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PUBLIC POLICY OPTIONS FOR ENCOURAGING ALTERNATIVE AUTOMOTIVE FUEL TECHNOLOGIES

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

NOVEMBER 15, 2005

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

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PUBLIC POLICY OPTIONS FOR ENCOURAGING ALTERNATIVE AUTOMOTIVE FUEL TECHNOLOGIES

TUESDAY, NOVEMBER 15, 2005

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 10 a.m. in room SD–562 Dirksen Senate Office Building, Hon. Ted Stevens, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. TED STEVENS, U.S. SENATOR FROM ALASKA

The CHAIRMAN. I'm sorry to report we have seven stacked roll call votes that start at 10:45 this morning. Since we're short on time, we're going to combine panels. We'll ask all Senators including myself to submit their opening statements. It is my hope that we can ask the witnesses to present their testimony. We have got six of you and if you could hold your statements down to about 5 minutes we will see if we can have a question period for a few minutes then be able to leave here about 10:50, 10:55 a.m. Any objection? Obviously not. Let me proceed then. Just in order that you're seated at the table.

Ms. Glassman.

[The prepared statement of Senator Stevens follows:]

PREPARED STATEMENT OF HON. TED STEVENS, U.S. SENATOR FROM ALASKA

Good morning. I am pleased to be here today to discuss the public policy options for encouraging alternative automotive fuel technologies.

I scheduled this hearing to improve the Committee's understanding of current and future alternative fuel sources and vehicle fuel efficiency technologies.

With so many different fuel sources and technologies available today or being developed, it is vital to understand them as we consider developing Federal policies and programs.

We already see some of these technologies emerging on the market, including hybrid and electric vehicles. I am encouraged by what I've seen thus far from these technologies that reduce both fuel costs and vehicle emissions. Congress must study these alternative technologies to better plan for the future; and act in a manner whereby markets continue to work and provide consumers the greatest flexibility possible when making decisions involving fuel technologies.

I apologize, but since there are seven stacked votes starting at 10:45 a.m. today and we are short on time, we will be combining the two panels of witnesses today. First, we will hear testimony from the Honorable Jeffrey Shane, who is accompanied by Jackie Glassman, the Deputy Administrator for the National Highway Traffic Safety Administration.

Then, we will hear from Mr. Steven Plotkin from the Center for Transportation Research of the Argonne National Laboratory, Mr. Fred Webber from the Auto Alli-

ance, Mr. David Friedman from the Union of Concerned Scientists, and Mr. Jason Grumet from the National Commission on Energy Policy.

STATEMENT OF JEFFREY N. SHANE, UNDER SECRETARY FOR POLICY, DEPARTMENT OF TRANSPORTATION

Ms. GLASSMAN. Actually, Mr. Shane will present the testimony for the Department of Transportation.

Mr. SHANE. Thank you very much, Mr. Chairman. I'm Jeff Shane. I'm the Under Secretary for Policy for the Department of Transportation and I'm accompanied by Jackie Glassman who is Senior Administrator at the National Highway Traffic Safety Administration.

The CHAIRMAN. There are only four of you. Why don't you take about 8 minutes apiece and we'll proceed after that.

Mr. SHANE. Thank you, sir. We appreciate the opportunity to discuss the efforts of the Administration and the U.S. Department of Transportation on policy options for encouraging alternative automotive fuel technologies. This is a matter obviously, of great importance to the economy and great importance to our national energy security. Mr. Chairman, I have a longer statement that we have submitted for the record and I'd be very grateful if that can be incorporated in the record.

The CHAIRMAN. All of your statements will be in the record. Make the comments you want to.

Mr. SHANE. Thank you. In 2003, noticing the rapid drop in the amount of fuel consumed in the United States that's actually produced in the United States, President Bush announced a bold initiative to begin the transition to a hydrogen economy. This initiative is aimed at developing commercially viable hydrogen-powered vehicle, hydrogen production systems, and hydrogen infrastructure. The hydrogen initiative's goal is to ensure America's long-term energy security by making vehicles powered by hydrogen fuel cells a practical and cost-effective choice for large numbers of Americans by the year 2020. This is the Administration's long-term vision.

The Department of Energy is primarily responsible for hydrogen production and storage technology, fuel cell development, and light duty vehicle development. The Department of Energy and the Department of Transportation share responsibility for codes and standards development. DOT, under its statutory authorities, is primarily responsible for ensuring the safety of hydrogen vehicles, the safety of hydrogen infrastructure, and for developing the regulations and the standards that ensure that safety.

My prepared testimony lists a number of DOT-specific responsibilities in this connection. I'll just ask that those be referred to in the prepared remarks in the interest of time.

We know that hydrogen technology development and deployment will take time and that is why the Administration is also committed to programs that will provide near-term results. These include rulemakings for light trucks under the Corporate Average Fuel Economy program. That's the CAFE program. In 2002, the Congress acceded to Secretary Mineta's request to resume rulemaking under CAFE. Rulemaking covering model years 2005 to 2007 is expected to save 3.6 billion gallons of fuel over the life of the regulated vehicles.

For model year 2008–2011 vehicles, we just issued a second rulemaking that proposes an innovative new approach: basing light truck fuel economy standards on vehicle size for the first time. This approach will yield greater fuel savings for the driving public while enhancing safety and reducing compliance costs.

Other programs that can be expected to yield near-term results include the tax credits for energy-efficient hybrid, clean diesel, and advanced internal combustion engine vehicles that were created by the Energy Policy Act of 2005;

the renewable fuel standard incorporated into the legislation, the extension of the renewable fuels CAFE credit under the Alternative Motor Fuels Act enacted as a part of the Energy Policy Act, and multiple "clean fuels" programs for heavy vehicles incorporated into the Energy Policy Act;

and, alternative fuel vehicles and associated infrastructure continue to be eligible under the Congestion Mitigation and Air Quality Improvement Program or CMAQ program, as authorized under SAFETEA–LU.

Finally, we're also placing great emphasis on programs to mitigate fuel-sapping congestion through encouraging high occupancy vehicle lanes, congestion pricing, public-private partnerships, the deployment of intelligent transportation systems and, of course, support for transit and paratransit systems.

Biofuels offer another approach for reducing our near-term dependence on imported fuels. All of the current and near-term advanced automotive technologies that we are considering today, including hybrids, can use biofuel blends. Today conditions are better than ever for expansion of renewable fuels in the transportation sector.

The renewable fuels standard enacted by Congress in the Energy Policy Act of 2005 mandates a near-doubling of ethanol use in gasoline by 2012 to 7.5 billion gallons.

The American Jobs Creation Act of 2004 greatly simplified the long-standing ethanol excise tax credit. Together with high petroleum prices, the Federal excise tax credit has greatly improved the competitiveness of alcohol fuels and biodiesel.

The Energy Policy Act of 1992 and the CAFE credit provisions in the Alternative Motor Fuels Act have created a fleet of more than four million "ethanol ready" vehicles that can use E85 ethanol blends at their owners' discretion. Essentially all gasoline vehicles sold in the United States today can use up to 10 percent ethanol blended in gasoline without affecting their warranties.

There is widespread commercial interest in expanding production of both ethanol and biodiesel. The Renewable Fuels Association reports that there are 92 ethanol plants in the United States with current fuel ethanol capacity of 4.2 billion gallons a year, and that 1.4 billion gallons a year of additional capacity are currently under construction. The National Biodiesel Board indicates that 2004 production is 25 million gallons and they expect 2005 production to triple to 75 million gallons.

In addition, the Energy Policy Act contains incentives for production of cellulosic ethanol, which, if the technology can be made economical, offers the opportunity to convert low value crop residues into fuel-grade ethanol. Biodiesel can be made from waste oils in

low volumes and from a range of oilseeds in potentially larger volumes.

Reducing our Nation's dependence on oil cannot be accomplished by one simple act. The Administration's efforts recognize that there are actions all of us can take today in the near-term and there are other actions and revolutionary new technologies that require a long-term commitment for successful deployment.

The Department of Transportation is very pleased to play a vital role in these and other important and ongoing efforts and ensuring public safety in transportation while helping innovative technologies roll out on America's roads.

That concludes my statement, Mr. Chairman.

The CHAIRMAN. Thank you very much.

[The prepared statement of Mr. Shane follows:]

PREPARED STATEMENT OF JEFFREY N. SHANE, UNDER SECRETARY FOR POLICY, DEPARTMENT OF TRANSPORTATION

Mr. Chairman and Members of the Committee:

Thank you for giving me the opportunity to discuss the efforts of the Administration and the U.S. Department of Transportation on policy options for encouraging alternative automotive fuel technologies. This is a matter of great importance to the economy and to our national energy security.

Back in 1985, 73 percent of the petroleum consumed in America came from domestic sources. Since then, American gasoline consumption has increased by about a third, while domestic crude production has dropped, resulting in a dramatic rise in oil imports. Today, only about 35 percent of the crude oil used in U.S. refineries is from domestic sources, and our dependence on foreign oil is increasing. This change did not happen overnight, and many of the strategies to address our oil dependence must look to the long term.

In 2003, President Bush announced a bold initiative to begin the transition to a hydrogen economy. This initiative spans a range of technologies, aimed at developing commercially viable hydrogen-powered vehicles, hydrogen production systems with carbon sequestration, and hydrogen infrastructure. The initiative's goal is to ensure the long-term energy security of America by making vehicles powered by hydrogen fuel cells a practical and cost-effective choice for large numbers of Americans by the year 2020. This is the Administration's long-term vision.

The Department of Energy is primarily responsible for hydrogen production and storage technology, fuel cell development, and light-duty vehicle development.

The Department of Energy and the Department of Transportation share responsibility for codes and standards development. DOT, under its statutory authorities, is primarily responsible for ensuring the safety of hydrogen vehicles and infrastructure, and for developing the regulations and standards that ensure that safety. DOT is also responsible for ensuring that hydrogen vehicles can be integrated into the larger transportation system. Some of the specific responsibilities within DOT:

- The National Highway Traffic Safety Administration (NHTSA) concentrates its efforts on ensuring that hydrogen vehicles are safe.
- The Research and Innovative Technology Administration (RITA) coordinates the Department's Hydrogen Working Group, and represents the Department on the National Science and Technology Council and as a member on the Interagency Working Group on Hydrogen exploring hydrogen delivery infrastructure needs. A multi-modal team will develop advice for first responders for vehicle crashes and hazardous material cleanup crews at vehicle crash sites, and for safe infrastructure location and permitting. RITA is also conducting multimodal safety research, covering vehicles, hazardous materials transport, and fixed infrastructure.
- The Federal Motor Carrier Safety Administration is developing guidelines for the operation, fueling, inspection, and maintenance of hydrogen systems in commercial vehicles.
- The Federal Transit Administration, in partnership with key stakeholders, leads a broad-based national effort focused on fuel cell buses.
- The Pipeline and Hazardous Materials Safety Administration (PHMSA) oversees the safety and security of hydrogen delivery by pipeline, rail, and truck,

including existing technologies such as high pressure cylinders and emerging technologies such as metal hydrides. PHMSA will continue to provide advice for first responders to hydrogen and other hazardous materials incidents.

Coordinated codes and standards work is critical to the success of the entire hydrogen venture. Although widespread use of hydrogen-powered vehicles is more than a decade away, there are prototype vehicles on public roads now. Safety is essential to the broad public acceptance of any new technology. Manufacturers of both vehicles and infrastructure will need to know which regulatory standards they must meet before designing systems for mass production and widespread deployment.

We know that hydrogen technology development and deployment will take time. That is why the Administration is also committed to programs that will provide nearer term results. These include:

- Rulemakings for light trucks under the Corporate Average Fuel Economy (CAFE) program. In 2002, the Congress granted Secretary Mineta's request to resume rule-making under CAFE. NHTSA's rulemaking covering Model Years 2005–2007 vehicles is expected to save 3.6 billion gallons of fuel over the life of the regulated vehicles. For model year 2008–2011 vehicles, we have proposed an innovative new approach: basing light truck fuel economy standards on vehicle size. This approach will yield greater fuel savings for the driving public while enhancing safety and reducing compliance costs.
- Tax credits for energy-efficient hybrid, clean diesel, and advanced internal combustion engine vehicles created by the Energy Policy Act of 2005;
- The renewable fuels standard incorporated into the Energy Policy Act;
- The extension of the renewable fuels CAFE credit under the Alternative Motor Fuels Act, enacted in the Energy Policy Act;
- Multiple "clean fuels" programs for heavy vehicles incorporated into the Energy Policy Act and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA–LU). Many of these clean fuels provisions explicitly permit funding for alternative fuel vehicles.
- Alternative fuel vehicles and infrastructure continue to be eligible under the Congestion Mitigation and Air Quality Improvement (CMAQ) Program, as reauthorized under SAFETEA–LU. Under CMAQ, the Federal Highway Administration and Federal Transit Administration are pursuing a program to reduce truck and heavy vehicle idling, in cooperation with the Department of Energy and the Environmental Protection Agency.
- Programs to mitigate fuel-sapping congestion through encouraging high occupancy vehicle (HOV) lanes, congestion pricing, public-private partnerships, deployment of intelligent transportation systems; and support for transit and paratransit systems and other private vehicle alternatives.

As this portfolio suggests, we view vehicles as elements in a larger transportation system. While improved vehicles are critical to reducing fuel consumption, viewing vehicles together with roads, technology, and alternative transport modes offers important synergies. As we begin to develop ways for vehicles to communicate with the roads and with each other, emerging transportation systems will grow in efficiency and safety.

While reducing automotive fuel consumption presents a difficult and long-standing challenge, today we have certain advantages. We are living in a period of rapid innovation in automotive technology. While today's vehicles may look very much like the vehicles of twenty years ago, many aspects of engine operation are now controlled by microprocessors. Automakers have several technological options for improving vehicle fuel economy without reducing performance, including clean diesel engines and hybrid vehicles. In the next few years, we should see increased potential for advanced hybrids and advanced internal combustion engines.

Due to recent increases in fuel prices, consumers are placing a higher value on fuel economy today than in the recent past. This creates the market conditions under which advanced vehicles that offer improved fuel economy can be successful in the marketplace. We believe that the National Highway Traffic Safety Administration's proposed light truck rulemaking will also encourage manufacturers to adopt more advanced fuel-saving technologies.

Biofuels offer an alternative approach to reducing our near-term dependence on imported fuels. All of the current and near-term advanced automotive technologies that we are considering today, including hybrids, can use biofuel blends. Historically, despite a range of incentives, high transportation costs limited the scale of fuel ethanol plants and tended to concentrate ethanol use in regional markets in

the Midwest and California. However, at present, conditions are better than ever for the expansion of renewable fuels in the transportation sector.

