted in the gasification process to a synthetic gas. In the second step, the cleaned up synthetic gas, a mixture of hydrogen and carbon monoxide, is passed through a reactor in what is called a Fischer-Tropsch reaction to produce diesel fuel and naphtha.

The key commercial elements of the Medicine Bow project include the following: We have an agreement with Arch Coal, one of the largest coal producers in the U.S., to acquire the Carbon Basin Coal Reserve. This reserve, currently owned by Arch, contains approximately 180 million tons of bituminous coal.

We have an agreement with General Electric to enable the project to use the General Electric coal gasification technology. We have an agreement with Rentech to utilize the Rentech Fischer-Tropsch technology. As Hunt said, the Rentech technology employs an iron based catalyst similar to that used by Sasol to produce liquid hydrocarbons from coal.

We have a preliminary agreement to sell all of the output of the facility over a multi-year period at market prices to a major refiner and marketer of diesel and naphtha in the Rocky Mountain region. These markets are currently importing liquid petroleum products from the U.S. Gulf coast, so this project will have a direct impact on reducing U.S. petroleum imports.

Finally, we have a preliminary agreement with an oil and gas production company to sell all of the liquid carbon dioxide produced by the project. The carbon dioxide will be reinjected into the ground into oil wells to increase their productive capacity and thus effectively sequestering the CO_2.

What can Congress do? The cost of the Medicine Bow project will be approximately $1.4 billion. We plan to complete the financing for the project in 2007. While we believe the equity side of the capital markets is prepared to participate in new CTL ventures, the unfamiliarity of major banks and EPC contractors with Fischer-Tropsch technology will initially make the project debt financing a challenge.

We therefore intend to immediately seek DOE loan guarantees as provided for in the EPACT 2005 legislation for the project. We urge the Department of Energy and the Secretary of Energy to move quickly to implement this program already authorized in the energy bill.

We do not believe these loan guarantees need to be an ongoing program. After the first few project financings are complete the project debt market will stand ready to finance well-developed projects like Medicine Bow without loan guarantees.

We will also apply for the industrial gasification investment tax credit provided by the energy bill. We do believe, however, that the cap imposed in EPACT 2005 on the ITC should be removed altogether in favor of a time deadline such as 2015.

Another key incentive we believe Congress should consider and has been mentioned by some of the other participants is making the 50 cent per gallon fuel excise tax credit provided in the highway bill available to CTL fuels. To do that you could extend the expiration of the current credit from 2009 when no CTL plants will yet be operational in the U.S. to 2015.

Finally, we think Congress should consider Federal environmental eminent domain legislation to assist in the developing of transportation corridors for pipelines carrying these fuels and pipelines carrying CO_2.

In conclusion, in the 2006 Annual Energy Outlook the Department of Energy estimated the CTL industry could produce between

800,000 and 1.7 million barrels per day of transport fuels by 2030. I think this is a reasonable estimate.

We are committed to making this forecast a reality. We appreciate the help that Congress can give us. Thank you very much.

[The prepared statement of Mr. Kelly follows:]

Statement of Robert C. Kelly, Partner, DKRW Energy LLC

Thank you, Mr. Chairman, Distinguished Members and guests. I am Bob Kelly, a partner of DKRW Energy LLC. We are a privately held, Houston-based energy company currently developing one of the first major coal-to-liquids ("CTL") facilities in the United States at Medicine Bow, Wyoming.

As the President outlined in the State of the Union Address, we are facing a serious energy crisis in the United States as our domestic production of oil declines and our domestic demand continues to grow.

We believe that CTL technology can have a major impact in helping to meet the future demand for energy in the United States in an environmentally acceptable way.

Our company's objective, over the next ten years, is to finance and build CTL facilities in the United States totaling 110,000 barrels per day of capacity. Over a thirty year period, these facilities can produce over 1.2 billion barrels of liquid transport fuels from domestic U.S. coal reserves. We believe that our efforts, along with those of others in our industry, are vital to achieving U.S. energy independence and to keeping the price of fuels in the U.S. at reasonable levels for American consumers.

The Medicine Bow Project

We have spent the last three years developing the Medicine Bow CTL project into what we believe will be one of the first major commercial coal-to-liquids facilities in the U.S. The initial phase of the project is designed to produce 11,000 barrels per day of ultra low sulfur diesel and naphtha transportation fuels.

The CTL technology we will employ at Medicine Bow is not new. The process was developed by German scientists in the early 1900s, was used in Germany during World War II to fuel their war economy, and is used today in South Africa to produce over 150,000 barrels per day of liquid transportation fuels.

The technology basically involves two key steps. In the first step, coal is converted in the gasification process to a synthetic gas. In the second step, the cleaned up synthetic gas, a mixture of hydrogen and carbon monoxide, is passed through a reactor, in what is called a Fischer Tropsch reaction, to produces diesel fuel and naphtha.

The key commercial elements of the Medicine Bow project include the following:

- We have an agreement with Arch Coal, one of the largest coal producers in the U.S., to acquire the Carbon Basin coal reserve. This reserve, currently owned by Arch, contains approximately 180mm tons of bituminous coal.
- We have an agreement with General Electric to enable the project to use the General Electric coal gasification technology.
- We have an agreement with Rentech to utilize the Rentech Fischer Tropsch technology. The Rentech technology employs an iron based catalyst, similar to that used by Sasol, to produce liquid hydrocarbons from coal.
- We have a preliminary agreement to sell all of the output of the facility over a multi-year period at market prices to a major refiner and marketer of diesel and naphtha in the Rocky Mountain region. These markets are currently importing liquid petroleum products from the U.S. Gulf Coast so this project will have a direct impact on reducing U.S. petroleum imports.
- Finally, we have a preliminary agreement with an oil and gas production company to sell all of the liquid carbon dioxide produced by the project. The carbon dioxide will be re-injected into the ground into oil wells to increase their productive capacity, thus effectively sequestering the CO_2

What Congress Can Do

The cost of the Medicine Bow CTL project will be approximately $1.4 billion dollars. We plan to complete the financing for the project in 2007. While we believe the equity side of the capital markets is prepared to participate in new CTL ventures, the unfamiliarity of major banks and EPC contractors with Fischer Tropsch technology will initially make project debt financing a challenge.

We therefore intend to immediately seek DOE loan guarantees as provided for in the EPACT 2005 legislation for the project. We urge the Department of Energy and the Secretary of Energy to move quickly to implement this program already authorized in the Energy Bill.

We do not believe that these loan guarantees need to be an ongoing program. After the first few project financings are complete the project debt market will stand ready to finance well developed projects like Medicine Bow without loan guarantees.

We also will apply for the industrial gasification investment tax credit ("ITC") provided by the Energy Bill. We do believe, however, that the cap imposed in EPACT 2005 on the ITC should be removed altogether in favor of a time deadline such as 2015.

Another key incentive we believe Congress should consider is making the 50 cent-per-gallon fuel excise tax credit provided in the Highway Bill available to CTL fuels. To do that, you could extend the expiration of the current credit from 2009, when no CTL plants will yet be operational in the U.S. to 2015.

Finally, we think Congress should consider Federal eminent domain legislation to assist in developing transportation corridors for pipelines carrying these fuels and CO_2 so that these products can get to market without significant delay due to right of way restrictions.

Conclusion

In the 2006 Annual Energy Outlook, the Department of Energy estimated that the CTL industry, given today's oil price outlook, could produce from 800,000 to 1,700,000 barrels per day of CTL transport fuels by 2030. I think this is a reasonable estimate.

DKRW is committed to helping make this forecast a reality. In addition to the Medicine Bow project, we have other projects in development in Montana and Illinois as well as in Wyoming.

We appreciate the efforts in Congress, in particular those of Representative Cubin and other members of the Wyoming congressional delegation in the Senate, as well as the state governmental officials in Wyoming and at the U.S. Department of Energy in looking at ways to get this project and this industry moving. Every one in the room understands the risks involved and what is at stake. Our economy, foreign policy, and national security are vitally affected by what you will do here. Thank you for supporting our efforts and for giving me the opportunity to provide you with my views.

Mr. GIBBONS. Thank you very much, Mr. Kelly. I appreciate you being here, and thank you for what you are doing in helping solve our country's energy needs as well.

We turn now to Garry Anselmo and Silverado Green Fuels. Mr. Anselmo, welcome. The floor is yours.

STATEMENT OF GARRY L. ANSELMO, CEO, SILVERADO GREEN FUEL, INC.

Mr. ANSELMO. Thank you, Mr. Chairman and Members of this committee. I am Garry Anselmo, and I am Chairman and CEO of Silverado Green Fuel, Inc., a publicly held——

Mr. GIBBONS. Mr. Anselmo, is your mike on? You may have to pull it closer to you.