- The renewable fuels standard enacted by Congress in the Energy Policy Act of 2005 mandates a near-doubling of ethanol use in gasoline by 2012, to 7.5 billion gallons (489,000 barrels per day). According to the Energy Information Administration, 2004 U.S. gasoline consumption was about 9.1 million barrels per day; 2004 fuel ethanol production was 3.4 billion gallons (202,000 barrels per day).
- The American Jobs Creation Act of 2004 greatly simplified the long-standing ethanol excise tax credit, offering ethanol blenders a credit of $0.51 for each gallon of ethanol blended into gasoline. Biodiesel from waste oils is eligible for a $0.50 per gallon tax credit (through 2008) and biodiesel from virgin agricultural materials is eligible for a $1.00 per gallon tax credit.
- High petroleum prices and the Federal excise tax credit have greatly improved the competitiveness of alcohol fuels and biodiesel.
- The Energy Policy Act of 1992 and the CAFE credit provisions of Alternative Motor Fuels Act have created a fleet of more than 4 million "ethanol ready" vehicles that can use E85 ethanol blends at their owners' discretion, and essentially all gasoline vehicles sold in the United States can use up to 10 percent ethanol blended in gasoline without affecting their manufacturers' warranties.
- There is widespread commercial interest in expanding production of both ethanol and biodiesel. The Renewable Fuels Association reports that there are 92 ethanol plants in the United States, with current fuel ethanol capacity of 4.2 billion gallons per year, and that 1.4 billion gallons per year of additional capacity are currently under construction, (including 23 new plants and expansions of existing facilities). Biodiesel production has advanced in recent years, although it is not nearly as well established as ethanol. The National Biodiesel Board indicates that 2004 production was 25 million gallons (1,600 barrels per day) and they expect 2005 production to triple to 75 million gallons (4,800 barrels per day). The Federal Transit Administration has a small program to test biodiesel on transit buses in Missouri. There is interesting research underway on biodiesel as well. A recent article in *Science* described a new, less energy-intensive method for making biodiesel that would permit ethanol plants to switch between making ethanol and biodiesel, and opens a potential pathway for generating biodiesel from plant wastes."
- The Energy Policy Act extended the Federal tax credit for small ethanol and biodiesel producers. Small producers (less than 60 million gallons per year) can receive a tax credit of $0.10 per gallon for the first 15 million gallons of annual production.

In addition, the Energy Policy Act contains incentives for production of cellulosic ethanol, which, if the technology can be made economical, offers the opportunity to convert low value crop residues into fuel-grade ethanol. Biodiesel can be made from waste oils in low volumes (limited by feedstock availability), and from a range of oilseeds in potentially larger volumes.

Biofuel usage is expanding rapidly. Widespread commercialization of cellulosic ethanol would have a positive impact. Essentially all motor vehicles on the road today can use biofuels in blends of less than 10 percent. There may be continuing commercial and economic barriers to expanding biofuel production. The commercial conditions under which biofuels are produced and consumed have changed greatly. In the coming months, the ways in which fuel producers and consumers will adapt to the new situation created by recent legislation and the continued high fuel prices will become clearer.

Reducing our Nation's dependence on oil cannot be accomplished by any one simple act. The Administration's efforts recognize that there are actions all of us can take today and in the near term, and there are other actions and revolutionary new technologies that require a long-term commitment for successful deployment. The Department of Transportation is pleased to play a vital role in these important and ongoing efforts, ensuring public safety in transportation while helping innovative technologies roll out on America's roads.

This concludes my statement. I will be glad to answer your questions.

The CHAIRMAN. Mr. Plotkin, welcome. And I would say to my colleagues that with the time frame of the schedule of votes, we're going to listen to the panel and then ask questions quickly before we leave at 11 a.m.

STATEMENT OF STEVEN E. PLOTKIN, TRANSPORTATION AND ENERGY ANALYST, CENTER FOR TRANSPORTATION RESEARCH, ARGONNE NATIONAL LABORATORY

Mr. PLOTKIN. Mr. Chairman, Senators, thank you for the opportunity of discussing with you the crucial subject of finding alternatives and supplements to oil-based fuel, especially gasoline. I will summarize my written testimony by listing a few key points.

My focus is primarily on the longer term. First, I would like to give you a little bit of context about where I think we're likely to be going if we don't have a new energy policy. I think I can foresee one of two possible futures. The first is that conventional oil production peaks within the next 20 to 30 years or at least falls way short of growing demand because of some combination of unlucky geology and hostility of key oil producing countries to the outside investment needed to sustain and increase their production. The result will be much higher oil prices and both the strangling of demand and a shift to unconventional sources of oil such as tar sands, gas to liquids, and oil shale. I think it quite likely that the transition to these sources will not go smoothly.

Second, if we are lucky at geology and if the key oil producers ease their hostility to outside investment, we may continue much as we have in the past few decades, periods of price and supply stability, interspersed with disruption, and price spikes. In this future we will remain at the mercy of events in the Middle East, and in both scenarios we're likely to have massive increases in greenhouse gases.

What can we do about this? Well, first, in the very near time frame, there are no quick fixes. The National Academy of Sciences has identified many vehicle efficiency technologies that are cost-effective in the very narrow sense of trading off lifetime fuel savings versus higher vehicle cost. These are capable of increasing fleet fuel efficiency eventually by about one-third, with other technology to be added in the future, but several years are required to redesign the vehicles, and a number of years past that to roll it into the fleet. As for new fuels, even for those fuels whose technology is well-developed, construction of new plants is slow and these plants are very risky in today's economic climate. And for those fuels not now commercially vetted, several decades will be required for them to make a large dent in our oil dependence, if the R&D roadblocks can be overcome.

Second, greater efficiency is needed not only to reduce gasoline use in conventional vehicles but also to make the alternative fuels more practical. Although this hearing is about fuels, I believe improving vehicle efficiency should be a crucial part of the U.S. Energy policy both to reduce gasoline demand, again, and to make the new fuel pathways more practical. Hydrogen is the most severe example. Its energy density is extremely low, very much like that of battery electricity and only an extremely efficient vehicle can practically store enough hydrogen to obtain the kind of range that we need, say 300 miles.

Another thing we need to do is expand our fuel options. First, I'm concerned that the transition to unconventional oil, if it is needed, is going to be a very rocky one. It's possible that conventional oil production will fall off quite rapidly. It's also possible that because

of the past and because of increases and decreases in price over time that investors are going to be extremely wary of putting billions of dollars into these new plants. I think the government has got to look carefully at policies to smooth the way to unconventional fuels, unconventional oil, if it's needed.

Second, look at hydrogen. The Federal Government's primary focus in the area of fuels research is hydrogen, for reasons including its multiple feedstocks, many of which are widely available in the U.S., its zero tailpipe emissions and high utilization efficiency in fuel cell vehicles, and its potential to achieve very low emissions of greenhouse gases. In my opinion, we will have to wait at least a few decades before we see a major impact from hydrogen, and that only if major R&D hurdles are overcome.

Third, we need alternatives to hydrogen, and the National Academy of Sciences has recommended that the Department of Energy look at alternative pathways that can achieve the same goals as hydrogen can. One of these pathways is the biomass pathway. Ethanol from cellulosic feedstocks, for example, will produce low greenhouse gas emissions and will fit very well into our existing vehicle and our fuel infrastructure, a great advantage. The supply of land is an issue, but the feedstocks can be grown on land that is lower in quality than that used for higher value food products. The cost of the fuel production is the key hurdle, and it is a difficult one. However, there are several potential solutions including genetic engineering of organisms that can break down and convert cellulose.

Recently the idea of a plug-in hybrid vehicle has gotten attention in the media. I like this concept too. A plug-in hybrid is like a regular hybrid with a larger battery and electric motor, so that it can be recharged overnight and use electricity to fuel a portion of its daily miles. Because most drivers log the majority of their miles in relatively short trips, plug-ins with moderate electric range, say 20 to 30 miles, can substitute electricity for a large portion of their gasoline use. However, like hydrogen, there are very substantial research and development hurdles to be overcome, particularly about vehicle costs and battery life.

We've got to recognize that moving alternative fuels into the marketplace is extremely tough. In the past California has attempted to move methanol into its fuels marketplace. It's attempted to move electric vehicles into its fuels marketplace. It has failed. There have been some positive side-effects because of these initiatives, but nevertheless these initiatives failed. The old EPACT failed to move large quantities of alternative fuels into the marketplace, so we have got to recognize that this is a hard task and it is going to require strong government policy.

And, finally, look at the level of R&D spending today. At today's gasoline prices we're going to spend about $300 billion dollars on gasoline over the next year. We will spend about one-tenth of 1 percent of that amount on Federal research on hydrogen, biomass, and vehicle efficiency technologies. I know this is a time of great pressure on Federal budgets, but I wonder if this is false economizing.

Thank you very much.

The CHAIRMAN. Thank you very much.

[The prepared statement of Mr. Plotkin follows:]

PREPARED STATEMENT OF STEVEN E. PLOTKIN, TRANSPORTATION AND ENERGY ANALYST, CENTER FOR TRANSPORTATION RESEARCH, ARGONNE NATIONAL LABORATORY

Chairman Stevens, Senator Inouye and other Members of the Committee, I appreciate the opportunity to testify on this crucial subject of finding alternatives and supplements to our current petroleum-based automotive fuel system. Although I have my Laboratory's permission to testify today, let me stress that the views I will give you are my own, based on my own analysis and my interpretation of the analyses of my colleagues in industry, government, and academia; they should not be interpreted as the views of Argonne or of the Department of Energy, the primary sponsor of my work for the past 10 years.

I'll begin by discussing what I believe will happen to automotive fuels over the next few decades if we take no strong action. I believe there is the *possibility*—and this is a much debated possibility, with lots of disagreement in the energy community—that the production of conventional oil will peak sometime during the next 20 to 30 years. This is partly a function of geology, which is inherently uncertain, and partly a function of the market. To keep on increasing oil production by nearly 2 percent per year, to match the forecasts of world oil demand of most major forecasting organizations, will require enormous capital expenditures, much of it in countries that are not allowing the free entry of outside capital into their oil production sector. If conventional oil production does peak, the most likely "gap fillers" will be some combination of "demand destruction"—lower demand for oil caused by very large price increases and some combination of lower economic activity and increased efficiency—and the increased production of "unconventional oil"—from tar sands, oil shale, natural gas ("Gas to Liquids, GTL"), coal liquids (as South Africa has been doing for decades), and other sources. These unconventional sources are attractive in the sense that they require no large changes in the major part of the world's transportation infrastructure—vehicles, refueling stations, fuel distribution network, and refineries. Because the production plants are immensely expensive, however, and will appear risky to investors if they believe oil prices may not remain high, there is quite a strong possibility that there may be a substantial period of time when investments in these plants do not come fast enough to prevent significant disruptions in the supply of transportation fuel. Further, these unconventional sources may have significant adverse impacts on emissions of greenhouse gases and have other negative environmental impacts as well, though potentially there are means of mitigating these impacts.

An alternative to this future is that geology turns out to be more favorable than analysts like Colin Campbell and his colleagues believe it to be, *and* OPEC creates a more friendly climate towards outside capital, allowing world oil production to match increasing demand. This scenario will lead us back to lower oil prices (though probably not for several years and perhaps never back to $25 oil) and back to a future of periods of stable prices interwoven with periods of price spikes because of natural and man-caused disruptions. Such a future may be preferable to its alternative, but it will still leave the U.S. economy at the mercy of events in the Middle East.

There are no quick fixes to reducing our gasoline use and substituting alternatives. There are many available vehicle efficiency technologies that are cost-effective in the narrow sense of trading off lifetime fuel savings versus increased vehicle cost, as discussed at length in the 2002 National Academy of Sciences report on fuel economy standards and literally hundreds of other reports and papers, but these cannot play a significant role for several years because of the time it takes to redesign vehicles and roll them into the total fleet. Keeping tires properly inflated, improving vehicle maintenance, and driving a bit more slowly and gently can all play a role essentially instantaneously, but a modest role only. And in terms of new fuels, building new plants for those fuels whose technology is well developed will still take a few years, and few investors will be clamoring to invest in those fuels not being heavily subsidized by (or required by) the government. Finally, a switch to fuels that are not now commercially ready, like hydrogen, will require several decades to make a large dent in oil dependence—assuming that existing R&D roadblocks can be overcome.

Before talking about alternative fuel technologies, let me point out that the most straightforward way to reduce dependence on gasoline is to increase vehicle efficiency, and in fact increasing vehicle efficiency is an important component in allowing alternatives to gasoline to play an important role in our fuel infrastructure (and a significant fraction of DOE's R&D funding in transport technology does go towards vehicle efficiency programs). This latter point is the case because some of the alternatives to gasoline have low energy density, and adequate fuel storage onboard the

vehicle is made much easier if vehicle efficiency is improved. Hydrogen is the most extreme case—a 75 mpg hydrogen-fueled midsize car that attains the Department of Energy's year 2010 goal for hydrogen storage volume (.045 kilograms of hydrogen/liter of storage volume) will require nearly 28 gallons of storage volume to achieve a 300-mile range (and 35 gallons at the DOE year 2007 goal). Reducing the weight of its "glider"—its structure and everything else not associated with its drivetrain—by half reduces its fuel storage requirement to 21.5 gallons at the 2010 goal. Because reducing vehicle weight, improving the vehicle's aerodynamics and tires, and increasing the efficiency of its accessories reduce the power needed to run the vehicle, every component of its drivetrain can be smaller and cheaper. Also, many alternatives to gasoline are limited in their ultimate production capacity—the obvious example is biomass fuels—and these alternatives can play a much larger role in a fleet of ultra-efficient vehicles than they can in a more conventional fleet. And, of course, even if gasoline remains the dominant fuel, a 50 mpg fleet will use a lot less gasoline than will a 25 mpg fleet (more than half as much, though, due to the lower "per mile" fuel cost). The policy problem, of course, is that achieving large improvements in fuel economy has proven extremely difficult in the past without relying on government arm-twisting. The technology has been available and has been used—the technical efficiency of today's cars and light trucks is startlingly higher than that of 15 years ago—but their *fuel economy* is the same. All that technology has been used to allow larger, heavier vehicles that reach 60 miles per hour in much less time than their ancestors. The Environmental Protection Agency, in its excellent annual reports on "Light-Duty Automotive Technology and Fuel Economy Trends," notes that the year 2005 light-duty vehicle fleet would have been 24 percent more efficient than it now is, had it kept the same weight and performance distribution that it had in 1987.

I think it makes more sense to focus on a longer time frame for new fuels—perhaps a decade or more. In reviewing the Department of Energy's hydrogen program in 2005, the National Research Council suggested to the Department that it look to a wider portfolio of fuels, given the substantial technical and economic risks associated with hydrogen *and all other potential fuel pathways:*

"The program should perform high-level systems analyses that identify the potential, the challenges, and the specific research breakthroughs for alternatives that could achieve the program vision without requiring a hydrogen infrastructure, and it should use these results to help define R&D efforts and allocate funds within DOE."

Planning for the suggested systems analyses is underway at DOE, and I am confident that these analyses will begin soon. There are many dozens of different pathways to achieving large amounts of alternatives to conventional gasoline, and it makes sense to take a hard look at most of them. In advance of this effort, however, let me share some of my preliminary views about a few pathways.

Using hydrogen in fuel cell vehicles is the most prominent fuel pathway being examined and developed in this country and worldwide. Vehicle manufacturers and suppliers in the U.S. and worldwide are spending billions of dollars on this research, and national governments and the EU are spending substantial sums as well. Although the Department of Energy spending on hydrogen is well below what the private sector is spending, hydrogen is the key focus of its vehicles and fuels R&D programs. The reasons for the focus on hydrogen include:

- Zero vehicle tailpipe emissions.
- Ability to use multiple feedstocks, including electricity, to produce hydrogen (though it's worth noting that gasoline and diesel fuel can also be made from multiple feedstocks using Fischer-Tropsch and other synthesis processes).
- High vehicle efficiency with fuel cells.
- Potentially excellent well-to-wheels emissions of greenhouse gases, with some hydrogen pathways.

There has been excellent progress on all fronts of the hydrogen R&D effort, but there remain formidable challenges in such areas as hydrogen production costs, fuel cell stack costs, onboard fuel storage, and a host of other key areas. My *opinion* is that we will probably have to wait for at least a few decades before we see a significant impact on light-duty vehicle fuel use from hydrogen. It is also my opinion that we have no guarantees that the hydrogen R&D program will be fully successful, despite our best efforts. Consequently, I fully agree with the National Academy's desire to see DOE expand its focus to encompass other fuel pathways. However, I am concerned that this expansion not rob the hydrogen program of needed resources, and I will discuss this issue a bit later.

DOE is also pursuing various biomass fuels, for example ethanol from cellulosic sources (e.g., wood, waste, fast growing grasses), though at a level well below the hydrogen programs. The advantage of this pathway is that it produces far fewer greenhouse gases than today's fuels because of the carbon recapture in the regrowth of the feedstock biomass. However, substituting for a significant share of U.S. light-duty vehicle fuel use would entail growing plantation-style crops (e.g., fast-growing grasses or trees) on a large percentage of U.S. cropland; on the other hand, biomass crops can be successfully grown on land that is of lower quality than that required for most food crops. The biggest R&D hurdle for this pathway is to drastically reduce the cost of the cellulose-to-ethanol production process. There are some tantalizing possibilities here, including efforts by Craig Venter (of human genome research) and others to discover and/or "design" microorganisms that can accelerate the process. Venter also is pursuing the production of hydrogen using genetically-engineered microorganisms, with some DOE support.

Tom Friedman and a few other journalists recently embraced the concept of the "plug-in hybrid," or PHEV, a hybrid electric vehicle with a larger motor and battery that can be recharged overnight and thus substitute electricity for gasoline for some of the vehicle's miles. Although journalistic embraces should be treated with some skepticism, I too like the concept and believe it is worth pursuing. The key here is that most drivers put on most of their mileage in short trips. A PHEV20, a plug in with 20 miles of battery range, can replace about 31–39 percent of annual miles driven for the average driver if the vehicle is recharged every night; a PHEV 60 can replace 63–74 percent of these miles. Coupled with the vehicle's high fuel economy, a fleet of PHEV60s would use less than 20 percent of the gasoline used by a similar fleet of current vehicles. Also, having the fuel used by that fleet be cellulosic ethanol is a tantalizing prospect—because it raises the possibility that biomass fuels could play a dominant role in the U.S. light-duty vehicle fleet sometime in the future, despite their supply limitations. Another thing I like about PHEVs is that, in the face of a severe disruption in liquid fuel supply, a PHEV owner will have the capability of traveling at least limited distances without using such fuels—and for considerable distances if fast chargers are available at a decent percentage of gas stations. However, I should be quick to note that PHEVs are like hydrogen fuel cell vehicles in one important regard—they have significant R&D hurdles to jump before they can be seen as fully practical. Substantial improvements in battery life and reductions in cost are the key hurdles, and I should note that lack of sufficient progress in batteries basically killed the electric vehicle "revolution" that California hoped to jump start a while ago. However, I do believe that the high degree of optimism that one *must have* to be confident that the hydrogen economy can succeed the oil economy, if applied to PHEVs, would make one a supporter of this pathway as well. At the least, this pathway deserves a very careful examination.

The group of pathways I mentioned before, those of "unconventional oil," are being pursued vigorously by industry, and some are now fully commercialized. Canada is well on its way to become a major world supplier of oil from tar sands, and several gas-toliquids plants have been built or are under construction. As I noted, I'm concerned that these pathways may not be built up quickly enough in the face of a peaking in conventional oil production (if it occurs), leading to a period (probably of several years) of severe supply disruptions. If the Federal Government is not willing to take the very strong initiatives that will be necessary to move hydrogen, biomass, or other true alternatives to gasoline into the marketplace, I would hope that it would at least pay strong attention to evaluating what policies could pave the way to a very rapid buildup of unconventional oil production should this become necessary.

Thus far, Federal and State attempts to move alternatives to gasoline into the marketplace have failed. California tried vigorously to promote methanol and then electric vehicles, and could not make much progress with either (although the push for methanol led to the introduction of reformulated gasoline, and the electric vehicle effort played an important role in improving electric drivetrains, the key to hybrid electric drivetrains and crucial to any hope for successful hydrogen fuel cell vehicles). The Federal Government's efforts, embodied in EPACT, achieved only a small fraction of its market penetration goals. The lesson here is that a limited or half-hearted attempt to move alternative fuels into the marketplace will almost certainly fail in the face of a firmly entrenched gasoline infrastructure and a vehicle/fuels system that delivers exceedingly good performance. And if we wait for the oil supply emergency that would ease the way for a fuels transition, we have many years of disruption before enough of the transition has occurred to support a stable transportation system.

In other words, we have the following choices:

1. Remain relatively passive and hope that geology and OPEC's willingness to support huge investments in expansion of oil supplies allows a reasonably stable future for worldwide supplies of transportation fuels.

2. Take whatever measures we can to smooth the way to a future transition to unconventional oil as a major part of world oil supplies.

3. Move strongly to reduce U.S. dependence on oil as the overwhelming source of our transportation fuels. Improving vehicle efficiency as well as taking a host of measures to reduce automobile dependence (better land use planning, improved transit services, etc.) should be an important part of the choice. The studies I am familiar with show, however, that moving to new fuels must be part of this choice if we also care about emissions of greenhouse gases.

I don't know how long oil prices will remain at today's high levels, and I don't think anyone else does, either. However, at today's prices, during the next year we will spend about $300 billion on gasoline for our fleet of cars and light trucks, and the fleet will drive more miles each following year for the foreseeable future. The Federal Government is now spending on the order of one tenth of one percent of this amount on research and development into improved vehicle efficiency and new fuels for this fleet, with a robust share going to hydrogen programs. I wonder if this is enough, especially for fuels pathways other than hydrogen (although the hydrogen program would also benefit from more resources) and especially for a world in which our oil security appears to be so fragile.

Thank you for giving me this opportunity to discuss my thoughts on this most important topic.

STATEMENT OF FRED WEBBER, PRESIDENT/CEO, ALLIANCE OF AUTOMOBILE MANUFACTURERS

Mr. WEBBER. Good morning, Mr. Chairman. Good morning, Senators. My name is Fred Webber. I'm President and CEO of the Alliance of Automobile Manufacturers. Today there are approximately 800 million vehicles on the road worldwide by some estimates. This number is projected to grow to 1.2 billion vehicles by 2020. Along with this growth in the size of the vehicle fleet there is also substantial growth in the demand for fuel because people are going to drive more, they're going to go more places.

As a result, growth in worldwide oil demand is expected to increase by at least 3 percent per year. With this in mind, if by some miracle it were possible to increase the fuel economy of the entire worldwide fleet of vehicles by 25 percent overnight, it would still take only 6 or 7 years for fuel consumption to return to and surpass current levels. This suggests that we have a daunting problem to address, not just in terms of U.S. gasoline consumption, but worldwide as well.

Is it hopeless? We don't think so. Any attempts however, to address concerns about U.S. dependence on oil cannot succeed by focusing only on one component of gasoline demand. Vehicle fuel economy has increased and it will continue to do so as new and improved technologies find their way into the market but that factor alone will not help slow the growing demand for gasoline in the U.S. transportation sector.

Mr. Chairman, the Alliance strongly supported the Energy Policy Act of 2005 because it created an effective energy policy based on broad, market-oriented principles. It also promoted policies that would foster research and development and accelerate the deployment of advanced technology vehicles by providing customer tax incentives and extending manufacturing incentives for the production of dual fuel vehicles.

Since 1996 automobile manufacturers have been producing vehicles capable of using high concentration blends of ethanol. There are more than five million of these E85 capable vehicles on the road today and nearly one million more are being added each year. If all of these E85 capable vehicles were able to refuel using only E85, the U.S. would be able to reduce its gasoline consumption by nearly three billion gallons per year.

Hybrid electric vehicles are being offered today and will increase substantially in numbers over the next several years. They offer significant improvements in fuel economy in excess of 50 percent in some vehicles on the road today. Also the automobile industry is working now to introduce technologies that will allow diesel powered vehicles to meet the EPA's latest emissions requirements. These types of vehicles can provide fuel economy gains in excess of 25 percent when compared to conventional vehicles.

Another promising and exciting technology is hydrogen powered internal combustion engines, ICEs. The concept of using hydrogen in internal combustion engines offers several advantages—near zero emissions, maintaining the utility flexibility and driving dynamic of today's automobile, assisting in the development of hydrogen storage technology, developing hydrogen distribution channels and helping to promote hydrogen refueling infrastructure.

From a vehicle perspective, hydrogen-powered fuel cells offer the biggest improvement in efficiency and emissions and the greatest opportunity to dramatically reduce the environmental and energy footprints of U.S. vehicles but the economic, technological, and infrastructure challenges are still substantial. For example, onboard hydrogen storage does present a great challenge. In addition, the introduction of fuel cells into America's light vehicle passenger and truck fleet will require a demonstration of greater durability and overcoming the packaging restrictions of size and weight.

The Alliance believes that the hydrogen title of the new energy law will prove to be of major assistance to the automobile industry in our efforts to overcome these hurdles and develop this promising technology and get it into the marketplace as soon as is technologically and commercially possible.

Transitioning away from the gasoline-powered internal combustion engines requires government, automotive manufacturers, auto suppliers, and fuel providers to work together to accelerate high volume advance technology vehicles and domestic alternative fuels. Any market driven focus, and incentives for consumers will, indeed, need to play a critical role.

Thank you, sir.

The CHAIRMAN. Thank you, Mr. Webber.

[The prepared statement of Mr. Webber follows:]

PREPARED STATEMENT OF FRED WEBBER, PRESIDENT/CEO, ALLIANCE OF AUTOMOBILE MANUFACTURERS

Thank you Mr. Chairman. My name is Fred Webber, President and CEO of the Alliance of Automobile Manufacturers (Alliance). I am pleased to be afforded the opportunity to offer the views of the Alliance at this important hearing. The Alliance is a trade association of nine car and light truck manufacturers including BMW Group, DaimlerChrysler, Ford Motor Company, General Motors, Mazda, Mitsubishi Motors, Porsche, Toyota and Volkswagen. One out of every 10 jobs in the U.S. is dependent on the automotive industry.

Today there are approximately 800 million vehicles on the road worldwide. By some estimates, this number is projected to grow to 1.2 billion vehicles by 2020. Along with this growth in the size of the vehicle fleet, there is also substantial growth in the demand for fuel because people want to go more places. As a result, growth in worldwide oil demand is expected to increase by at least 3 percent per year. With this in mind, if by some miracle it were possible to increase the fuel economy of the entire worldwide fleet of vehicles by 25 percent overnight, it would still take only six or seven years for fuel consumption to return to and surpass current levels.

This suggests that we have a daunting problem to address—not just in terms of U.S. gasoline consumption, but worldwide as well. Is it hopeless? We don't think so!!

Consider what is happening in the U.S. today. With the price of gasoline around $2.50 per gallon, the focus on fuel economy of cars and light trucks is receiving ever-increasing scrutiny. Fortunately, the automobile industry is in a very strong position to meet any shifting consumer demands for fuel economical vehicles or vehicles that operate on non-petroleum based fuels. Automakers currently offer more than 100 models that have EPA-estimated highway ratings of 30 miles per gallon or more. In addition, new models are increasingly available with highly fuel-efficient technologies like cylinder deactivation, variable valve timing, continuously variable transmissions and more. Ongoing advancements by automobile industry engineers will lead to even greater fuel economy gains. Furthermore, advanced technology and alternative fuel vehicles, including hybrid-electric, E85 flexible fuel, fuel cell, hydrogen internal combustion and clean diesel vehicles, offer the current and future promise of significant increases in fuel efficiency or petroleum displacement, without sacrificing consumer expectations for safety, performance, comfort and utility. So, American consumers currently are, and should continue to be, well served in terms of the vehicles that provide outstanding fuel economy or alternatives to gasoline.

But as with the world market noted earlier, U.S. gasoline consumption is a function of much more than just vehicle fuel economy. The number of miles driven by Americans has risen dramatically over the last few decades. And the size of the vehicle fleet on American roads has also increased substantially—resulting in increases in U.S. gasoline demand despite impressive improvements in vehicle fuel economy. Any attempts to address concerns about U.S. dependence on oil cannot succeed by focusing only on one component of gasoline demand. Vehicle fuel economy has increased—and it will continue to do so as new and improved technologies find their way into the market—but that factor alone will not help slow the growing demand for gasoline in the U.S. transportation sector.

Energy Policy Act of 2005

The Energy Policy Act of 2005, recently approved by Congress and signed into law by President Bush, contains a number of provisions that are important to our industry and our Nation as we look at the challenges ahead. The Alliance strongly supported the legislation because it created an effective energy policy based on broad, market-oriented principles. It also promoted policies that will foster research and development and accelerate the deployment of advanced technology vehicles by providing customer tax incentives and extending manufacturing incentives for the production of dual fuel vehicles. This focus on "accelerating the implementation of advanced technologies" leverages and enhances the intense competition of automobile manufacturers worldwide. Competition drives automakers to develop and introduce breakthrough technologies as rapidly as possible to meet the demands and needs of consumers and to try to outperform each other in the market. Market share is precious to these companies and they fight hard to maintain what they have and to wrest some from competitors.

However, often these new technologies carry significantly higher costs, at least initially, as they are developed and refined for use on the various types of vehicles needed by American consumers. Incentives can help to offset these higher costs during early market introduction and allow the demand for these technologies to progress and achieve economies of scale more rapidly than otherwise might be the case. The recently passed energy bill included consumer tax credits for various types of alternative technology vehicles, such as hydrogen fuel cells, hydrogen internal combustion engines, alternative fuels, hybrids and advanced lean-burn diesel. The tax incentives will allow the Nation's consumers to choose from a wide variety of vehicles and technologies designed to meet their needs. The acceleration of these technologies into the market—based on incentives, not mandates—will help automakers to continue meeting American consumers' needs while at the same time advancing the Nation's broader energy policy objectives.