Mr. ANSELMO. Thank you. Thank you, Mr. Chairman. Garry Anselmo, Chairman and CEO of Silverado Green Fuel, Inc., a publicly held company headquartered in Fairbanks, Alaska. I appreciate the opportunity to share with you today the vision that Silverado has for the use of America's sub-bituminous and lignitic coals.

As you know, proven U.S. coal reserves are greater than all of the world's gas or oil reserves. U.S. coal reserves are capable of fueling America's growing economy for hundreds of years. Because nearly half of the U.S. coal reserves are either sub-bituminous or lignitic coal, unlocking the fuel energy potential of these inexpensive coal reserves is one of the critical keys to solving America's developing energy crisis.

High moisture content has been the major obstacle of the widespread use of sub-bituminous and lignite, often referred to as low-rank coals. Over the past 40 years, low-rank coal researchers around the world have investigated virtually every coal drying technique conceived. Of all the low-rank coal drying technologies assessed, hydrothermal treatment is the only process that produces a liquid fuel with the inherent benefits of liquid handling, transportation and storage. A primary liquid fuel is a strategic fuel.

Silverado Green Fuel, Inc. is fortunate to have on staff Dr. Warrack Wilson, a world-renowned scientist and developer of the hydrothermal treatment process. This treatment is an advanced technology that features a process of moderate temperature and pressure and non-evaporative drying that can irreversibly remove much of the moisture from low-rank coal. Low-rank coal water fuel or LRCW fuel is a non-hazardous, easily transportable liquid fuel.

In a joint research project supported by the U.S. Department of Energy and the Alaska Science and Technology Foundation, test quantities of LRCW fuel were produced from Alaska's Beluga coal in a pilot plant and burned in a test boiler. The Beluga LRCW fuel proved to be an excellent fuel, having less than four percent ash and only .07 percent sulfur. Other low-ranked coals from around the United States have been shown by bench scale testing to be good candidates for processing into LRCW fuel.

Mr. Chairman, I had a movie to show, but we have no sound here today so I have one picture to show you of the fuel itself. It will come up here in a moment. I will talk in the meantime. If it does not come up, that is fine too.

The fuel looks like oil. It pours like oil. It ships and stores in existing oil facilities and is a non-toxic, non-hazardous, non-flammable, environmentally friendly fuel. Our projected production costs in Alaska for sub-bituminous is $15 per barrel. In Mississippi, Texas, Louisiana, Alabama and Georgia, lignite, $11 per barrel. In Montana, Wyoming, $10 per barrel. Understand that it takes 2.2 barrels of our fuel to give off as much energy as it does one barrel of oil.

Presently low-ranked coals are lower energy, costly shipping because they contain 25 to 40 percent water, i.e., every 100 train cars are 25 to 40 cars of water.

At the mine site we crush, grind, hydrothermally treat, pressure cook at 285 degrees Centigrade and 1,500 pounds per square inch at gravity or sea level. This liberates the water from the particle and the CO_2 and cetanes.

While it is in the hot aqueous phase, the particle also exudes its resins or waxy substances, and they tend to stay attached to the particle as they are hydrophobic. They do not want to attach to water. They attach to the particle.

As the solution cools, they coat the particle, fill the pores on the particles and do not let the water back in. The particle is now dehydrated. We then separate the particles from the solution and set them aside. The solution, however, is hydrocarbon rich. It also contains CO_2 and heavy metals.

The CO_2 may be removed and sold today to oil companies who are repressuring their fields with CO_2 where this greenhouse gas

remains sequestered in the ground. The heavy metals may also be extracted.

The hydrocarbon rich waters are added back to the particles, and this is the LRCW fuel. We make it up to shipping grade, and at the other end on burning we can make up water for burning grade, thereby reducing shipping costs.

Shipping and storage can be done in existing oil facilities. If a pipeline ruptures you have water and coal particles, which may be picked up and reconstituted. If a ship ruptures, as they do, you end up with water and a substrate on the ocean floor that is conducive to plant growth. Whether at home or a theater of war, our fuel, if ruptured, will flow and put out the fire. Lives will be saved.

On the use of this fuel into a boiler, it must be spray injected into a preheated boiler with an existing flame. In doing so, we end up with a complete carbon burn out and a hot, stable flame. As the fine particles of ash stay within the entrainment velocity, there is minimal agglomeration or fouling of boilers.

As the ash escapes with the flue gases, the ash is taken out with bag houses, electrostatic precipitators. Sulfur dioxides are removed with water scrubbing systems, later treatment. Ergo, we have a low-cost, environmentally friendly fuel.

As you can see, LRCW fuel offers the least expensive route and is the perfect feedstock to make a value added liquid fuel from America's most abundant and lowest cost fossil fuel.

In addition, boilers. LRCWF can be used in General Electric gasifiers to produce synthesis gas for integrated gasification combined cycle power generation and synthesis of clean fuels, ultraclean fuels, including synthetic diesel, gasoline and jet fuels, rocket fuel, plastics, explosives, fertilizers, urea and other downstream products.

In summary, our research shows us that the United States consumes approximately 18 million barrels of oil per day or 6.5 billion barrels per year at a current cost in excess of $400 billion a year.

This country is indeed blessed as it contains fully 25 percent of the world's coal reserves, more than all of the oil or all of the gas in the world. At a guesstimate, we could be wholly energy self-sufficient in a low-cost, environmentally friendly manner in 25 to 30 years at a cost of some $3 trillion. The first commercial production facility could begin production of LRCW fuel in five years or less, and we can cut our gasoline prices in half.

Three major obstacles to successful, large-scale liquid fuel production is steel shortages—we need to ramp up our iron and nickel production; relevant equipment shortages—we need to increase our manufacturing; and the permitting process. Reduced time and increased productivity.

Mr. Chairman and committee Members, thank you for this opportunity to testify, and I look forward to answering any questions you may have.

[The prepared statement of Mr. Anselmo follows:]

Statement of Garry L. Anselmo, Chief Executive Officer, Silverado Green Fuel, Inc.

Low-Rank Coal-Water Fuel Commercial Demonstration

Coal: America's Only Strategic Fuel

Of all the world's fossil energy reserves, coal is by far the most plentiful. The energy represented by the known reserves of oil are only a small fraction of its coal reserves. Few would disagree that the ascent of the United States to the world's most powerful and affluent nation was made possible to a large degree by inexpensive energy (especially electrical power.) Proven U.S. coal reserves are greater than all of the world's gas or oil reserves. U.S. coal reserves are capable of fueling America's growing economy for hundreds of years, whereas many experts predict America's oil and gas reserves will be exhausted in a few decades. Domestic production of petroleum accounts for only 40% of America's annual usage, requiring imports of a massive 60%, much of it from countries with unstable or unfriendly governments. Thus, in the 21st century coal will remain a key energy resource, and must therefore be used in an environmentally and economically responsible manner. Although coal is the only U.S. energy resource abundant enough to be a strategic fuel, to maximize its potential it must also be made available in a liquid form for advanced combustion applications. Nearly half the U.S. coal reserves are either sub-bituminous or lignite. Unlocking the full energy potential of these inexpensive sub-bituminous and lignite coal reserves is one of the critical keys to solving America's developing energy crisis. This synopsis outlines the process whereby the U.S. can utilize a new technology to unlock the full energy potential of half of its coal reserves.

Coal's Poor Public Image

It is no surprise that coal is generally viewed as a "dirty" fuel given decades of poor coal mining practices, dust generated during handling and shipping, large unsightly coal stockpiles, and coal burning and coke production without emission controls. Despite many improvements (such as extensive mine land reclamation programs, advances in emission controls, and development of clean coal technologies) public perception has changed little.

Why is oil not viewed as a dirty fuel? The answer is simple: oil is used sight unseen.

Coal spilled in water is non-toxic and non-hazardous. It will settle to the ocean floor and form a carbonaceous substrate for marine growth. So why is it that coal is considered dirty, even though coal spilled in water is non-toxic and non-hazardous? Unlike oil, usage of coal is a highly visible and unsightly process. Americans regularly see massive trucks hauling coal to stockpiles, hundred-car trains hauling coal to ports for distribution or to utilities, and enormous stockpiles at coal-fired utilities. If, however, coal could be used sight unseen in today's modern utilities, public perception of coal as a dirty fuel would change. The Low-Rank Coal-Water Fuel (LRCWF) Project is designed to demonstrate the economic feasibility and environmental superiority of LRCWF as a low-cost alternative to oil while creating a coal fuel that can be used sight unseen.

Comparison of High and Low-Rank Coals

Almost half of the world's estimated coal resources, including those of the U.S., are low-rank coals (LRC), which are sub-bituminous, lignitic, and brown coals. The mine-mouth price for Low Rank Coal is typically less than half that of bituminous steam coal. The price advantage in favor of LRC has been offset by higher transportation costs to distant markets due to LRC's high moisture content and consequently low energy content, which until now limited most LRC use to mine-mouth power generation.

When the U.S. air emission standards (which drastically reduced sulfur emissions) were first promulgated in 1970, utilities were faced with the decision to switch to low-sulfur coals or to add sulfur capture devices. Even more stringent new standards enacted in 1987 and 1990 have led to widespread switching from high-sulfur eastern bituminous coals to low-sulfur LRC. For example, in 2004 the amount of LRC mined in Wyoming's Powder River Basin reached nearly 400 million metric tons.

In terms of utilization, LRC is non-agglomerating and has more volatiles, providing faster ignition and virtually complete carbon burnout. Thus, from a power generation perspective, LRC offers the potential for higher efficiencies in both conventional boilers and advanced combustion and gasification systems. Many LRCs also have low sulfur contents, ranging from less than 0.2% to 1%. Low mining costs, high reactivity, and low sulfur content would make these coals premium fuels were it not for their high moisture levels, which range from 25% for sub-bituminous coal

to nearly 40% for some lignites. Many major coal users mistakenly perceive high-moisture coal to be of inferior quality and overlook the many positive features of LRC.

Coal-Water Fuels

Coal-water fuels were developed in response to the oil crises of the 1970s and early 1980s and led to a new industry that produced a low-cost alternative to imported oil. Today's coal-water fuel (CWF) industry uses expensive bituminous coals that are formulated with water, using costly proprietary additives, to produce dense CWF. Due to its low inherent moisture, bituminous coal can be used directly without moisture reduction to prepare Coal Water Fuel; however, since bituminous coal is hydrophobic, it tends to settle rapidly. Because of its settling tendencies and high viscosity in water, bituminous CWF requires costly additives to reduce viscosity and provide stability. The high cost of bituminous coal and required additives coupled with the oil glut in the 1990s led to decreased interest in CWF in North America. Canada, the world leader in CWF technology in the 1980s, has no CWF producers today; however, Japan, which must import all its oil and is concerned about the security of oil suppliers, has developed a commercial bituminous CWF industry.

Burning Coal-Water Fuel (CWF) is essentially burning bituminous coal with its inherent strengths and weaknesses. Most work on bituminous CWF production in North America focused on increasing the solids content and improving viscosity; little attention was paid to the combustion characteristics. Consequently, the initial tests with CWF were plagued by poor atomization, particle agglomeration, and incomplete combustion. Because most bituminous coals swell and go through a plastic state when heated, they tend to agglomerate, producing particles many times larger than the initial feed. Ash coatings form around the unburned carbon and the agglomerated particles burn slower and not as well as single particles. Agglomerates also lead to erosion problems in the convective sections of boilers and to a significant "boiler derating"; however, after the Department of Energy and Japanese CWF developers spent millions of dollars developing new atomizers for bituminous CWF, tests in large oil-fired boilers that employed relatively long residence times achieved acceptable carbon burnout and launched the CWF industry.

(NOTE: Boiler derating is a value that quantifies how well a replacement fuel performs in providing the same energy as the original fuel. For example, if the maximum amount of replacement fuel that can be used in an oil-fired boiler provides 75% of the energy that the original oil does, then the replacement fuel has a 25% derating. Obviously, low derating numbers indicate better substitute fuels. Derating is based on combustion-related characteristics such as the speed of ignition, completeness of carbon burnout, particle size and agglomeration, etc.)

The Search for a Low-Rank Coal Utilization Technology

High moisture content has been the major obstacle to the wide-spread use of Low Rank Coals. Over the last 40 years LRC researchers around the world have investigated virtually every low-rank coal drying technology conceived. The driving force behind this research was the desire to develop an economical drying method that would produce a dry and stable LRC that could withstand the rigors of shipping and compete with bituminous steam coal. Any LRC can be dried to virtually 0% moisture using hot flue gases to evaporate the coal moisture. These processes cost the least due to the low temperatures used, and are preferred if the dried product is for immediate use; however, evaporative drying temperatures are too low to cause permanent changes in the coal structure. As a result, evaporative-dried LRC behaves like a sponge, reabsorbing lost moisture when exposed to humidity or water. Another drawback to evaporative-dried LRC is that it is more friable than raw LRC, rapidly degrading into dust, and thus making it more susceptible to spontaneous combustion and even explosion.

The Breakthrough: Hydrothermal Treatment

Of all the low-rank coal drying technologies assessed, Hydrothermal Treatment (HT) is the most promising. All other low-rank coal-drying processes are designed to produce a dried low-rank coal. In contrast, the HT process produces a liquid fuel with inherent benefits of liquid handling, transportation, and storage and also eliminates the stability problems that have plagued the traditional use of dry LRC. Hydrothermal Treatment is an advanced technology that features a process of moderate temperature and pressure non-evaporative drying that irreversibly removes much of the moisture from Low Rank Coal. The HT process is particularly effective for producing a concentrated low-rank coal-water fuel suitable for many liquid fuel applications. Hydrothermal Treatment allows LRCWF to be produced that has a solids content rivaling those obtained with bituminous coal-water fuels. Unlike bituminous CWF, which requires the use of costly additives, LRC characteristics

retained during HT make additives unnecessary. LRCWF is a non-hazardous, easily transportable liquid fuel that avoids the dust-generation and spontaneous combustion problems associated with LRC handling, storage, and transportation.

In comparison to bituminous coals, LRC has clearly superior combustion characteristics Bituminous coal agglomerates into larger and slower burning particles when heated. In contrast, LRC has more volatile matter and when heated blows apart into smaller fragments, exposing tremendous surface areas, which leads to superior combustion. These LRC properties lead to rapid ignition and nearly complete carbon burnout. In addition, much of the mineral matter (ash) in LRC is inherent. It is molecular in size and bonded to the organic structure of LRC or exists as minute grains of minerals finely dispersed through-out the coal. This mineral matter is so fine that it easily follows the hydrodynamic flow and does not impinge on the heated surfaces, thereby greatly reducing erosion and fouling. LRC's high reactivity, rapid carbon burnout, and small-sized ash ensure superior LRCWF combustion. In all reported combustion tests, LRCWF always burned substantially better than bituminous CWF.

In a joint research project (supported by the U.S. Department of Energy and the Alaska Science and Technology Foundation) test quantities of LRCWF were produced from Alaska's Beluga coal in a pilot plant and burned in a test boiler. The Beluga LRCWF proved to be an excellent fuel, having less than 4% ash and only 0.07% sulfur. Carbon burnout rated "excellent:" at over 99.8%. Gaseous emissions monitored during the test registered extremely low levels of SO_2 in the flue gas and reduced NO_x (Nitrogen Oxides) compared to burning the coal in its raw form. Likewise, substantially less LRCWF ash deposition was created compared to burning the parent coal. Further, the LRCWF ash deposit was softer, which permits easy removal by normal soot-blowing operations. Other Low Rank Coals from around the United States have been shown by bench-scale testing to be good candidates for processing into LRCWF.

The technical feasibility of HT has been demonstrated in small pilot plants in Australia, Japan, and the U.S. Over a dozen LRCs from the major deposits around the world have been processed. They all responded favorably to HT and produced LRCWF that could be burned without the addition of any supplemental fuel. As a general rule, the increase in energy density for LRCWF versus coal water slurries prepared from untreated coals are 30% for sub-bituminous coals, about 50% for lignites, and well over 100% for brown coals, peat, and biomass.

Low-Rank Coal-Water Fuel's Environmental Premium

For a product to compete successfully with petroleum-derived fuels, it is not enough merely to be priced lower. Other advantages must be offered for users to consider switching to a new fuel. LRCWF has many important environmental advantages associated with its production and use. One of LRCWF's most important environmental attributes is its non-hazardous nature in the event of spills. This property alone will be a significant factor in the acceptance of LRCWF as a replacement for fuel oil. Another advantageous attribute of LRCWF made from sub-bituminous coal and lignite is its relatively low-sulfur content. As U.S. utility companies strive to comply with new clean air regulations, they are faced with the decision of either adding expensive sulfur emission clean up equipment or switching to lower sulfur fuels. Finally, when LRCWF is burned, its inherent water moderates combustion temperatures and eliminates hot spots, thereby reducing thermal NO_x.