Alternative Fuel Vehicles

Another important provision of the new energy law is the increased promotion of renewable fuels in the transportation sector. Since 1996, auto manufacturers have been producing vehicles capable of using high concentration blends of ethanol. There are more than 5 million of these E85 capable vehicles on the road today and nearly 1 million more are being added each year. If all of these E85 capable vehicles were able to refuel using only E85, the U.S. would be able to reduce its gasoline consumption by nearly 3 billion gallons per year.

One area of special concern to the auto industry and the driving public is the lack of infrastructure in the United States that allows flexible fueled vehicle owners and operators to run on "E85" rather than on gasoline. Congress, in the Energy Policy Act of 1992, encouraged that automakers produce such flexible fuel vehicles—and they have. However, very few of the over 167,000 gas stations in the U.S. have ethanol or E85 pumps. The recently passed energy bill will help in this by raising the requirement for the use of ethanol and other renewable fuels to 7.5 billion gallons per year by 2012 and providing tax incentives aimed at making more such pumps available to the driving public and thus saving money for consumers and helping to reduce reliance on imports. However, these incentives are only the tip of the iceberg. We need a commitment by all to accelerate their installation at many more stations to ensure greater use of ethanol and E85 fuels.

Advanced Technology Vehicles

As I mentioned earlier, a whole array of advanced technology vehicles are also underway. Some sixty models of advanced technology vehicles are either on American roads or in development by automobile manufacturers. As they are successful, these efforts will lead to substantial improvements in efficiency and emissions performance—all, without sacrificing safety, utility, and performance.

Hybrid-Electric Vehicles

Hybrid-electric vehicles are being offered today and will increase substantially in numbers over the next several years. They offer significant improvements in fuel economy, in excess of 50 percent in some vehicles on the road today. These products use electric motors to reduce some of the burdens on the traditional internal combustion engine and they capture usable energy through regenerative braking. Hybrid vehicles do not require additional investment in fuel infrastructure which helps reflect their potential for near term acceptance. It is estimated that by 2010, more than 50 hybrid nameplates will be available in North America with volumes approaching 1 million vehicles. Hybrid technology is also complimentary to fuel cell technology especially with regenerative breaking and high capacity battery technology.

Advanced Lean-Burn Technology Vehicles

Vehicles that are powered by advanced lean-burn technology such as clean, direct injection diesels offer greater fuel economy and better performance. While diesel powered vehicles are very popular in Europe—where environmental standards are less stringent than in the U.S. and economic incentives are provided through lower diesel fuel prices—their prospects in the U.S. market have been less certain. U.S. emissions standards for these vehicles are very challenging and diesel fuel pricing does not provide the same economic incentives. Still, the automobile industry is working now to introduce technologies that will allow diesel powered vehicles to meet the EPA's latest emissions regulations. These types of vehicles could provide fuel economy gains in excess of 25 percent compared to conventional vehicles.

Hydrogen-Powered Internal Combustion Vehicles

Another promising and enabling technology is hydrogen-powered ICEs. The concept of using hydrogen in internal combustion engines offers several advantages: near zero emissions, maintaining the utility, flexibility, and driving dynamic of today's automobile, assisting in the development of hydrogen storage technology and developing hydrogen distribution channels and helping to promote hydrogen refueling infrastructure.

Fuel Cell Vehicles

From a vehicle perspective, hydrogen-powered fuel cells offer the biggest improvement in efficiency and emissions and the greatest opportunity to dramatically reduce the environmental and energy footprints of U.S. vehicles. But the economic, technological and infrastructure challenges are still substantial. For example, onboard hydrogen storage presents great challenges. In addition, the introduction of fuel cells into America's light vehicle passenger and truck fleet will require dem-

onstration of greater durability and overcoming the packaging restrictions of size and weight.

The Alliance believes that the hydrogen title of the new energy law will prove to be of major assistance to the automobile industry in our efforts to develop this promising technology and to get it into the marketplace as soon as is technologically and commercially possible.

Also important in pursuing this market will be a robust fuel cell commercialization plan for use in stationary power units. Experience and commercial expansion of stationary power units, relatively unconstrained by size and weight, will be helpful, gaining the experience necessary to meet the cost targets for commercialization in the vehicle sector.

Fuel Economy Regulation

A constant challenge faced by the auto industry today is the almost singular focus on CAFE standards as the "answer" to concerns about light duty vehicle gasoline consumption. As noted earlier, many factors contribute significantly to U.S. oil demand, and attempting to reduce demand by pulling only one lever will not work. In addition, the CAFE program, over its lifetime, has had unintended consequences—from adverse economic impacts to documented adverse implications for highway safety.

The National Highway Traffic Safety Administration (NHTSA) is trying to address these concerns by reforming the structure of the CAFE program. The Alliance applauds these efforts. We also note that when NHTSA is finished with its current CAFE rulemaking covering 2008–2011 model year light trucks, it will have established increases in the CAFE requirements for light trucks for seven consecutive years—from 20.7 mpg in 2004 to over 24 mpg by 2011. This represents the most aggressive increase in the CAFE standards for these vehicles in the history of the program. For 2008–11 alone, NHTSA estimates that over 10 billion gallons of gasoline will be saved over the useful life of the vehicles produced in these model years.

Most importantly for the auto industry, NHTSA is required to carefully balance the technological feasibility, economic considerations, consumer needs, competitive impacts, vehicle and highway safety, impacts on U.S. jobs, and other considerations in setting the "maximum feasible" levels.

But I want to say again that the CAFE program is not the "answer" to U.S. gasoline consumption concerns. Vehicle fuel economy has increased and will continue to do so—but it ultimately comes down to what vehicles consumers buy and how they use them that drive U.S. gasoline consumption.

Conclusion

For its part, the auto industry is committed to advance the state of technology and bring new vehicles using these technologies to the market as quickly as possible. Competition among the automakers will drive this process far better and with fewer disruptions to the marketplace and consumers than any regulations that can be adopted. Furthermore, stimulating consumers can help accelerate this process. The recently enacted consumer tax credits provisions of the energy law will help to spur the purchase of these new vehicles which years of research and development have made possible.

A consistent government focus and market-driven incentives will help the manufacturing and fuel industries in this transition. Attached is a list of benefits, and possible policy options that would aid in this transition.

ATTACHMENT

Energy Technology Opportunities

Advanced Technologies and Renewable Fuel Incentives: Transitioning away from gasoline powered internal combustion engines requires government, automotive manufacturers, auto suppliers, and fuel providers to work together to accelerate high-volume advanced technology vehicles and domestic alternative fuels. Market-driven focus and incentives for consumers will need to play a critical role.

Advanced Diesels

- Can provide 25–30 percent improvements in fuel efficiency.
- Selective Catalytic Reduction (SCR) technology (i.e., urea system) would enable diesels vehicles to meet the stringent U.S. tailpipe emissions standards.

  —Needed: Full implementation of EPA's low sulfur diesel requirements, on-time.

  —Needed: Flexibility from EPA to introduce SCR technology and support in developing urea fueling infrastructure.

—Needed: Development of appropriate and consistent biodiesel fuel quality standards to enable greater petroleum displacement.

Hybrids

- Current applications of hybrid technology can increase fuel economy by up to 50 percent.

—Needed: Consumer incentives that reduce incremental vehicle costs to accelerate the acceptance of hybrids in the marketplace (currently less than 1 percent of vehicle sales).

—Needed: Manufacturing incentives and grants to facilitate conversion of facilities to production of advanced technologies; will accelerate the growth of a U.S. advanced technology supply base, especially in the areas of battery technologies, transaxles, and regenerative braking systems.

Biofuels

- Over 5 million E85 Flex Fuel Vehicles (FFVs) on U.S. roads and more in pipeline.
- Use of E10 nationwide could displace over 13 billion gallons of gasoline a year.
- Utilizing E85 in the existing FFV fleet could displace over 3 billion gallons of gasoline a year.
- As a result of the incentives in the Energy Bill, manufacturers are expected to produce nearly 1 million more FFVs per year, which if operated on E85 could displace over 500 million more gallons of gasoline per year.

—Needed: Increase retail E85 fueling infrastructure to encourage greater ethanol production and E85 availability.

—Needed: Accelerate R&D efforts on cellulosic ethanol production; cellulosic ethanol holds the promise of reducing net production energy needs and yielding greater reductions in GHG emissions.

Hydrogen

- Hydrogen fuel produced from renewable sources holds the promise of eliminating CO_2 emissions.

—Needed: Government maintained long-term R&D focus on technology and innovation.

STATEMENT OF DAVID FRIEDMAN, RESEARCH DIRECTOR, CLEAN VEHICLES PROGRAM, UNION OF CONCERNED SCIENTISTS (UCS)

Mr. FRIEDMAN. Thank you, Mr. Chairman and Members of the Committee. I'm Research Director and Senior Engineer with the Union of Concerned Scientists Clean Vehicles Program. To begin I just want to note that during the next 5 minutes the United States will spend over $2 million on imports of oil and other petroleum products. That represents nearly a half a million dollars leaving the U.S. economy every minute. That's almost one-third of the United States trade deficit. As long as the United States is tied to oil, America's pocketbooks will be susceptible to instability in the Persian Gulf and other regions of the world. As long as the United States is tied to fossil fuels, we will be contributing to many significant environmental problems that impact our health and our economy, especially the reality of global warming. These facts make the long-term destination clear.

We must switch to clean, renewable fuels to power our cars and trucks. But the reality is that there are no silver bullets to tap into overnight. We will continue to be dependent on oil as a transportation fuel for decades to come.

Now, while there are no silver bullets, there is reason for optimism if we set ourselves on a path of innovation and efficiency. In-

novation is required because all of the possible clean renewable fuels require breakthroughs to be affordable and widely available. Efficiency is needed because the problem is too big to wait for these breakthroughs and we already have the technology. The efficient vehicles are also a key part of making clean renewable fuels possible.

If we are to tap into this innovation, there are at least three major options that can serve as alternatives to gasoline—renewal hydrogen, cellulosic ethanol, and renewable electricity. These three share many features. Among them are that if pursued aggressively each have the *potential,* and I underline the word potential—to eliminate the use of petroleum as an automotive fuel by the middle of this century. But they also all require changes to, or an overhaul of our refueling infrastructure.

In addition, none of them are inherently clean. There are other ways to make and use these alternatives, some of which could actually harm U.S. energy security and the environment.

Finally, all of these alternatives require vehicles to be significantly more efficient than they are today in order to fulfill their potential. Otherwise, they will require too much land and too many resources. Nobody knows which of these alternatives is the right one but because they all have such promise, each one needs to be supported so that they can eventually compete to determine our long-term path.

Now, I also want to spend some more time on the issue of efficiency because improving the efficiency of the cars and trucks consumers drive every day can sometimes get lost in the excitement surrounding clean renewable alternatives to fuels. Besides being a lynchpin in the future of cleaner alternative fuels, investments in vehicle efficiency actually offer greater potential to stabilize car and truck gasoline demand in the near-term, creating hundreds of thousands of new U.S. jobs and saving consumers billions of dollars every year.

The automobile industry has been investing in technologies that can safely and economically allow consumers to get more miles to the gallon in cars, minivans, pickups and SUVs of all shapes and sizes. The chart to my right shows the potential for these technologies to dramatically increase the fuel economy of an SUV with the same size and acceleration of a Ford Explorer mid-size SUV. The majority of these technologies have no influence on the safety of the vehicle. However, some such as use of high strength steel and aluminum and unibody construction can actually help make highways safer while improving fuel economy. With technologies costing only $600 to $800 a consumer could have the choice of an SUV that gets the fuel economy of today's family car. For just over $2,000 a consumer could have the choice of an SUV that gets the fuel economy of a compact car. At just $2.00 per gallon this SUV would save consumers over $6,000 on fuel costs during the lifetime of the vehicle, almost three times the cost. The technologies needed to get this SUV to more than 35 miles per gallon would even pay for themselves in less than 4 years at that fuel price.

The problem is that automakers are not giving consumers these choices. While automakers do offer many models that get more than 30 miles per gallon on the highway, most of these are cars

and most driving is in the city. That leaves a mother with three children in car seats with no real choice today.

The problem is for the past 20 years, technologies like this have gone to doubling power and increasing weight by 25 percent. As a result the average fuel economy of new automobiles is lower today than it was 20 years ago. But that does not have to be our future if we put these technologies to work. If we put them to work across the fleet, we could see an increase in fuel economy on the order of 65 percent and this type of investment would lead to over 160,000 new jobs throughout the country in the next 10 years. In the automotive sector alone jobs could grow by over 40,000 and consumers would end up saving over $20 billion per year.

Tapping into hybrids could take us even further but this will not happen on the current path. The Administration recently proposed an interesting change to the structure of fuel economy standards for SUVs, minivans, and pickups. A lot of work clearly went into this and while this change addressed a key automaker concern and has the potential to open the door to significantly higher increases in the standard, the proposal falls short of the technically feasible and economically practical levels that are seen in this chart. The Administration proposal also does not include the new increases to cars that represent over half of all the vehicles sold today.

Finally, the proposal did not close key loopholes in fuel economy regulations and may open up new ones, but there is significant potential and the changes needed to take advantage of the potential, the innovation and efficiency needed, will not happen on their own. But this should not be surprising. In fact, every major transportation revolution this country has ever seen needed the help of the Federal Government to succeed, whether that be planes, trains, or automobiles, and the next transition will be no different.

There are several different mechanisms the Government could use to make this a reality—oil savings targets, incentives for automakers and suppliers to get this technology on the road, and eliminating the cap on consumer tax credits. Also, incentives to increase alternative fuel use and infrastructure and to increase the efficiency of our heavy-duty vehicles in other sectors.

Finally, we need to close existing loopholes in fuel economy regulations and tax laws and significantly increase fuel economy standards for cars and trucks.

In closing, again, none of these are silver bullets but by adopting a reasonable package that includes several of these measures now, we can reduce the trade deficit and create hundreds of thousands of new jobs while steadily reducing our oil usage.

Thank you very much.

The CHAIRMAN. Thank you very much.

[The prepared statement of Mr. Friedman follows:]

PREPARED STATEMENT OF DAVID FRIEDMAN, RESEARCH DIRECTOR, CLEAN VEHICLES PROGRAM, UNION OF CONCERNED SCIENTISTS (UCS)

Thank you, Mr. Chairman and Members of the Committee, for the opportunity to testify before you today. My name is David Friedman. I am the research director and a senior engineer with the Union of Concerned Scientists' (UCS) Clean Vehicles Program. UCS is a nonprofit partnership of scientists and citizens that has been working at the intersection of science and policy for over 30 years.

To begin, I want to note that during the five minutes I will use to speak today, the U.S. will spend over $2 million on imports of oil and other petroleum products. That represents nearly $500,000 leaving the U.S. economy every minute—almost one-third of the U.S. trade deficit.