In comparison to using raw LRC, LRCWF provides the opportunity to economically recover CO_2 (carbon dioxide) and reduce greenhouse gas emissions. CO_2 emitted during combustion is only a fraction of the flue gas, due to N_2 dilution from combustion air. Carbon in the coal that exists as oxygenated species contributes little or nothing to coal's energy content but adds to the amount of CO_2 released during combustion. During Hydrothermal Treatment much of the oxygenated carbon species are released as CO_2. Since this off-gas stream typically consists of over 95% CO_2, it can be recovered far more easily and inexpensively at this phase of the HT process than as CO_2 from exhaust flue gas streams, which have been greatly diluted by N_2 in the combustion air. Since many likely LRCWF production sites are near oil fields, the recovered CO_2 may well have a value for use in enhanced oil recovery.

Unprocessed LRC has a water content of approximately 25% to 40%. All water that is initially separated from the LRC during the Hydrothermal Treatment will be captured and recycled to formulate the liquid LRCWF. Thus, all LRCWF production plants will be zero aqueous discharge facilities.

Estimated Commercial Low-Rank Coal-Water Fuel Costs

The pro forma calculations for a commercial production LRCWF plant located near a mine are based on a 10 million BOE per year of LRCWF. This number was

the chosen basis in order to take advantage of economies of scale and to be large enough to obtain a favorable long-term LRC purchase price agreement. This size would service the (oil-fired) electrical industry in a meaningful manner while still providing enough LRCWF to feed a Texaco Gasifier for the production of jet fuel and a myriad of other exotic fuels and products.

Low-Rank Coal-Water Fuel Market Potential

Low-Rank Coal-Water Fuel offers the potential to reverse the trend of declining U.S. coal exports while increasing employment opportunities by creating a value-added product from coal, the U.S.'s most abundant natural resource. LRCWF will permit LRC to compete in the more valuable oil marketplace, rather than the thermal or steam coal market. LRCWF could be transported by pipeline, semi-tractor trailer, or rail to barges for delivery to oil-burning utilities in Florida, other Gulf Coast states, and the Northeastern United States, or to maritime tankers for export. LRCWF would create new market opportunities without the environmental hazards associated with oil or bulk coal handling and transportation.

The huge market potential for LRCWF in the Gulf Coast region alone can be appreciated by examining the magnitude of petroleum-derived fuel use in utility and industrial boilers. Florida utilities are by far the largest consumer of oil for power generation in the U.S. In 2001 Florida utilities consumed over 65 million barrels of petroleum-derived fuels. Industrial oil use is much larger, but more difficult to quantify since most of it is used in the petrochemical industry. Nevertheless, although only 25% of the industrial oil use in Texas and Louisiana is for process heating and power in industry, it amounted to over 196 million barrels of oil in 2001.

Another unique property of LRCWF is that it will not burn in open air. It is non-flammable except when injected into a preheated boiler, gasifier, or heat engine. Thus a tank farm of LRCWF cannot be set ablaze. This safety feature may be a consideration for LRCWF use in other applications. For example, military bases at home or abroad can be provided with an environmentally friendly and less expensive energy source for installation heating and electricity, as well as a non-explosive fuel at base locations that might potentially be subject to terrorist attacks.

Another advantage to LRCWF is that it can be transported via any of the thousands of miles of existing fuel-carrying pipelines throughout the U.S. Further, if a pipeline carrying LRCWF is ruptured, whether by a natural disaster or a terrorist act, it will not result in a fiery explosion.

Low-Rank Coal-Water Fuel Commercial Demonstration Project

The next step in commercializing the promising Low-Rank Coal-Water Fuel technology is the construction and operation of a commercial demonstration-scale LRCWF production facility. The first nation to build the world's first and probably only LRCWF demo plant will be the industry leader and have the opportunity to test LRC from around the world. Silverado has formed a team of the best LRCWF experts in the world and has developed a design for a 120-ton per day LRCWF production plant that can be operated 24/7 for weeks at a time. Construction of the facility and conducting the entire LRCWF commercial demonstration project will cost approximately $26 million and require less than 36 months to complete.

The primary objectives of the LRCWF production and utilization demonstration are to:

- Validate the process on a commercial scale and develop scale-up parameters;
- Determine the derating when switching from oil to LRCWF in commercial oil-boilers;
- Accurately establish process and commercial production costs; and
- Produce thousands of tons of LRCWF for independent end-user testing.

Project Expectations

The technical feasibility of producing and utilizing a premium Low-Rank Coal-Water Fuel made from ultra-low-sulfur Alaskan sub-bituminous coal following hydrothermal treatment has already been successfully demonstrated on a pilot plant scale. In follow-on combustion tests, this LRCWF produced excellent results. Fouling was minimal, carbon burnout was exceptional, and SO_x emissions (sulfurous oxides) were below even the most stringent requirements. Process economics suggest that Low-Rank Coal-Water Fuel can be commercially produced from Mississippi (or other Gulf Coast states') Lignite for about $11 per BOE, from Alaskan Low-Rank Coal for approximately $13 per BOE, and from Montana/Wyoming Low-Rank Coal for approximately $10 per BOE.

This demonstration project is the culmination of years of extensive planning and research, and the work of a world-class team of scientists and experts, headed by Dr. Warrack Willson, a world-renowned leader in the field of Low Rank Coal processing; Silverado Green Fuel, Inc. is absolutely confident of the success of this

LRCWF Commercial Demonstration Project. Silverado Green Fuel, Inc. believes that this successful demonstration will lead to the creation of a new industry that produces millions of tons of Low-Rank Coal-Water Fuel from sites across the United States. This will provide the United States a secure supply of a non-hazardous, low-cost substitute for petroleum fuels used in industrial and utility boilers. Such a secure domestic supply will preclude the price volatility inherent in the oil market controlled by OPEC. LRCWF technology will also be available to assist developing nations in using their indigenous LRC in an environmentally sound manner.

The Low-Rank Coal-Water Fuel Commercial Demonstration Project will establish the United States as the world leader in this exciting new industry, and provide the means to inexpensively create a high-demand, value-added product from America's most abundant fossil energy resource. The LRCWF Commercial Demonstration Project will also pave the way for the United States to once again become a major exporter of coal products and decrease our nation's dependence on imported oil.

ATTACHMENT #1

LRCWF APPLICATIONS

LRCWF in Oil-Designed Boilers

The near-term commercial application for LRCWF is as a non-hazardous, low-cost alternative to petroleum-derived fuels in oil-designed boilers. LRC has far superior combustion characteristics in comparison to high-rank bituminous coal. It is non-caking: it does not agglomerate into larger, slower burning particles, but rather blows apart into thousands of smaller fragments providing tremendous surface areas. It also contains more volatile matter. These properties lead to rapid ignition and carbon burnout. In addition, much of the mineral matter (ash) in LRC is molecular in size and is bonded to the organic structure of LRC and the minute grains of minerals finely dispersed throughout the coal. Most of the mineral matter is so fine that it follows the hydrodynamic flow and does not impinge on the heated surfaces. These beneficial characteristics greatly reduce erosion and fouling.

The physics of burning any Coal Water Fuel, and the deratings experienced, are governed by the parent coal combustion characteristics. Deratings with bituminous CWF typically range from 20% to 33% because of the relatively inferior combustion characteristics of bituminous coal. Because LRCWF retains the superior combustion characteristics of the parent low-rank coal, it should burn in oil-designed boilers with minimal derating, which is one of the primary objectives of this demonstration project. To date, there have been no commercial-scale tests of LRCWF in oil-designed boilers. There has never been a Low-Rank Coal-Water Fuel production facility large enough to produce the thousands of tons of LRCWF needed for independent testing to establish commercial LRCWF derating statistics. Previously performed pilot-scale testing indicates there will be excellent deratings. Silverado's proposed commercial-scale demonstration project will provide the first such facility.

LRCWF in Direct Fired Turbines

The oil crises of the 1970s and early 1980s prompted interest in the use of alternate fuels for direct-fired turbine power generation. This interest resulted in a NASA-sponsored coal-derived fuel combustion component development program. In 1982, the Department of Energy (DoE) became the executive agency for the program. In 1986, component technology development had advanced enough that DOE awarded General Motors's Allison Turbine Division a contract to develop a proof-of-concept CWF-fired gas turbine engine. Allison developed a high-temperature, high-pressure, gas turbine combustion system that succeeded in simultaneously controlling NO_x and CO levels while also removing ash from the gas stream in a dry state.