As long as the U.S. is tied to oil, American's pocket books will be susceptible to instability in the Persian Gulf and other regions of the world. Rising oil consumption in China and other developing nations will only make matters worse. And as long as the U.S. is tied to fossil fuels, we will be contributing to many significant environmental problems that impact our health and our economy, especially the reality of global warming.

These facts make the destination clear—we must switch to clean, renewable fuels to power our cars and trucks—but the reality is that there are no silver bullets to tap into overnight. We will continue to be dependent on oil as a transportation fuel for decades to come.

While there are no silver bullets, there is reason for optimism if we set ourselves on a path of innovation and efficiency. Innovation is required because all of the possible clean, renewable fuels require breakthroughs to be affordable and widely available. Efficiency is needed because the problem is too big to wait for these breakthroughs and we already have the technology.

Innovation

If we are to tap into innovation, there are at least three major options that could serve as alternatives to gasoline: renewable hydrogen, cellulosic ethanol, and renewable electricity. These three share many features:

- They have the potential to eliminate the use of gasoline or diesel as an automotive fuel by the middle of this century if aggressively pursued;
- They will require changes to or an overhaul of the refueling infrastructure;
- They all need breakthroughs in production, while hydrogen and electric vehicles also need breakthroughs in storage technology if they are to work;
- There are different ways to make the alternatives, some of which could actually harm U.S. energy security and the environment;
- They all require vehicles to be significantly more efficient than they are today in order to fulfill their potential, otherwise they will require too much land and too many resources.

Because breakthroughs are still required, nobody knows which alternative is the right one. It could be fuel cell vehicles powered by hydrogen made from the sun, the wind or biomass. It could be hybrids running on cellulosic ethanol made from grasses, rice straw, corn plants, and other woody products grown in the U.S. It could also be battery electric vehicles that develop from hybrids that you can plug-in and recharge with renewable electricity. But because these alternatives all have such promise, each one needs to be supported so that they can eventually compete to determine the best path.

Accelerating innovation towards clean and renewable alternatives to oil will not be a small or inexpensive task, but the benefits far outweigh the costs. To be successful, such a path will need a clear and reasonable timetable along with milestones to help determine which alternative is showing the most promise over the next decade or two. The necessary support that will be needed on this path must also recognize that hydrogen, electricity, and even biofuels are not inherently clean—instead they are energy carriers that are only as clean as the process that produced them and how they are used.

Efficiency

Improving the efficiency of the cars and trucks consumers drive every day can sometimes get lost in the excitement surrounding clean, renewable alternatives to oil. However, investments in vehicle efficiency actually offer greater potential to reduce oil dependence in the near term and can create hundreds of thousands of new jobs in the U.S. while saving consumers billions on fuel. Improving vehicle efficiency is also essential to reducing the amount of land needed for the renewable hydrogen, cellulosic ethanol, or renewable electricity that could power vehicles in decades to come.

The automobile industry has been investing in technologies that can safely and economically allow consumers to get more miles to the gallon in cars, minivans, pickups and SUVs of all shapes and sizes. Figure 1 shows the potential for these technologies to dramatically increase the fuel economy of an SUV with the size and acceleration of a Ford Explorer. These technologies include efficient gasoline engines, more efficient transmissions, improved aerodynamics, high strength steel, and

lower rolling resistance tires. The majority of these technologies have no influence on the safety of the vehicle. Some, however, such as the use of high-strength steel and aluminum and unibody construction could actually help make highways safer.

With technology costing only $600–$800, a consumer could have the choice of an SUV that gets the fuel economy of today's family car. For just over $2,000 a consumer could have the choice of an SUV that gets the fuel economy of a compact car. At just $2.00 per gallon, this SUV would save consumers over $6,000 on fuel costs during the vehicle's lifetime. The technologies needed to get this SUV to more than 35 mpg would pay for themselves in less than four years (the savings in Figure 1 are based on gasoline at only $1.40 per gallon).

The problem is that automakers are not giving consumers these choices. Instead, for the past twenty years similar technologies have gone to doubling power and increasing weight by 25 percent. As a result, the average fuel economy of new automobiles is lower today than it was twenty years ago. Twenty years from now, however, this does not have to be the case. Because new technologies have been developed, there is an opportunity to move to a future where consumers can have the same size and performance they have today, but with dramatically higher fuel economy.

In order to quantify the benefits linked with such a future, UCS estimated the effect of moving existing technologies into cars and trucks over the next 10 years to reach an average of 40 miles per gallon (mpg) by 2015. We found that:

- In 2015, the benefits resulting from investments in fuel economy would lead to 161,000 more jobs throughout the country, with California, Michigan, New York, Florida, Ohio, and Illinois topping the list.
- In the automotive sector, projected jobs would grow by 40,800 in 2015.
- For consumers, the cost of the new technology would more than pay for itself, saving a net $23 billion dollars in 2015 alone.

Getting technologies like these into the fleet over the next ten years and then tapping into the growing potential of hybrid cars and trucks could get us to the point of saving five to six million barrels of oil per day by 2025 (Figure 2). That would be enough of a reduction in oil use to stop the current growth in oil demand and hold us where we are today while we wait for the breakthroughs that are needed for clean and renewable alternatives to oil.

But this will not happen on the current path. The Administration recently proposed an interesting change to the structure of fuel economy standards for SUVs, minivans, and pickups. While this change addressed a key automaker concern and had the potential to open the door to higher increases in the standard, the proposal falls short of the technically feasible and economically practical levels shown above by a factor of three. The Administration proposal also does not include any increases to the cars that represent fifty percent of all light duty automobiles sold today. Finally, the proposal did not close key loopholes in fuel economy regulations and may open up new ones.

Conclusion: Government Policy

A transition to clean, renewable alternatives to oil will be complex, expensive, and technically challenging and will not happen overnight. Investing in efficiency to cut oil use, while the best option over the next two decades, has often been overlooked and mired in political challenges. And neither of these will happen on their own. But these are exactly the reasons why Federal, State and local Governments must play a role. This is not surprising. In fact, the Federal Government has helped drive every transportation revolution this country has ever seen, whether it was trains, planes, or automobiles. The next transition will be no different.

There are several different mechanisms the government could use, and many of them are currently being considered as options to help reduce oil usage. Among the viable options are:

- Enforceable, national oil savings targets
- Performance-based incentives for suppliers and manufacturers and eliminating the cap on consumer incentives
- Incentives to increase alternative fuel production, including production targets, research and development, and infrastructure investments
- Incentives and requirements to increase efficiency of oil usage in the heavy duty transportation and industrial sectors
- Closure of existing loopholes in fuel economy regulations and tax laws
- Increased fuel economy standards for cars and trucks

Again, none of these options is a silver bullet. And some, if not all of them, are politically challenging. But by adopting a reasonable package that includes several of these measures now, we can reduce the trade deficit and create hundreds of thousands of new jobs, while steadily reducing our oil usage. And that's something I hope we can all support.

Thank you for the opportunity to testify today. I would be happy to answer any questions you may have.

Figure 1. Fuel Economy Potential for a Ford Explorer.

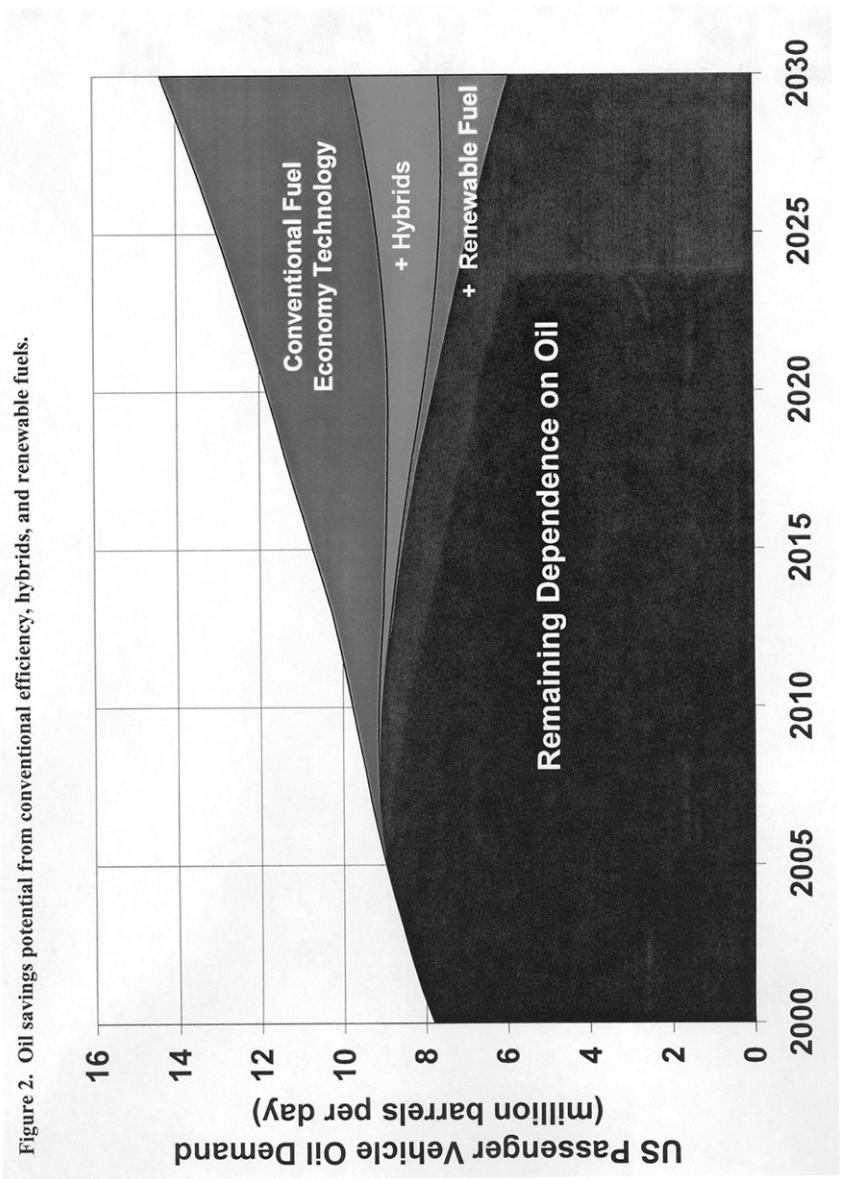


Figure 2. Oil savings potential from conventional efficiency, hybrids, and renewable fuels.

STATEMENT OF JASON GRUMET, EXECUTIVE DIRECTOR, NATIONAL COMMISSION ON ENERGY POLICY (NCEP)

Mr. GRUMET. Thank you very much, Chairman Stevens. I'm Jason Grumet and I'm here on behalf of the National Commission on Energy Policy which is a diverse bipartisan group of energy experts. I am thankful for the opportunity to be here today.

Coming at the end of a long stream of very substantive testimony I want to try to focus on three points. I want to share with you the conclusion that our Commission reached over a year ago that enhancing oil security is far and away the most pressing near-term challenge facing our energy system.

I next want to talk a little bit about why we believe that cellulosic ethanol is in fact, the most promising near-term opportunity to address our present reliance on oil.

And third, I want to touch on the recently improved Energy Policy Act which I think has put us on a critical path and gives us some optimism toward commercializing these kinds of advanced biofuels over the next 20 years.

So if I can begin on oil security, obviously, recent events highlight the vulnerability of our economy to disruptions in our petroleum supply chain. They also highlight I think a very discouraging reality that once a disruption occurs no matter how hard we try there is very little that we can do in the near-term to reduce the harm to consumers.

Unfortunately, the fundamentals of our oil industry don't suggest this dynamic will change any time soon. The spare capacity of the global oil supplies are at an almost all-time low of 2 percent of the total global annual demand, and as Mr. Webber and others have suggested, oil demand both domestically and globally is predicted to grow by a full 50 percent in the next 20 years.

In addition, Chevron and other companies have pointed out recently that for many years now our annual consumption is exceeding the discoveries of the new oil reserves.

And finally, oil intensity, the measure of how much oil we use per dollar of GDP which has declined very sharply from the mid-1970s into the mid-1980s, has now started a plateau as our fuel economy has stagnated. As we have a global market, Mr. Chairman, a disruption anywhere in the world, whether it is a labor unrest in Venezuela or a civil unrest in Nigeria or terrorism in the Middle East or an accident, a natural disaster anywhere that affects oil supply, will dramatically harm not only the U.S. but, in fact, the global economy. And it is for this reason that our Commission recommended a suite of proposals to boost global supply and to significantly reduce domestic oil demand over the next 25 years.

I want to now focus on biofuels because we believe that a greater reliance upon biofuels is, in fact, one of the more realistic and important opportunities that we have when trying to increase our energy security. Just for a point of reference, we use approximately 140 billion gallons of gasoline each year in this country. In thinking about what could be a meaningful contribution to displacing billions of gallons of this very useful product, our Commission came up with four criteria which we think are at minimum important.

Any alternative fuel has to have an ample and domestic feedstock, has to be compatible, largely compatible, with the existing infrastructure, needs to have relatively low carbon emissions and finally, needs to be able to compete cost effectively against gasoline sometime over the next couple of decades.

Now, when we looked at these criteria we first thought about corn-based ethanol which is far and away a most successful existing alternative fuel. Corn-based ethanol has significant attributes.

It is able to be used largely in the existing infrastructure, it's about 20 percent better than gasoline when it comes to greenhouse gas emissions when we look at the full fuel cycle energy balance, and then we start to run into a little bit of trouble. It takes roughly 4 percent of the Nation's corn supply to displace 1 percent of the Nation's gasoline supply. So the 7.5 billion gallon renewable fuel standard, which would displace about 5 percent of our Nation's gasoline, would require about 20 percent of our Nation's corn. Many of the enthusiasts for ethanol whom I work with tell me that once you get above about 10 or 12 billion gallons of corn-based ethanol you really start to strain production, you start to have a real competition between the ethanol used and the corn used for ethanol, and the corn necessary to support our livestock and food.

Turning now to the issue of cellulosic ethanol, we see some greater opportunities. Cellulosic ethanol can be made from a variety of waste products as well as energy crops like switchgrass. Though there are ample feedstocks, the infrastructure is exactly the same as with traditional ethanol. It's an essentially carbon neutral fuel, and while there's not a commercially available source of cellulosic ethanol, projections suggest that over time there are reasons to believe that cellulosic ethanol could be more cost competitive with gasoline than traditional ethanol.

Mr. Plotkin mentioned the key issue that people raise when thinking about a massive deployment of cellulosic-based ethanol, that's land requirements. You may have heard some people suggest it would take all the arable land in the United States to create enough cellulosic ethanol to displace half of our Nation's fuel supply. Our Commission looked at this quite carefully and came to a different conclusion. Our sense is that with deliberate but unremarkable progress with crop yields for things like switchgrass, with improved conversion efficiency to turn the cellulosic material into ethanol and with improvements in fuel economy, it's quite manageable to imagine the displacement of about half of the Nation's gasoline supply with cellulosic ethanol.

I just wanted to note, a number of others have mentioned this, but the transition to alternative fuels and to ethanol will be dramatically undermined if we do not, and at the same time and at the same scale, increase our fuel economy. I won't repeat that analysis, but our Commission made a number of recommendations to reform and strengthen the vehicle fuel economy which I'd be happy to talk about in other hearings.

So let me now conclude by talking for a few moments about the Energy Policy Act. It does a lot of very important things. It creates 10 significant new programs to move toward commercialization of cellulosic biomass. If you look at the explicit appropriations for those 10 programs, they total over $4.2 billion over a decade and it provides a series of grants and production incentives, and R&D and loan guarantees that we believe really give us an opportunity over 10 or 15 years to diversify the fuel supply.

It's very encouraging. It demonstrates a clear enthusiasm of Congress and a clear intent to diversify our fuel supply, but I believe that we need a different kind of vigilance to make this happen. If you look at past efforts we have been trying to diversify our fuel supply for quite a number of years. Unfortunately past efforts to

advance our coordinated research program, have been significantly undermined by an inadequacy of appropriations, by inconsistency from year to year, and by an unusual number of Congressional earmarks.

Now we recognize that in this fiscal climate, everything needs to be scrutinized and appropriations is clearly going to be a challenge going forward. Also, I entirely appreciate that Congress and only Congress has the authority to direct spending. I think it is paradoxical that the enthusiasm that many Members of Congress have for advancing these kinds of projects is in many ways responsible for the great appetite to direct this spending. Our request is simply to ask Congress to channel that enthusiasm to obligate the implementing agencies to give a clear and transparent long-term research plan and try to ensure the earmarked projects are consistent with that overarching strategy.

Mr. Chairman, there's really little that we can do when we face an energy shock like we've experienced over the last few months, but one thing is for sure, this will happen again. There's an absolute inevitability that our Nation will again, whether it's in one month, one year, or 10 years, face another significant disruption in world oil supply. We have an opportunity and I think an obligation to try to mitigate what are very predictable harms by focusing on biofuels.

This hearing today is a step in that direction and I thank you.

[The prepared statement of Mr. Grumet follows:]

PREPARED STATEMENT OF JASON GRUMET, EXECUTIVE DIRECTOR, NATIONAL COMMISSION ON ENERGY POLICY (NCEP)

Good morning, Chairman Stevens and Members of the Committee. I speak to you today on behalf of the National Commission on Energy Policy (NCEP), a diverse and bipartisan group of energy experts that first came together in 2002 with support from the Hewlett Foundation and several other leading philanthropies. Last December, the Commission released a report entitled *Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges.* Oil security and biofuels figured prominently in our recommendations and I am pleased to be with you today to discuss policy approaches to encouraging alternative automotive fuel technologies.

Over the next few minutes I will attempt to explain the NCEP's rationale for promoting biofuels and the basis for our conclusion that cellulosic ethanol is the most promising gasoline alternative. I will conclude with some reflections on recent efforts to promote biofuels in the recently adopted Energy Policy Act of 2005 (EPAct 2005).

Oil Security

During our deliberations, Commission members actively debated the extent to which our oil dependence limits U.S. foreign policy, provides funding for terrorism and imposes burdens on our military. While members voiced a variety of passionate opinions on these questions, Commissioners were unanimous in the belief that oil dependence poses an unacceptable threat to the U.S. economy. To address this threat, we propose a variety of measures to increase global oil supply while simultaneously seeking to reduce domestic oil demand through increased vehicle efficiency and the diversification of our transportation fuels.

Events of the last few months highlight our vulnerability to disruptions in the petroleum supply chain. As Congress and ordinary Americans struggle to find economic relief, it has become clear that once a serious disruption occurs there are no good near-term options. In our collective frustration, many have sought to focus blame on price gouging, windfall profits or restrictive environmental laws as if our plight was somehow the result of a few bad people or poorly written statutes. While these assertions should not be dismissed out of hand, they should not distract us from the fundamental reality that our economy and very way of life are dependent upon a product that is beyond our control. The United States possesses less than three percent of the world's proven oil reserves and consumes twenty-five percent

of the world's annual oil production. At present, global spare capacity to compensate for supply disruptions has fallen to a mere 2 percent of global demand. In today's tight global oil market a supply disruption anywhere can have a dramatic effect on price everywhere. It doesn't matter if the cause is labor unrest in Venezuela, civil unrest in Nigeria, terrorism in the Middle East, accidents or natural disasters affecting oil production anywhere in the world, our economy and consumers will suffer. While we have few options to mitigate the impact of the current gasoline price shock, we have an obligation to prepare for the inevitable future oil supply disruptions. That such disruptions will occur is a certainty. Our challenge is to minimize their harmful effects over the next several decades while we transition to a more secure and diversified transportation system.

All evidence suggests that absent a significant course correction, our economic vulnerability to oil disruptions is likely to get worse in the future. Both domestic and global demand for oil is projected to grow by roughly 50 percent over the next 20 years. This rate of growth is more than double the historical rate since 1980 (Figure 1–1.) Moreover, according to Chevron and others, the energy sector has for years experienced a consistent and growing gap between oil production and the discovery of replacement reserves. In addition, the rate of improvement in U.S. oil economic intensity has slowed in recent years. Oil economic intensity is a measure of how much oil is required for the U.S. economy to produce a dollar of economic output. This measure is important because the ability of the U.S. economy to weather oil price shocks improves as oil's share of our economic output decreases. Since 1970, the U.S. oil economic intensity has dropped by half—a tremendous achievement—largely due to CAFE standards and high oil prices in the late 1970s and early 1980s, and to a shift in the electricity sector away from the use of petroleum. Further improvements would further insulate the U.S. economy from oil price shocks (Figure 1–2).

The Commission firmly believes that we can neither produce nor conserve our way to energy security—we must do both. At the same time, we recognize that oil is a global commodity with one global price. The vulnerability of our economy to oil price shocks is purely a function of how much oil we consume. In this regard, the origin of the oil makes no difference whatsoever. While oil production in the U.S. has important regional and national economic value, improves our balance of trade and improves global supply, the only way to reduce the impact of an oil price shock is to use less oil.

While I will focus today on opportunities to enhance the use of biofuels, it is important to recognize that the transition toward alternative fuels is unlikely to succeed absent a commensurate effort to increase vehicle fuel economy. First, the effort to diversify our fuel supply will take decades. Increased vehicle fuel economy can essentially buy us time while this effort progresses. Second, biofuels and most other alternative fuels suffer from a lack of available feedstock, a lower energy density than gasoline, or both. Unless our vehicle fleet becomes more fuel efficient, the transition to a greater reliance on alternative fuels will likely falter due to inadequate supply or inadequate driving range of alternatively fueled vehicles. I have attached a copy of the full Commission Report in which we recommend significantly reforming and strengthening the current CAFE program and offer specific ideas to address the cost, domestic competitiveness, safety and performance issues that have caused our Nation's fuel economy to remain essentially stagnant for nearly two decades.

Biofuel Attributes and Challenges

We burn nearly 140 billion gallons of gasoline each year in the U.S. In order to meaningfully improve our Nation's energy security, alternative fuels must be capable of being economically and reliably produced on a truly massive scale. The Commission identified four criteria that characterize a promising alternative fuel: (1) they can be produced from ample domestic feedstocks; (2) they have low carbon emissions during production and use; (3) they can work in existing vehicles and with existing infrastructure; and (4) they have the potential to become cost-competitive with petroleum fuels given sufficient time and resources dedicated to technology development. Among the variety of alternative fuel options potentially available for the light-duty vehicle fleet, the Commission believes that ethanol produced from cellulosic biomass (i.e. fibrous or woody plant materials) should be the focus of near-term Federal research, development, and demonstration efforts. Let me briefly discuss the attributes of traditional corn-based ethanol and then turn to cellulosic ethanol.

Corn-based ethanol is far and away our most successful non-petroleum transportation fuel. The Renewable Fuels Standard adopted in the 2005 Energy Policy Act imposes an annual ethanol sales requirement that grows to 7.5 billion gallons in 2012. Current ethanol sales were roughly 4 billion gallons last year. Despite the

beneficial sales-volume credits given to producers of cellulosic ethanol, virtually all of this mandate will be met with traditional ethanol. A requirement to sell 250 million gallons of cellulosic ethanol takes effect in 2013.

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

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

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

An examination of the land requirements to produce enough cellulosic ethanol to fuel half of the current U.S. passenger fleet reveals the importance of advancements noted above. Using status quo assumptions for crop yields, conversion efficiency and fuel economy, it would take 180 million acres or roughly 40 percent of the land already in cultivation in the U.S. to fuel half the current vehicle fleet. However, with steady but unremarkable progress over two to three decades, it should be possible to cut the required land down to 30 million acres by doubling the per acre yields of switchgrass, increasing conversion efficiency by one-third and doubling the fuel economy of our vehicle fleet. As a point of reference, there are roughly 30 million acres in the Conservation Reserve Program (CRP).

Another central challenge is reducing production costs for cellulosic ethanol. The lack of fertilizer, pesticide and herbicide needed to grow energy crops like switchgrass offers obvious economic benefits as does producing ethanol from materials that would otherwise be treated as waste. The National Renewable Energy Labs and a separate analysis sponsored by the NCEP both suggest that mature cellulosic ethanol production could compete economically with gasoline. However, these studies are projections. At this time, there is no fully commercial scale production of cellulosic ethanol anywhere in the world. Until cellulosic ethanol is produced in a variety of commercial facilities, it will not be possible to prove or disprove these

cost estimates. These are serious challenges, but achievable if we dedicate ourselves to a serious, coordinated, and sustained research, development and commercialization efforts. The Energy Policy Act of 2005 offers promise in this critical direction

Energy Policy Act of 2005

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

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

Conclusion

Since the late 1980s, the U.S. has pursued a stated policy of promoting alternatives to petroleum-based transportation fuels as a means of diminishing our vulnerability to oil price shocks and supply reductions and reducing emissions from passenger vehicles. Despite these efforts, gasoline and diesel fuel still account for roughly ninety-eight percent of our transportation fuels. Biofuels offer an important opportunity to lower energy prices, protect the economy from oil price shocks and minimize greenhouse gas emissions. These homegrown, renewable fuels are also major source of income for America's farmers and rural communities. By following through on the critical path set forth in the 2005 Energy Policy Act, we have the potential to develop cost-competitive biofuels that will strengthen our economy and protect our environment.

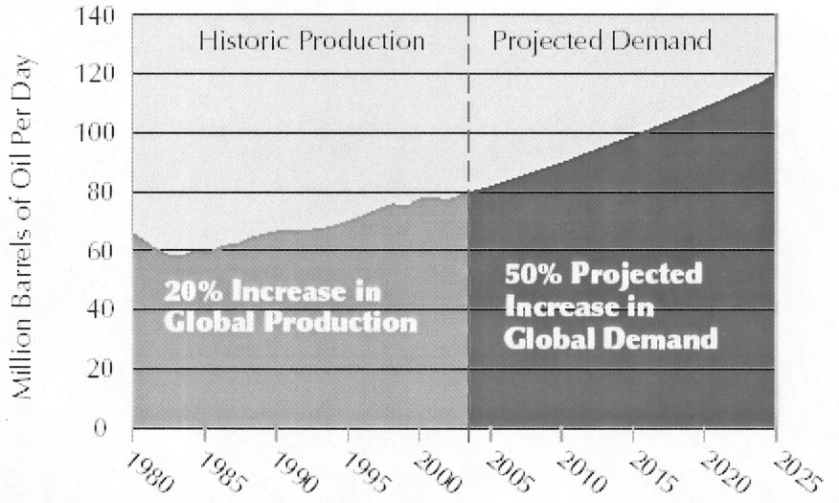
I thank the Committee for focusing its attention on this important topic.

Figures from Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges, National Commission on Energy Policy (2005)

Figure 1-1

Trends in Global Oil Production and Future Demand

Future demand for oil is projected to grow at more than double the historical rate since 1980.

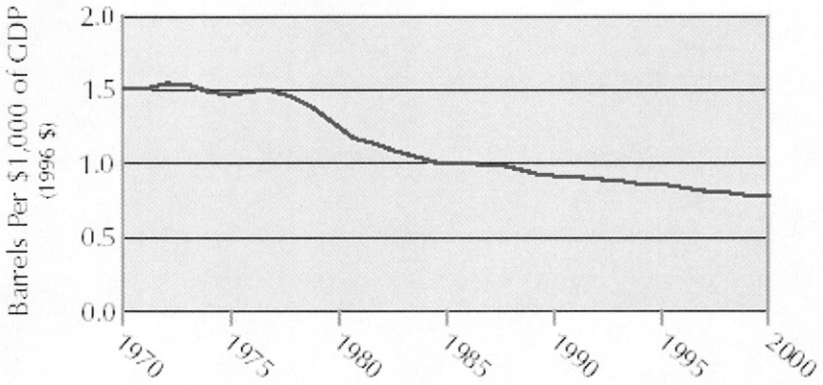


Data Source: Energy Information Administration, 2004

Figure 1-2

Oil and the Economy

The ability of the U.S. economy to weather oil price shocks improves as oil's share of GDP decreases. This share has declined over the past several decades, although the rate of decline has slowed in recent years.



Resources for the Future, 2004

The CHAIRMAN. Thank you very much.

This is really the first in a series of hearings we have jurisdiction over technology base. I was interested to note that China has reduced its consumption of oil in one year from 30 percent of the world's share down to 16 percent.

We have to start looking at alternative sources and the technology base will determine that, I think. Recently I had a meeting with one of the Nobel Peace Prize winners and I asked him whether we have the right policy when we closed canyons that are capable of producing massive amounts of hydropower and instead start looking at putting solar panels in Arizona the size of which would cover all of Arizona just to cover five major cities of the country.

We've got a great many technology problems to chase. One of them is the gas hydrates, in my state some 3,000 trillion cubic feet of gas trapped in ice. We have a whole series of questions to determine whether we should change our policies and pursue a different technology base for our energy. Brazil turned to hydroelectric power. China is turning to other types of power. But very clearly we're in a global economy and the race is going to be how much diversity can a country develop in terms of its energy supply.

Now, we don't have much time. I've taken 3 minutes. I would yield to my friend from Hawaii and we'll just see how long we can stay here running down the list. I don't think any Member should take more than 4 minutes. Thank you very much.

STATEMENT OF HON. DANIEL K. INOUYE,
U.S. SENATOR FROM HAWAII

Senator INOUYE. Thank you, Mr. Chairman. It's obvious that the problems we're facing are reaching a crisis point and everyone has agreed that something has to be done. One has said that CAFE is not the answer, some have suggested hydrogen and other alternative energies. It should be clear that none of us on our side are experts. We know very little, if any, about what we're discussing and yet we'll be called upon to make policies and decisions and so the ideal situation would be if all of you and people like you got together and came up with some proposal. Because if you don't, then the political aspect will come in, who gives the most contributions, who is the most helpful, and that usually is not the best answer.

And so we plead with you to come up with something because in the final analysis our job will be how much can we spend.