The most severe combustion tests to date with LRCWF were those run in GM's Allison coal-fired turbine simulator with 5,000 gallon batches of LRCWF made from hydrothermally treated sub-bituminous coal from the Powder River Basin in Wyoming. The residence time, which in oil-designed boilers is typically measured in seconds, was reduced to hundreds of milliseconds in the direct-fired turbine combustor. These tests clearly demonstrated the superiority of LRCWF over commercial bituminous CWF. Carbon burnout obtained with the LRCWF was over 99% during all operating conditions. In contrast, carbon burnout obtained with commercial bituminous CWF with even much smaller particles and under optimum operating conditions, was typically 4-5% lower. If CWF-fired turbine power generation becomes an option in the future, LRCWF will undoubtedly be the preferred fuel.

Reduced oil and gas prices in the 1990s, and increased gas availability following gas price spikes, had halted direct CWF-fired turbine research. Recent gas and oil

price increases, along with reduced LRCWF costs due to process improvements and tax credits, may rekindle interest in LRCWF-fired turbines. The Silverado Team has discussed possible LRCWF turbine applications in developing nations with International Power Systems.

LRCWF-Fired Diesel Electric Generation

Research scientists investigated coal-water fuel diesel-electric generating (DEG) systems to fill a market niche for small, compact generating plants, i.e., 2 to 20 megawatts of electricity (MWe) for remote locations such as Alaska, Hawaii, and Indonesia, the Philippines, and other developing nations. These locations are too remote to be served by power transmission lines from major utilities. Successful demonstration of an LRCWF-DEG would provide a new coal-fired power plant option free from the price and availability uncertainties of conventional oil-fired DEG systems, while eliminating the environmental hazards caused by oil spills and leaks.

A number of diesel manufacturers have conducted extensive research and development involving the use of CWF in slow to medium speed diesel engines. Work using a single-cylinder research engine established the feasibility of burning a micronized bituminous CWF mixed with an equal mass of water. At this time, however, not enough research has been done to definitively determine that LRCWF can be used in large-scale diesel engines. The commercial demonstration plant will make sufficient quantities of LRCWF available for research to establish its feasibility as a diesel fuel substitute.

LRCWF-Integrated Gasification Combined Cycle Power Generation

By using the process of gasification, energy and/or petrochemical feed stocks can be generated from coal more cleanly and efficiently. Coal gasification also offers a better means to recover energy and remove gaseous pollutants (such as SO_x and NO_x) than do conventional coal-fired power plants. The Electric Power Research Institute (EPRI) has been instrumental in developing integrated gasification combined cycle (IGCC) systems that produce coal power more efficiently and cleanly than oil. In the IGCC system, coal is gasified and gas from the gasifier is fed to a direct gas-fired turbine. The hot exhaust from the turbine generates steam for use in a conventional steam turbine for additional power generation. One of EPRI's most notable successes was its joint development with Texaco of a high-pressure, entrained flow, coal-slurry fed, slagging-gasifier. EPRI supported the successful demonstration of the 1,000 ton per day Cool Water IGCC demonstration plant near Barstow, California. This Cool Water IGCC demonstration plant, featuring a slurry-fed Texaco gasifier, used western bituminous coal-water slurry.

Texaco gasification technology is in use in a number of plants in the U.S. and abroad. The Tampa Electric Company's 260 MWe IGCC generating plant was selected during the Department of Energy's Clean Coal Technology Program. With conventional emission controls, the Tampa plant reports greater than 98% removal of SO_x and a 90% reduction in NO_x. Most of the ash is recovered as a glassy slag (which can be marketed as road bed material, cement additives, and other products.) The largest Texaco gasification installation is at Ube Industries petrochemical complex in Ube City, Japan.

Utilities in the Gulf of Mexico, western, and southwestern portions of the United States have access to large deposits of lignite and sub-bituminous coal, which can easily be recovered by strip mining at a modest cost. These LRCs, however, are high in inherent moisture, and their low heating value reduces their performance in slurry-fed gasifiers. With inherent moisture levels ranging from 25% for sub-bituminous coals and up to 40% for lignites, the maximum dry solids content for a pumpable slurry was only a little over 50% for sub-bituminous coals and even less for lignites. Low-energy content, high-water slurries can be gasified in the Texaco gasifier, but the much higher oxygen demand made their use uneconomical in comparison to highly concentrated bituminous CWS.

Consequently the EPRI supported research for upgrading the LRC and increasing the dry solids content to make utilization in slurry-fed gasifiers a more viable operation for electric power generation for all ranks of coal. Hydrothermal Treatment was shown to be the most effective method to convert LRCs into LRCWF with high enough solids content to permit its efficient use in slurry fed gasifiers. All that remains for commercial Texaco LRCWF applications is for an LRCWF demonstration facility to provide commercial-scale process economics and produce several thousand tons for testing at commercial Texaco installations. During the project definition phase the Silverado Team will renew discussions with EPRI, Tampa Electric, and Ube Industries, Japan, regarding commercial-scale LRCWF tests in their facilities.

Military uses for LRCWF

Another potential use for LRCWF involves the U.S. military. In addition to its obvious use as a low cost petroleum substitute for industrial boilers on military bases and shipyards, LRCWF is an outstanding candidate to serve as a raw energy source (feedstock) for gasification to produce synthetic products "downstream." The Department of Defense, with its Clean Fuels Initiative, is interested in clean jet fuels which can be produced via the Fischer-Tropsch (FT) synthesis process from domestic coal, petroleum coke, natural gas and biomass. LRCWF is available from secure domestic sources, and is low cost, environmentally friendly, and liquid. Once LRCWF is gasified into a synthesis gas, it can be converted using the FT process into extremely clean-burning liquid fuels. Military needs for transportation fuels are approximately 300,000 barrels per day, representing an annual demand of about 110 million barrels. A large commercial production plant dedicated exclusively for the military would be necessary to help meet this need.

Discussions have occurred regarding DOD's interest in using LRCWF for this purpose. Silverado has agreed to provide 1,000 barrels of product to the military for FT synthesis and operational testing from the Commercial Demonstration Plant's first run.

LRCWF can also provide the military a low cost and environmentally friendly substitute for fuel oil used on military installations for heating and power applications. In FY 2004 the U.S. military used in excess of 200 million gallons (approximately 5 million barrels) of fuel oil for the operation and maintenance of their installations. The current price of fuel oil is over $2 per gallon. Silverado is currently in discussions to provide LRCWF as a fuel oil substitute. The advantages of using LRCWF are threefold. First, LRCWF is less expensive than oil—running at a cost of approximately $13 per oil barrel equivalent. Second, it is cleaner burning and third, utilizing LRCWF will provide a stable, domestic source of fuel and thus reduce dependence on foreign oil.

Polygeneration Potential of LRCWF Gasification

Because LRCWF lends itself to gasification and is a low-cost raw energy source, it can serve as the starting point for a wide variety of industrial products once converted to a synthesis gas. The LRCWF-based synthesis gas, when transformed by the Fischer-Tropsch process, can create synthetic diesel and jet fuel, as well as naphtha and waxes. The synthesis gas can also be turned into ammonia and urea, for fertilizers and explosives. It can also be converted to methanol, ethers, and ethylene for plastics, polymers and other industrial and petrochemical uses. Clearly the development of LRCWF has numerous beneficial applications for the economy.

1) LRCWF combustion looking across the throat of a vertical injector in a coal-fired boiler. Notice the intense, bright flame and the nearly complete absence of "sparklers." (Sparklers would indicate agglomeration and incomplete combustion.) Contrary to bituminous coal, LRC does not agglomerate, instead it explodes upon heating for rapid ignition, clean burning, and a complete carbon burnout as shown here.

2) Combustion of commercial bituminous CWF. Note the poor flame quality and the many "sparklers" (which are agglomerates many times larger than the feed coal). Some agglomerates are ash-covered spheroids, containing unburned carbon, and are so large that they exceed the entrainment velocity and fall to the boiler floor. This leads to poor carbon burnout and loss of efficiency.

Left Side: Microscopic View of Raw Low-Rank Coal Particle

Water fills macro and micro pores of the raw coal particle. Water is also bound to the coal particle via hydrogen bonding to the oxygen-containing sites in the LRC and via electro-static bonding between oxygen in water and cations (mineral matter) that are bonded to the LRC. This inherent moisture, as opposed to surface moisture, explains why some LRC containing over 50% moisture appears dry. Lignite or subbituminous coal has inherent or equilibrium moisture values of 25% to 40%. The high inherent moisture in LRC increases shipping costs (e.g., a 100-car train of LRC is actually transporting the equivalent of only 60 to 75 cars of dry coal and 25 to 40 cars of water.) High moisture content has relegated most LRC to be used for mine-mouth or nearby power plants from which the electricity is transported.