All of you spoke of incentives that translates into money, taxes, or something like that and before we decide we'll have to know what's ahead of us. Because no matter how great the program is, the average American on the street is not going to be happy if his taxes are suddenly increased by 10 percent or 20 percent and so my plea with you is somehow let's get together. We know the manufacturers have their problems, the auto producers have their problems, the scientists have theirs, we have our problems. Thank you very much.

The CHAIRMAN. Senator Burns. Do not exceed 4 minutes.

Senator BURNS. I don't have any problems.

[Laughter.]

STATEMENT OF HON. CONRAD BURNS,
U.S. SENATOR FROM MONTANA

I just want to make just a statement here. When you look at our sources of energy, I'm really interested in what Mr. Grumet said that it makes more sense that we start making our renewable fuels from the biowaste than it does to use a kernel because pretty soon we're going to get in competition with the food chain of humans. We all eat every day. The second thing we do, in fact is eat. The first thing you do when you get up you have a lot of options but the second thing you do is eat. When we get in competition with that and you start driving other costs and sources for humans so biomass and solar offer us a great deal of opportunity.

I just want to offer a suggestion to this group here that what Mr. Inouye has just suggested is right that industry and market-driven is usually our best scientist, so to speak. Necessity is the mother of invention and so whenever we start looking at where we want to be in 25 years or 10 years has to come from some of you folks sitting at this table today. We've got some of the smartest people in the world located in this town however, we at times have a lack of wisdom and to look into the future.

So with all of this information it's time that we set the goals and recommend the policies and it will be a combination of things and then develop a way to find and to secure those finds for we are not going to do anything to damage the love that the American has for his automobile and the freedom he enjoys with it. We found that out in the building of our highways. You can put three more lanes on each side between here and Springfield, Virginia, and we fill them in 30 seconds. We can't out-build the love for the automobile.

And then we've got to look and say how do we move great masses of product and commodities and we haven't really found anything that replaces diesel yet, even though our gasoline prices in Montana are down around $2.20, $2.25 I think this last weekend, we have still not found anything to move a massive amount of any volume of anything to replace diesel. Diesel is not coming down and we have to do something about that.

So thank you for the hearing. Thanks for your testimony today but we've got to pick the right stuff for our alternatives and our renewables, or that will drive us into other problems that our society will face in that 25-year period.

Thank you very much, Mr. Chairman.

The CHAIRMAN. Next with us I think is Senator Pryor.

Senator PRYOR. I think it's Senator Nelson.

Senator BEN NELSON. Senator Pryor is such a gentleman. I appreciate his recognizing that.

STATEMENT OF HON. E. BENJAMIN NELSON,
U.S. SENATOR FROM NEBRASKA

First of all I want to thank you for your appearing here today and your testimony. Obviously, there's a lot that needs to be gleaned from what you said and what others are saying as well. My approach is two-fold. One is to try to determine what we can do as a Nation to move from merely having an energy bill to having an energy policy that is comprehensive and sufficient to get us into the next 20 years or, hopefully, way beyond that.

I propose, and I hear other people saying something similar that we should have the equivalent of a Manhattan Project like we did in the Second World War to develop nuclear capabilities at that point but to develop an energy policy that includes all kinds of energy and the most appropriate use of each form of energy for the development of our needs.

Now having said that, I guess I'm interested in what you may think about something like that as to whether it's even possible—I'm not looking for an energy czar or anything like that but bringing together other people from industry, from academics, people who obviously have a background and knowledge and commitment to this so I will ask you that in one second.

The second thing though is I keep hearing, and, Mr. Grumet, you may be able to help us most on this, what can be done to counter the faulty assertions about the cost of producing fuels like ethanol and cellulosic biomass, what do we do to overcome that obvious bias and do so with facts. Let's start with that, then maybe I can get some thoughts about the other.

Mr. GRUMET. Well, Senator Nelson, I think it is a complex question. I think the challenge that cellulosic ethanol faces is that there

is no present day commercial scale production. So the best any of us can do is to offer informed thoughtful projections and argue about whose model is smarter than whose model. This is why moving forward with the kinds of provisions in the energy bill I think are so critically important so we can actually get to the bottom of whether this very substantial opportunity can actually stand on its own two feet.

You know with corn-based ethanol there have been lots of battles over the years. One has been the question of whether it takes as much energy to produce ethanol as ethanol provides. Our Commission thinks we have answered that question clearly that, no that is not the case, that there is an energy benefit to ethanol. The ethanol from corn has become more efficient in recent years but at the same time it is a rather mature technology. So I think there is a lesser chance that there is going to be a kind of cost breakthrough or an order of magnitude with corn ethanol as there might be with ethanol coming from the use of cheaper waste products. I think it's fundamental when you think about the comparison between ethanol and gasoline, you have to think about what you're counting. If you're just counting production costs of one gallon to one gallon, corn-based ethanol costs more money, at least until very recently, at over $2.00 a gallon many things are cost-effective.

When you factor in the broader social concerns about oil dependence and start to deal with those external costs and the cost of air pollution, the cost of climate change, the cost that may be associated with maintaining a large military presence, the cost that may be associated with undermining our foreign policy, when you put those numbers together you may come up with a very different answer and I think that is a longer debate than you've been involved in for quite a while.

Senator BEN NELSON. Thank you. Maybe you could just tell me on the other, is it possible to have the equivalent of a Manhattan-type project, yes or no, because we're running out of time, starting with Mr. Shane.

Mr. SHANE. Mr. Chairman, I think we have the equivalent of a Manhattan project right now. It's cut across the entire country. I think possibly the Congress and even the Executive Branch is a little short. We have stimulated an enormous amount of research that has taken place everywhere. My colleague from the Energy Department might have a more interesting answer than I do on these questions but I honestly think that we have incentivized a huge amount of research and that we're moving this technology along probably as fast as is humanly possible.

Senator BEN NELSON. I'm ahead of time. I appreciate that.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much.

Senator Pryor. I think you've got 4 minutes. The vote has been extended. It will start in just 2 minutes.

STATEMENT OF HON. MARK PRYOR,
U.S. SENATOR FROM ARKANSAS

Senator PRYOR. Thank you, Mr. Chairman. I want to thank this panel of witnesses for being here today. Some of the things you said are very encouraging. There's a lot of potential upside and I

agree with what Senator Nelson and others have said, that we really need to make this a national priority. You can look at a country like Brazil. I know that the U.S. is different in a lot of ways than Brazil, but some of the things they've done down there that I think provide a model for us in some ways and I know some of those things apply and some don't.

But, Mr. Chairman, I was interested to learn a few weeks ago that in the timber industry, and I think Mr. Grumet sort of touched on this a few moments ago, but in the timber industry when they harvest timber, of course, they typically cut it for building material, et cetera. About half or maybe even as much as two-thirds is waste. It's branches and et cetera that you just can't use but you can chip it up and make ethanol out of it and so there's a huge resource all around this country. And the way I look at this is, if we're smart about it, and invest in the technology and incentivize various industries around the country, it will be a huge economic stimulus.

I know that last week or 2 weeks ago we had a big fight on the floor about agriculture policy and if we're smart, again, we could incorporate energy production into our ag policy. A lot of the problems, a lot of the challenges, will go away because you create an entirely new domestic market for agriculture. That is not food-based or fiber-based but it's energy-based and it helps all across the board. It helps with our trade imbalance, which is at a record high, it helps with the value of the dollar, it helps stimulate rural America. And so I really appreciate you all being here today and also, Mr. Chairman, thank you for mentioning that this is the first of many of hearings because I do think as a national policy, the U.S. Senate could really provide some great leadership and this Committee can provide great leadership on steering the course into the future for the U.S.

Mr. Grumet, tell me, you probably know this better than I, about the timber industry and the waste in timber and what it can be used for. Am I right on that?

Mr. GRUMET. Senator, you're absolutely right that in most operations, half the actual volume of the lumber is not able to be productively put into commercial products. Now much of that is sometimes chipped and put into co-firing of utilities. It's not all wasted so to speak, but there is a tremendous opportunity from a vast variety of feedstocks. One of the things that gets people so excited about cellulosic ethanol is it's hard to find a state that doesn't have three or four different opportunities. For so long in the ethanol discussion, we've had these undertones of a battle between the Midwestern States and the coast. I'm sure you've all seen that play out in many of the votes prior to today. What is so productive about the transition now to this national renewable fuel standard and providing the extra credits for cellulosic ethanol is to create the opportunity to have a truly national biofuels market that will provide the kind of support and kind of longevity of support that we will need to be successful.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator Bill Nelson.

STATEMENT OF HON. BILL NELSON,
U.S. SENATOR FROM FLORIDA

Senator BILL NELSON. Mr. Grumet, can you make cellulosic ethanol cheaper than from corn?

Mr. GRUMET. I believe that there's every reason to think that over time cellulosic ethanol can become more cost-effective for the simple reason that corn is a high value product. You can make cellulosic ethanol——

Senator BILL NELSON. Over how much time?

Mr. GRUMET. If we fund and implement the provisions in the recent energy bill, we believe that by 2015 to 2020 you will have commercially available cellulosic ethanol that can compete with gasoline. So as all of the panelists have said, this is not a solution for next year.

Senator BILL NELSON. And is that advance of technology in improving the making of ethanol process, or is that assuming that gas is going to be three bucks a gallon in 2015?

Mr. GRUMET. It's more the former, sir. There are really two fundamental challenges. One is increasing the yields. While we can make a lot of progress with waste like wood chips and others, ultimately, to really have billions and billions of gallons, we'll have to grow energy crops.

Switchgrass is one of the crops that people think is one of the most promising opportunities, much easier to grow, lower value land, no fertilizer, no pesticides, but we need to increase the yield. If we increase the yield of switchgrass half as much as we increased the yield of corn over the last 10 years and we increased the conversion efficiency. We have to come up with some new enzymes which is why folks like Craig Venter and others are out there in the laboratories trying to figure out ways we can come up with enzymes that will break down the woody parts of these plants so we can get the sugars out. If we do those two things, costs will come down.

Senator BILL NELSON. Is switchgrass what we otherwise would think of as prairie grass?

Mr. GRUMET. Yes, sir.

Senator BILL NELSON. And there are 31 million acres of prairie grass in this country.

Mr. GRUMET. Absolutely. And we also have the CRP lands which were set aside for conservation and unlike growing of corn, growing prairie grass would be consistent with the goals of the conservation program.

Senator BILL NELSON. And just as you were talking with Senator Pryor, I come from a state that raises a lot of pine trees. When they come in and harvest those pine trees for wood, they cut-off all the branches and the branches are just left right there to decompose. That is a source, again, something that is wasted now that could be chipped and converted?

Mr. GRUMET. That's correct.

Senator BILL NELSON. Well, then what I don't understand, Mr. Chairman, is here we are in a situation where we have dependence on foreign oil to the point of 60 percent of our daily consumption. We have the technology in every way indicated that we can at least move to improve the technology so that it becomes economically

promising, and you all have talked about hybrids, you've talked about increased miles per gallon, you take hybrids plus plug-in hybrids so that you're charging up the battery from a source other than oil. When it's parked in the garage at night, you mix gasoline with ethanol so you're using less oil. This is something we can start on tomorrow if we have the will.

And as you say, Mr. Grumet, it may be tomorrow, it may be a month from now, it may be a year, it may be 10 years, but there is going to be an abrupt disruption of the supply of oil at some point. And why we don't get on it and start changing the energy policy to wean ourselves from this foreign oil that we're so dependent upon is just beyond me.

And thank you all. And, Mr. Chairman, thank you for having this hearing.

The CHAIRMAN. Well, I think we should continue, I was told they were going to start at quarter of to vote and then I was told that it was going to start at ten of and now I'm told it's going to start in around 5 minutes.

Senator, you heard the testimony. One-third of our trade deficit come from importing that oil. If that money was spent in the United States, we would eliminate our deficit and have almost 100 percent more to allocate to basic research. I've been pressing for 25 years to start exploring the Arctic plain and to develop Alaska's gas.

I want to thank you, Mr. Grumet, for your report on the Alaska Natural Gas Pipeline. I believe there should be an energy czar. Again, we had one once before and Frank Zarb did a good job but right now the emphasis ought to be on technology and that is what we're exploring right now, is how to find some way to put the steam behind the technology base we need in terms of gas hydrates.

Hydrogen is a byproduct of that, as I understand it. ConocoPhillips and BP are now investing $45 million dollars apiece a year on gas hydrate research. We should be investing a half billion dollars a year, that's 30,000 cubic feet of gas, and we'll be importing half of our LNG by 2020, half of our natural gas will come from overseas in LNG by 2020.

Now, let me ask you all, how would you suggest—another 4 minutes maybe, and then we'll have other people join in here—how would suggest we put the emphasis behind the technology base? We're not the Energy Committee. We're dealing with technology. How do we get some movement behind technology so we can develop the alternative fuels we need for the future? And we'll go right down the line. If you would each take a couple of minutes.

Mr. SHANE. Again, Mr. Chairman, the Energy Department is really the Department that probably has a better answer for you. By creating the incentives is what I would say. We're seeing some very interesting market effects right now just by virtue of the fact the cost of fuel has gone up so high. There is now a market demand for hybrid vehicles. I think it's fair to say we have market demand for other fuel saving measures, including alternative fuels. And so when you know that the demand is latent and pent up and it doesn't take too much to unleash it, then you know it doesn't take

very much to incentivize the kind of research you're talking about in a more intensive way than we are seeing today.

I happen to think there's a tremendous amount of research going on and I don't have a glib answer for why we haven't achieved the millennium just yet. My guess is it's not that far away but as I say I think I would defer to our colleagues in the Energy Department. Presumably they'll be invited to future hearings that you have.

The CHAIRMAN. Mr. Plotkin.

Mr. PLOTKIN. Well, first let me say that I'm testifying only for myself. I don't want to give heartburn to my Department of Energy sponsors who support my lab. I believe that, in terms of looking at fuels, we have a very strong program in hydrogen. We have a much more modest program in biomass fuels. I think we are not supporting the kind of range of different fuel alternatives that we really ought to be doing in this country and we probably ought to emphasize other fuels in addition to hydrogen, not stealing resources from the hydrogen program but adding to it.

I would also like to mention that I don't think the answer is to start putting some of these technologies right out there into the marketplace. Plug-in hybrids, for example, I really like this concept but they have a long way to go before they will be commercially successful. The kind of batteries that we use for hybrids will not last very long in the kind of service required for plug-ins. In hybrids you can have a battery last a lifetime of the vehicle because you're only moving the state of charge just a little bit every day. With a plug-in, battery state of charge will go all the way down and then all the way back up. That type of operation destroys the lifetime of the battery. It cuts it way down. We've got to work on that, and so if you throw these things out into the marketplace I think you're going to burn your bridges.

It's sort of like what we did with diesels back in the 1970s. People still remember how bad some of those engines were and even though modern diesels are fabulous and Europeans love them, you can't sell them in cars today, only in trucks. I'm afraid we've got to be careful about that aspect of it. Don't throw these technologies out into the marketplace before their time, but support more R&D on alternatives.