Right Side: Microscopic View of Hydrothermally Treated LRC Particle

Hydrothermal Treatment involves heating LRC to coal specific temperatures in an aqueous phase maintained by pressures above the saturated steam pressure (typically about 285 oC and 1500 psig), somewhat analogous to pressure-cooking. Water expands and is expelled from most of the pores when much of the oxygen in the LRC is released as CO_2 during heating. This process eliminates most of the pore-

bound moisture that was held by the LRC's oxygen functionalities. When CO_2 is lost, cations are also released into the water phase, eliminating the inherent water associated with LRC cations; however, a key to permanent moisture removal is the evolution of some of the LRC volatile matter as waxy substances upon heating. Being hydrophobic, waxy material is retained on the LRC in the pressurized aqueous environment. Upon cooling the waxy material seals the micro-pores, thus limiting moisture re-absorption. Following hydrothermal treatment, the energy content of the dry LRC increases since most of the volatile matter is retained and LRC carbon lost as CO_2 has already been oxidized.

NOTE: Additional attachments submitted for the record have been retained in the Committee's official files.

Mr. GIBBONS. Mr. Anselmo, thank you very much for your time and your contribution to a better understanding of this issue by those of us sitting up here.

As you can tell, I am the only one left so what really happens now is you have to suffer through the ignominy of just me asking questions.

Mr. ANSELMO. I look at it as they left the two best guys for the end.

[Laughter.]

Mr. GIBBONS. All right. We can live with that. We can live with that as well.

Let me begin with you, Mr. Anselmo, because there were some questions that were raised through your testimony. Relative to the fuels derived from oil production, how competitive is your process and your coal/water fuel that you have out there? How competitive is it in terms of cost?

Mr. ANSELMO. It is very competitive as our base cost of $10 to $15 per barrel of oil equivalent. As compared to $75, we are so far ahead of the game to start that this fuel, which is used for industrial heat and electricity and boilers, has a very low base cost.

Therefore, a nominal increase in our cost to the market beats the heck out of burning oil. We do not compete with oil. We compete with burning oil.

Mr. GIBBONS. Right. If you were to look at the energy contained in an equivalent volume/mass of your product, your coal water fuel, and say fuel converted from coal outside of your process, are you getting the equivalent BTU requirement?

Mr. ANSELMO. It takes 2.2 barrels of our fuel to produce the same amount of energy as does a barrel of oil, so we speak in barrel of oil equivalents. People understand a barrel of oil.

Mr. GIBBONS. OK. What you would then say is for the equivalent BTU energy it would take somewhere between $20 and $30 of your process to equate to a standard barrel of oil?

Mr. ANSELMO. No. In fact it costs $10 to $15 to produce 2.2 barrels of our fuel, which gives us as much energy as does a barrel of oil.

Again, our base cost is so low that we have all the upside in the world to produce products that are low end cost.

Mr. GIBBONS. Have you started producing your fuel in quantity yet? For that matter, have you gotten into any commercial production with it?

Mr. ANSELMO. No, we have not. Our first job is to build the demonstration facility, for upscale design for commercial production, to test this fuel in various engines, jet engines, to produce 1,000

barrels of jet fuel for consumption by the DOD for their tests as they have requested. Then the commercial plant would take somewhere in the neighborhood of five years or less to come on stream.

Mr. GIBBONS. Thank you.

Mr. Kelly, is there any way we can streamline our process or streamline your process that could get these plants on line before 2015?

Mr. KELLY. I think in terms of processes, I think the permitting process and perhaps Federal eminent domain legislation on rights-of-ways for product pipelines and new carbon dioxide pipelines that can transport and sequester the fuel.

At the Medicine Bow project, for example, we have a CO_2 flood that is 80 miles away. We will have to build a new pipeline. Anything that we can do to streamline that permitting process, which allows us to meet the environmental objective of sequestering that CO_2, would be very helpful.

Mr. GIBBONS. Maybe I should say this. Realistically speaking, what changes to the infrastructure needs? I mean, you have talked about the pipelines that have to be constructed, but what infrastructure needs should we be considering when we look at this?

I mean, we already have right-of-way permitting processes. We already do the sort of thing that would allow or permit you to construct those, but still that is an investment cost that has to be made and has to be established and has to be put down before you can become a commercial supplier, so to speak.

What do we need to do with regard to that infrastructure need to accommodate the transportation of these fuels?

Mr. KELLY. Mr. Chairman, I mean as far as the primary product is concerned, for example, the liquids product pipelines, those pipelines in our project exist, are eight miles from our facility, are being converted to ultra low sulfur diesel now and are building capacity because they are anticipating the production from the Medicine Bow facility.

I think the private sector is helping do that. I think in terms of, for example, permitting across BLM lands, getting rights-of-way across BLM lands for pipelines and in particular for new CO_2 pipelines could be very, very helpful here.

Mr. GIBBONS. So you are still going to require new pipelines to be constructed? I mean, in addition to the eight mile connector that you are talking about there you are still going to have to construct new pipelines on these existing rights-of-way because are most of these pipelines not currently full or at their capacity at this point?

Mr. KELLY. Some of them are. In our particular case there is capacity on the line, and we are finalizing a contract to take that product and ship it out on that line to Denver for a 20 year period.

I think over time there is going to need to be increased infrastructure to meet the requirements of this Fischer-Tropsch fuels.

Mr. GIBBONS. OK. We have been joined by Mr. Cannon. Mr. Cannon, do you have any questions?

Mr. CANNON. I do, Mr. Chairman. Thank you, and thank you for holding this hearing. I appreciate it.

This is a fascinating area, and if we could predict prices for 10 years or 20 years a lot of the uncertainty I guess would come out of that.

Mr. Ward, thanks for being here, by the way. John and I go back a long ways. It is nice to see you here.

I have heard a lot of talk about these smaller scale facilities that are designed to do like 10,000 barrels a day or less. I am wondering why that is. Really are there not economies of scale that kick in so that a much larger facility would be justified?

Mr. WARD. Yes. Thank you, Congressman Cannon. I think when you look at the panel that is here today you probably notice the absence of a lot of very large companies. I think when you look at the fuels industry, very large companies really do not have incentives to go out and build new industries that may disrupt the very successful business models that they already have going.

What you have in front of you are small companies that are entrepreneurial that have an interest in creating a new industry and in causing disruption, and that drives us to look at what is possible to do in the financing markets.

At Headwaters we believe that larger facilities are more economical. We are looking to try projects in the 30,000 to 50,000 barrel a day range and think the ultimate size may be as large as 80,000 barrels a day, but to do that we will need significant support.

The difference for a small company in trying to raise $1 billion in the private market versus trying to raise $4 billion in the private market is a significant hurdle.

Mr. CANNON. So to get a 10,000 barrel a day plant going then you think you can justify going into a larger operation?

Mr. WARD. That is the theory of this incremental step up. Now, if Congress were to decide that they wanted to invest significant incentives to get this industry started the greater incentives that Congress can provide to the industry now, the shorter we can make that timeline of getting plants in service, establishing the business model and then creating larger plants that can have a real significant impact on our oil usage in this country.

Mr. CANNON. You know, some people complain about the government—I complain about the government—picking winners and losers, but if the Federal government decided to help in this area could you talk a little bit about what we could do and maybe talk in terms of what we could do with a small, 10,000 barrel a day plant versus one of these much larger plants and what the effect of that would have on these issues, what we would do and what the effect would be either with small plants or large plants?

Mr. WARD. Again, I think the answer is how much support is Congress going to provide? You have heard a number of suggestions from the witnesses as far as the types of incentives that they see as helpful in getting this industry started.

I do not think any of the witnesses see long-term subsidies as a solution here. What we are really looking for is assistance to help cross this deployment gap. There is this space between research and development when technologies can be commercially feasible and this space where you have something in a position where the commercial financing markets will take care of them.

We are talking about bridging that gap, so we suggest steps like providing funding for front end engineering and design, having the government step in as a customer for buying fuels from these first few plants and thereby insulate from the risk of oil prices going

back down, fully funding the loan guarantees and investment tax credits provided for in the Energy Policy Act, extending the 50 cent a gallon alternative fuels excise tax credit incentive that was in last year's transportation bill, but does no one any good because it expires before you can build a plant.

I think if Congress were to do all of those things you would naturally see industry respond and the larger plants get built faster.

Mr. CANNON. When you talk about this gap, let us just be clear for the record here.

That gap is between the work and research that has been done at the Federal level using Federal dollars for research and development and other developments and the engineering and the kind of practical things you have to do to actually create a plant that would use that technology that has been developed?

Mr. WARD. It is my personal opinion that government is good at funding research and development. What we are talking about in coal to liquids here is that not a lot more government funded research and development is needed. Industry is doing a good job of advancing that R&D.

You cannot say that just because the technology is commercially ready that the private financial markets are ready to seize it and open their pocketbooks and lend the money that is needed to do these things, so that deployment gap has to do with spending the risky dollars, and for one of these facilities you will spend upwards of $50 million to do your front end engineering and design to get your permitting and that kind of thing in place.

That is very risky capital. Can you provide support for that? Can you provide customer support so that we can go to Wall Street and say we have someone who will buy this product at a price? All of those things will give you the support you need to get the private market to respond on these first risky plants.

Mr. CANNON. Mr. Chairman, if you will indulge me for one more question? In your case you are not asking for that whole $50 million to be paid for by the Federal government, right? You are looking at a partnering relationship that will allow you to put some money at risk, but also mitigate your risks in the process?

Mr. WARD. That is correct, Congressman. I think you will also find a number of states who are going to be eager to participate in those types of arrangements as well.

Mr. CANNON. So you are suggesting if the Federal government takes the lead then state and local governments will step in and help mitigate that risk, which is a market risk that creates an obstacle that is beyond the kind of disruptive companies' capability; that is the companies that are willing to do it which are disruptive which have limited resources?

Mr. WARD. That is correct, Congressman.

Mr. CANNON. Thank you, Mr Chairman. I yield back.

Mr. GIBBONS. Thank you, Mr. Cannon.

Let me ask this question because we are all talking about plants either being built in Kentucky—well, maybe Kentucky, but Pennsylvania, Wyoming where large coal beds currently exist.

Can these plants be located in states where rail transportation of the coal or the feedstock would have to occur over a 100 or 200 mile area and still be commercially competitive? For example, this

would be a tradeoff between building the 80 mile or the 200 mile pipeline from the plant to the oil connecting infrastructure versus transporting the coal.

Is there a difference in your mind between where the plant is located and how far the infrastructure costs versus transportation costs have to be?

Yes, Mr. Anselmo?

Mr. ANSELMO. In the case of the low-rank coal and the removal of water from the coal, it is best done at the mine site so we are not transporting water.

Mr. GIBBONS. So yours is very transportation dependent?

Mr. ANSELMO. Yes. It is the transportation of the water that has really held back the use of low-rank coals, so to remove the water at the mine site and transport a slurry which can then be further treated with adding water at the burning end is the answer to bringing these coals on stream.

We would have infrastructure from the mine site to the closest existing transportation facility, be it pipeline, shipping, trucking or whatever.

Mr. GIBBONS. OK. I have a pretty good idea of what the answers would be. I mean, I do not know if anybody else wants to contribute to that.

Mr. RAMSBOTTOM. I could add to that.

Mr. GIBBONS. Mr. Ramsbottom?

Mr. RAMSBOTTOM. Yes, Mr. Chairman. At our proposed plant in Natchez we can use two feedstocks, for instance, down there. We have rail and barge access to that proposed facility.

Mr. GIBBONS. That was going to be one of my questions why, and that is what started it is why you chose Natchez because I do not know of a coal area close to it.

Mr. RAMSBOTTOM. Right. We can use mines. We have proposals for mines in Illinois and can ship down river, rail. We can ship petroleum coke up from the Gulf, so we can use two feedstocks, if you will, to gasify. We are indifferent to each one.

The other point I think which was brought up earlier is distribution point. In that area there are refiners that want to blend our fuels into their fuels to meet the sulfur requirements coming up from the Federal government, so there are other requirements other than where the feedstock are.

There could be distribution. There could be CO_2 sequestration, which we have the opportunity in that region to do that. There are a number of factors that go in other than where the feedstock is.

Mr. GIBBONS. OK. Mr. Rich, let me talk to you a little bit about the relationship and the work that is going on in Pennsylvania to clean up the mine sites using your process and your company.

Describe for me, if you will, the collaborative effort between the public/private partnership that is going on today with your process that makes it work in Pennsylvania. You are going to have to use the microphone.

Mr. RICH. Well, we have 200 years worth of history in Pennsylvania in the anthracite fields. There is a lot of refuse material, reject material that has been disposed of there over the years. That is really a cheap source of feedstock is what it boils down to.

To go back to your earlier question, if you were to relocate the plant elsewhere just adds a little incremental cost on the front end getting the feedstock to the plant.

The State of Pennsylvania, and this goes back to Governor Ridge, and Governor Rendell recognized that we have the feedstock. It is cheap. It is why we started looking at this when we did because our cost per finished gallon was competitive five, six years ago. It has only gotten more appealing as evidenced by the interest obviously.

We have the state recognizing that we are creating all new jobs when we do this. We are getting rid of a blight. We are creating products that there is an incredible appetite for. The state has embraced it under two administrations.

We have applied for participation at the Federal level. We have two contracts in place that have helped foster all of this. We have a very well-developed project. As I mentioned, we have permits issued. We have a site. We are in the coal business. That is what we do.

What we do not have and what we have not been able to do yet is convince the bankers, which is more scrutiny than you can begin to imagine, that this is something that needs to be pursued. That is why we came back to the Federal government. We are not asking for money. We are asking for a loan guarantee. We are asking for Uncle Sam to stand behind this first mortgage. That is all we are asking.

Others are asking the same, but the point is once we close the financing, once we are able to announce that, it stimulates the capital market. It creates competition there. They want to get involved in these. We are soliciting the investor communities now. That dynamic changes. They say wait a minute. We are going to miss out on something. Here is an opportunity.

During all of this, the price of oil is going up. The need to reduce our dependence is going up. The fact that we are creating all new quality jobs, high paying jobs, jobs that require welders and mechanics and engineers and legal profession and accounting profession. It is all new jobs. We are trapping them here. The payback is phenomenal.

It has been recognized in the State of Pennsylvania as evidenced by what we have done, and this is a great opportunity to sit here and listen to others and try to drive our point home that time is against us.

The Chinese are encumbering resources. I am not talking about just commodities like concrete and steel and oil. There is a limited amount of talent out there that design these facilities, that price these facilities, that have the balance sheet to stand beyond a construction contract such that it is built on time and under budget.

These are the resources we are competing for right now. Because of the activity in China and the talk we hear in India, the price of our plant and the delivery schedule on our plant and these types of machines are being jeopardized. We have to move. We have to move quickly.

Mr. GIBBONS. Well, I think that is a very exciting recital, including the job creation. It was very exciting until you got to the part about the lawyers.

[Laughter.]

Mr. GIBBONS. After that, it sort of went downhill.

But I wanted to talk a little bit about the claim or the prospect that you can produce up to 20 percent of the transportation fuels that we're currently importing for that. That seems like an awful lot, you know. But, I mean, over what time frame do you see that 20 percent——

Mr. RICH. Twenty percent of what we are importing—we are importing nine million barrels a day [sic]. That is less than two million barrels a day.

Sasol, for example, who we are working with, has one facility that produces 150,000 barrels a day. That is roughly 11 plants. That is a huge market opportunity. With a group like this pursuing and the competition that this in and of itself creates, I think we are understating 20 percent frankly.

Mr. GIBBONS. OK.

Mr. RICH. I think no matter what we say, I do not know how we can dramatize how much opportunity is out there when it comes to getting into this transportation sector, but I think 20 percent is well within the art of the possible in 10 to 12 years.

We have the pressure on oil that is driving price up. We are very competitive. We are talking about a 57,000 barrel a day facility that is roughly $4 billion that delivers us a cost per gallon that is roughly $1. One dollar per finished gallon? That is $42 a barrel finished. That is roughly $32 a barrel crude, and we are paying $74 for crude today? Twenty may be understating it.

Mr. GIBBONS. OK. Mr. Ramsbottom?

Mr. RAMSBOTTOM. If I could one moment add to that? Last week I was up at our new plant in East Dubuque, Illinois, that we purchased, and that facility, as I mentioned earlier, is going to be a polygeneration. That is fertilizer, fuel and electricity.

Now, that plant probably had we not purchased that would have been probably the twenty-third fertilizer plant to be shut down in the United States. I guess it will take us three years to convert that facility. We will create 1,700 new jobs over the next three to four years in converting that plant to coal. We will double the number of permanent jobs in that facility, and now that facility has a life to go forward not just for fertilizer, but fuels and power.

That is the kind of impact I think that John is alluding to that this industry can have in the United States.

Mr. GIBBONS. What kind of salaries do you expect to be paying for those jobs, and do you expect to have a shortage of skilled workers for those jobs?

Mr. RAMSBOTTOM. There will be a shortage—absolutely—in this industry. We are already seeing it with the APC contractors out there today. The resources are finite.

The jobs in that facility with benefits are around $60,000. These are union paying jobs in that region, which we all know are going away, so these are significant paying jobs. In Natchez, for instance, it is about $45,000 to $50,000 in that region that has lost I think 3,000 jobs in the last three years down in that region.

This will bring jobs back, permanent jobs back into the communities.

Mr. GIBBONS. I think with that statement I think it is clear that more states, states with diminishing industrial job-based markets, should be interested in creating incentives in those states for these kinds of plants to be built.

Of course, if we can get the cost of transportation for getting this feedstock from areas where there are major coal deposits then we could have a complete new transition in the industries of this country.

Mr. RAMSBOTTOM. And communities.

Mr. GIBBONS. And our communities. We can save some of our communities from just withering and atrophying down to ghost towns almost.

Mr. Kelly, you look like you are anxious to say something.

Mr. KELLY. I just wanted to add on to what Hunt said. I mean, in the Wyoming project we are looking at 300 to 400 new jobs, half of them in the coal facility in the longwall newer technology mine and half of them in the CTL facility for just the first 11,000 barrel a day facility.

I think there, you know, the people in Wyoming in that particular region are looking for those opportunities, so I think it would be a welcome addition to the growth in jobs in that area. These are high paying jobs, scientific jobs. They can be fed by the University of Wyoming and the other universities in the area. I think it is a good source of job growth in the country.

Mr. GIBBONS. What are the air quality ramifications of creating a plant? In other words, do you have to go look for offsets in air quality for the emissions of these plants, or is there no——

Mr. KELLY. Not at this stage.

Mr. RAMSBOTTOM. No. At this stage there is not an issue. We will reduce the emissions.

Right now at the East Dubuque facility, which is run on natural gas, our studies have shown we will reduce the emissions by 33 percent by gasifying coal in the region.

Mr. GIBBONS. Great. Great. That is amazing.

Mr. RICH. We are not talking about burning coal.

Mr. RAMSBOTTOM. Right.

Mr. RICH. We are talking about converting it to hydrogen and CO and then using that and then converting that of course to liquid.

Mr. GIBBONS. Some of these plants require heat, do they not, to go through this process?

Mr. RICH. Yes.

Mr. GIBBONS. So you are going to have some emissions from that heat unless you are using electricity.

Mr. RAMSBOTTOM. We will make our own power.

Mr. GIBBONS. OK.

Mr. KELLY. Mr. Chairman, I think most of these plants that are polygeneration will produce and consume a lot of electricity to produce oxygen for the gasification, but that facility, that structure, is really what I will call an inside-the-fence, integrated coal gasification combined cycle, an IGCC plant, which I think in most areas is viewed by the environmental community as the best available control technology to produce that type of power and for those types of emissions.

Mr. GIBBONS. I want to wrap up just by giving a plug to the State of Nevada. Any of you wishing to come to the State of Nevada, we want to welcome you there.

We have plenty of land, great jobs. We have a mining industry that often times goes through very cyclic periods with very technical, very skilled labor forces. We would love to have a full-time, permanent, long-term job creativity. By the way, you can always ship your coal from Wyoming to Nevada too. That works for us.

I want to thank you. We have kept you here about 20 minutes longer than the requisite time for torture, which is two hours. We appreciate the fact that you have taken time out of your busy days to help us better understand this very exciting proposal. It is something that I think this country should embrace with open arms.

From everything you have said and testified to, it is something that we must do as part of the big picture of helping us solve our energy problems. Your commitment and your dedication to this very, very challenging project is starting to show real results.

I think our country is going to be well situated to be at least less dependent on foreign sources of energy in the future because of what you do. We in Congress need to create the political will to enable industries like yours to go forward and to be successful. That is principally the purpose of the hearings like we are having here today.

I want to thank all of you for your presence. I want to thank you for your testimony. I want to also say that we may have written questions be submitted from other Members who were not able to make this due to scheduling problems or even from the committee staff to clarify parts of testimony here.

We would ask that you respond to those questions promptly and return them to us. It helps us better understand the issue and builds on the committee record for this very important hearing.

From my standpoint as the Chairman of the Energy and Mineral Resource Subcommittee, that you have been here today and spent this kind of time, to you and the first panel I want to thank you. It has been enlightening. It has been educational. Quite honestly, I am building a greater hope now inside for the future of the country and feel that we have answers and solutions to some of our energy problems.

Again, I want to thank you for your testimony today. Again, keep up the great work. We look forward to a brighter energy future incorporating much more coal than we have in the past, so thank you very much.

With that, the hearing is adjourned.

[Whereupon, at 12:25 p.m. the Subcommittee was adjourned.]

[Additional statements submitted for the record follow:]

Statement of The Honorable Chris Cannon, a Representative in Congress from the State of Utah

Mr. Chairman, thank you for holding this hearing today. As the current cost for of oil is reaching record highs and some forecast that the cost could reach as high as $80 a barrel by the end of June, finding alternative energy sources is a high priority. In my home state of Utah, the average price for gasoline is $2.83 a gallon slightly below the national average price of $2.92 a gallon at the pump. This is an increase of more than 30 percent just one year ago. Addressing alternative energy sources is of great importance to this committee and to all Americans.

The United States has been too dependent on foreign sources of oil. Coal is an abundant resource here in the U.S. with more than 250 billion tons of recoverable coal reserves, equivalent to approximately 800 billion barrels of oil. Yesterday, the cost for a barrel of oil was $73 and it is projected that this number will not significantly decrease anytime soon. However, the current estimate of liquefied coal is around $40/barrel. If this is true, and I hope to learn more during this hearing, I believe that this technology is an important alternative to our nation's dependence on foreign oil.

South Africa has had a commercialized coal liquids industry since the 1950s. They have produced over 700 million barrels of synthetic fuels from coal for over two decades. Additionally, it is my understanding that China is investing $6 billion in new liquefaction plants, which will produce 440 million barrels of liquid fuel annually. As foreign countries have acknowledged the benefit and need for development of coal-to-liquid technology, I question, why we have no commercial coal liquefaction plants in the U.S.

I look forward to hearing from all of our witnesses today as we explore coal-to-liquid technology and learn more about the role coal resources could have in fueling our energy needs. Additionally, I want to extend a warm welcome to one our witnesses, who is a fellow Utahan, Mr. John Ward of Headwaters Incorporated. At today's oil prices, I feel it is our obligation as Members of Congress to explore alternative energy sources, and I look forward to working this Committee as we do so.

[The prepared statement of Mrs. Cubin follows:]

Statement of The Honorable Barbara Cubin, the Representative for All Wyoming

Mr. Chairman, skyrocketing energy costs to heat our homes and businesses—as well as fuel our cars, trucks, and tractors—has American consumers crying out for innovation. Over the past two years, our nation's dependency on foreign oil has averaged more than 58%—over 20% higher than during the 1973 Oil Embargo. We simply must look to an increased use of other traditional and non-traditional domestic energy resources if America is ever going to gain a reasonable share of our energy independence.

According to the Energy Information Administration, there are over 267 billion tons of recoverable coal reserves in the United States—almost 42 billion of which are located in my home state of Wyoming. Those reserves equate to roughly 800 billion barrels of oil. Compare that to the 260 billion barrels of oil in Saudi Arabia's proven reserves and you can see just how great the potential for this abundant American resource can be through the application of new coal-to-liquids and gasification technologies.

Before industry can really apply these new technologies, they must first have a regulatory climate that supports them. Our Committee was responsible for crafting many of the provisions within the Energy Policy Act signed into law this past summer that will ease our nation's rapidly growing energy demand through increased domestic production of traditional and alternative fuel sources alike. Perhaps more importantly, we also included in the bill several investment tax credits and loan guarantees for facilities and demonstration projects that utilize the cutting edge, clean-coal technologies we'll be learning more about today.

Regulatory red tape has made the utilization of these technologies so expensive and time-consuming in the past, that it simply wasn't economically feasible for the private sector to pursue. In today's climate of ever-increasing prices for oil and gas resources, those investments are making more and more sense. If fact, the possibilities for expanded coal use make so much sense in the west, that even state governments are working to promote the use of new, innovative technologies. The Wyoming state House of Representatives, for example, passed legislation just this past February that would give energy companies a tax exemption on equipment used to construct new coal gasification and liquefaction plants in the state.

The future utilization of coal in America will be dependant on all of the factors I have mentioned this morning—technology development, supportive public policy, and implementation through private investment. I am hopeful that our witnesses today will provide additional guidance as to how we can continue to ensure we are continually moving forward in each of these areas. Doing so makes sense for our national energy security, our environment, and the American consumer.

Thank you Mr. Chairman for holding this important hearing. I yield back the balance of my time.

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