The CHAIRMAN. Thank you.

Mr. Webber.

Mr. WEBBER. Well, Mr. Chairman, first let me assure the audience that the automobile industry has gotten the message and has been moving out very smartly. We have over 100 vehicles today in car lots that get over 30 miles per gallon. My daughter just bought a van. She has two young children. That van gets over 30 miles per gallon. I just wanted to set the record straight.

Second, it all depends or relies on research and development. The global automobile industry pours $35 to $40 billion a year in research and development. Here in the United States alone, we poured $15.2 billion last year into research and development. I wish this entire panel had the time to travel to a city like Detroit and look at advanced technology vehicles, drive them, see the research going on in biodiesel, clean diesel hybrids.

It's very exciting and the industry is very serious in moving forward with these advanced technologies. Yes, we're going to need

time, we're going to need to address infrastructure problems, we're going to need to address fuel requirements. It's going to take a collaborative effort maybe along the lines of a Manhattan Project, I'm not sure, but we are going to all have to put our heads together to make sure that these advanced technologies are not only going to work but they're going to be made available to the consumer.

But we're in the midst, in my humble opinion, of a revolution in the automobile industry the likes of which we haven't seen in 100 years and it's very, very exciting and we're moving as quickly as we can.

The CHAIRMAN. Thank you very much.

Mr. Friedman.

Mr. FRIEDMAN. Thank you, Mr. Chairman, I do believe we need a moon shot, we need some radical changes if we're going to get to this type of future. This body has definitely acted in ways that are moving us in that direction. But as Mr. Plotkin said we're only spending one-tenth of 1 percent of the amount of money that actually is going toward fuels in the first place, and so we do need a moon shot for example, even before the plug-ins to echo Mr. Plotkin's comments.

Ten years ago I helped build a plug-in hybrid. It was a great vehicle, it got really high fuel economy, but the batteries were too expensive and they didn't last as long. That's the reality. We need breakthroughs in these technologies in order for them to work but we don't need breakthroughs in order to get the fuel efficiency to work and to get this technology out there. This isn't rocket science. This is auto mechanics. And the reality is that if we put that technology to work we can change things.

The EPA fuel economy sticker for the best minivan out there is 22 miles-per-gallon. They can get a lot better. They need to get a lot better and if they do, as you said, we can take some of that trade deficit, turn it into dollars inside the United States which means more jobs, which means a better tax base, which means we can afford to pay to get the research done, and get these technologies out on the road and get these fuels into cars and trucks.

The CHAIRMAN. Thank you.

Mr. Grumet, before you comment I want to point out here the report said that the lengthy construction period of 10 years is required to complete the Alaska Gas Pipeline. You might be interested to know that an Act of Congress passed gave them 18 months to issue the permits for that system. We had a visit from the people in the Administration and we were told it was going to take 44 months to get prepared for the 18 months. So that 5 years of that 10 years is spent right here in this town complying with myriads of laws, to build a pipeline that follows the route of the Alaska Oil Pipeline down to Fairbanks and then follows the Alaska/Canada Highway the balance to the Canadian border. Not more than a thousand yards from that road all the way to Canada and yet it's going to take 5 years to determine if the permit should be issued. That's why I think we need a czar. Will you please answer the question?

Mr. GRUMET. Mr. Chairman, your leadership on the pipeline was one of the most critical supply projects we've undertaken. It's ap-

preciated and I hope that the 5-years doesn't get spent unnecessarily.

Your question about how you stimulate innovation in a complicated society and economy is exactly the right one. And I just reflect on two critical goals for government. One is to provide the resources for the kinds of long-term research and development like the methane hydrates or cellulosic ethanol that are too far down the road for private capital to be willing to invest in.

The second challenge I believe for government is to provide private capital with the kinds of incentives and obligations for it to innovate. Obviously, government should not dictate technology but government does have to dictate goals.

One thing that Mr. Webber alluded to is that the auto industry is making incredible technological progress over the last 20 years. Cars and engines have become more efficient by at least a percent a year every year. But because there's been no government direction to devote that benefit toward the public good of lowering our dependence upon oil. That benefit has gone to the private good, having bigger, faster, heavier cars. And we all want to have lower oil dependence, but when we get into the showroom we also want to have bigger, faster, heavier cars and that is where really government probably has a role.

Had we directed the auto industry to increase fuel economy by that same percentage, we would have cars that were as fast and big as they were 15 years ago but they would be 20 or 25 percent more fuel efficient. And so it is those kinds of choices. We have to give the private sector the incentives and the clear public direction and then get out of the way and let them get the job done.

The CHAIRMAN. Senator Inouye.

Senator INOUYE. This is all very interesting and very important for Hawaii. As you know, when the gas prices were $2.00 here it was $2.75 in Hawaii. When it became $3.00 we were close to $4.00 because we are dependent. However, I'm proud to say that we have taken risks, everything from ocean thermal energy conversion to solar energy, to wind energy and they have begun to pay off and we're now less dependent on fossil fuel than most states.

And, unfortunately, or fortunately, we in Hawaii love our automobiles. The city of Honolulu has more automobiles per capita than any other city of its size, so please help us.

The CHAIRMAN. Well, gentlemen, Howard Baker used to say Senators can do almost anything except keep time. We're given more time here. I don't want to keep you but I do want to ask about the question of this concept. You mentioned that yourself, Mr. Plotkin, what greater emphasis can your Department give—pardon me, it's not Mr. Plotkin, it's the Department's representative, Mr. Shane—you're Transportation, you're Energy, is that right?

Mr. SHANE. Correct.

The CHAIRMAN. Are you two working together to develop these new technologies or do you work each on your separate paths?

Mr. SHANE. The Departments of Transportation and Energy do cooperate a lot, particularly in the context of setting standards. The Department of Energy has the technology side of it. The Department of Transportation is not contributing in a significant way to the development of alternative fuels technology. What we're re-

sponsible for at DOT is to ensure that the safety of the vehicles remains what it is. The safety of infrastructure is what we need and so there is a cooperative relationship. It is a strong bond between the two agencies, but there is also an important division of labor as to the substance of what we respectively do.

The CHAIRMAN. Mr. Plotkin.

Mr. PLOTKIN. Senator, the Department sponsors my research but I am not their employee and I really hesitate to speak for them.

The CHAIRMAN. Will anyone answer the question why have we abandoned hydropower? Why have we abandoned the concept of building new hydropower dams? Brazil converted its energy and dependance. They were more than 70 percent dependent on imported oil. They're now less than 30 because they went to hydropower within the last two decades.

Mr. PLOTKIN. Senator, hydropower provides electricity but Brazil hasn't gone to electric vehicles. What they have gone to is ethanol vehicles and they're using their sugarcane, I believe, to power much of their vehicles and that is their answer to reducing gasoline use. I'm not really sure that hydropower has anything to do with that.

The CHAIRMAN. I was told they built a substantial number of hydropower plants.

Mr. PLOTKIN. Yes, that may very well be true but that doesn't provide them with transportation fuels. It provides them with a source of electricity. Perhaps they were using a lot of diesel for power generation.

The CHAIRMAN. But doesn't it link the demand for the fossil fuel so if you can supply major cities with electricity without using diesel?

Mr. PLOTKIN. But the reality is in this country we use very, very little oil in our power sector and only for peaking power. So the kind of base load power that hydropower provides really would not have an effect on our oil use unless, of course, we manage to move plug-in hybrids or electric vehicles into the fleet. But currently we could produce lots more energy, theoretically, from hydropower and do nothing to help our oil situation.

The CHAIRMAN. Mr. Friedman. Excuse me, before you do that, Mr. Plotkin, we in Alaska have half of the coal in the United States, only one operating coal mine, and coal is very much involved in the generation of electricity in major cities in the Southern 48, isn't it?

Mr. PLOTKIN. Yes, coal provides about half of our electric power generation capability.

The CHAIRMAN. Mr. Friedman.

Mr. FRIEDMAN. Thank you, Senator. I just also wanted to add that I think part of the difference is just a difference in resources between Brazil and the United States. In the United States one of greatest opportunities for renewable electricity is actually wind power which is now becoming cost competitive with natural gas and other electricity sources because of the technology progress that has been made. So we have substantial opportunity through renewable energy standards and other credits to dramatically increase the amount of renewable electricity that we generate.

Part of what that can do is offset other fossil fuels and eventually in the future say if we go with hydrogen or potentially with electricity as our alternative fuel, some of those resources along with solar power and biomass could be tapped in order to make hydrogen in a very clean and energy-efficient manner. That helps make a lot of progress and in the long-term could move us out of oil but in the short-term could substantially help reduce the amount of coal and if needed natural gas that we use.

The CHAIRMAN. If my memory serves me, my memory says your wind power comes on any line at the highest alternative source of cost. Therefore, it's subsidized to begin with, isn't it, much more than any other form of alternative energy?

Mr. FRIEDMAN. Well, right now even without the subsidy levels that are out there it is, especially with natural gas, with the prices where it is today it can be cost competitive. The big challenge with wind power is that it is intermittent. When there's a lot of wind you have electricity, when there isn't a lot of wind, you don't and that creates a great opportunity to actually marry multiple systems together. You could marry the wind system with a hydrogen future or electric future where when there's excess wind you could generate hydrogen or electricity for vehicles and otherwise you can operate it as more of a base load. So you actually enter into a system that balances these two.

In reality, in the end what you probably want to do is have a diverse set of fuels and a diverse set of resources, biofuels, wind power and for many decades to come, oil as alternatives and options for fueling our cars and trucks.

The CHAIRMAN. The vote has finally been called. You know, none of you mentioned things like fuel cells. Is there no hope that fuel cells will bring about a greater economy in and of themselves, Mr. Webber?

Mr. WEBBER. We're very excited in the automobile industry about fuel cell development. As I mentioned, in this country alone we're spending over $15 billion a year in advance technology. Part of that is going into fuel cell development. We see great possibilities. We've got a long way to go but we are moving very much in that direction.

The CHAIRMAN. Mr. Grumet.

Mr. GRUMET. On the question of fuel cells no one likes to be a Grinch. All technology is wonderful, but considering the fact we have to make hard choices, our Commission does not have high hopes for hydrogen or fuel cells any time in the next 30 years or so. We have a history in this country of failing dramatically when we need to change the fueling infrastructure. This was pointed out before when California tried to move to methanol, and in the past when we tried to have an all-electric infrastructure.

We think that hydrogen is a wonderful idea for the second half of this century but I think I would agree with what Mr. Plotkin was alluding to that we would refocus our resources somewhat away from hydrogen in a world of limited resources and toward things like near-term efficiency and near-term biofuels.

Mr. WEBBER. We would respectfully disagree. And again, let me take you to Detroit and drive a hydrogen fuel automobile. Let me let you talk to some of the top research and development people in

the global automobile industry. We have high hopes for hydrogen. We're not going to give up. If we took that viewpoint then, yes, it would take 50 years but we see great possibilities here and we're going to drive in that direction, no pun intended.

The CHAIRMAN. Mr. Shane.

Mr. SHANE. Yes, I just wanted to reiterate that the President's hydrogen initiative contemplates a practically available viable fuel cell-powered vehicle available to Americans by 2020. I realize that is pushing the envelope. Senator Nelson asked about whether we needed a Manhattan Project. I think what the President is saying is that by putting the might of the American government behind the concept of a fuel cell powered vehicle, working closely with our friends in Detroit who have been working on this for a long, long time even prior to the initiative, as well as work that is going on abroad. We think that 2020 is not an unreasonable target date.

The CHAIRMAN. Mr. Plotkin.

Mr. PLOTKIN. I would just like to add that I would hope, in refocusing our energy R&D program, that we would not move resources out of hydrogen toward other alternatives because I believe that—and I think this is true of all of these fuels—so much work needs to be done, that hydrogen is perhaps barely getting the resources it needs.

If you remove funds from the hydrogen program, I think we will have no chance of having a viable hydrogen economy any time soon. I think we need to add resources to the other alternatives like cellulosic ethanol, like plug-in hybrids, but I think it would be a big mistake to shift resources away from hydrogen. In a zero sum game I think what you would end up with is that nothing would substitute for oil, and you will have that future of either a continuation of today, or we will move to unconventional sources of oil which will have some substantial environmental impacts and won't really change our energy security situation very much.

The CHAIRMAN. Mr. Friedman.

Mr. FRIEDMAN. Senator, I would also like to add that if we look at the history of alternative fuels, part of the reason why they've often failed is because of the lack of consistent and sustained support. And I would worry that if we pulled back from hydrogen that we would end up with the type of future that Mr. Plotkin is talking about from our perspective, whether it's hydrogen with fuel cells, whether it's electricity and plug-ins or battery electric vehicles or even ethanol, there are still significant breakthroughs that need to happen in order to make them work. That is a part of the reason why these are long-term technologies and all of these technologies are going to need significant help in order to get there and that's the significant role that the Federal Government and this Congress can play.

But I think and I encourage us to be careful not to jump from silver bullet to silver bullet. Hydrogen has gotten lot of attention, in some ways deserved attention and in some ways maybe too much hype. Ethanol is now getting a lot of attention. It has a lot of potential but, again we need to look at all of them reasonably and fairly and if you look at the technologies where they are today they all have huge potential but they all have important hurdles

that need to be overcome and that need help in order to get there, unlike efficiency which could definitely make a lot of help now.

The CHAIRMAN. Last comment, Mr. Webber.

Mr. WEBBER. I never thought I would agree with Mr. Friedman. We have debated many issues. I think really he's right and what I would reiterate in his remarks is let's go forward on several technologies. That is why the global automobile industry is developing clean technology for diesel. Hybrids, biofuels, and hydrogen, those are several fronts we're working on. They have great promise and they will help us achieve the goal you stated earlier, Mr. Chairman, about getting off oil.

The CHAIRMAN. Well, gentlemen, I think the real problem that—the base of this, and we're both still on appropriations, but it's the money question. I do think we have to have more money and I've been trying to find some way to convince those people who won't support us on our desire to explore and develop the Arctic Plain or to accelerate this development and building of the Alaska Gas Pipeline to convince them those two projects will be the two largest projects in the history of the United States. The gas pipeline is probably the largest single private enterprise project in the history of man and totally private enterprise. Those two projects will bring in enough money if we could dedicate it to the subject we're dealing with now to the development of technology base for alternative fuels; we might give some hope to our grandchildren.

But right now all we can see is just an increased demand throughout the world for the fuels we're using and increased competition from those countries that are going to really, really take the oil from us, in effect. We have to find some way to develop the technology base to stay ahead and I think it's going to take cash. I'm still preaching to the wind. Thank you all very much.

[Whereupon, at 10:25 a.m., the hearing was adjourned.]

A P P E N D I X

WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO JEFFREY N. SHANE

Mr. Shane's responses to the following questions were not received at the time this hearing went to press:

Question 1. Mr. Shane, the Energy Information Administration now projects that the average retail price of gasoline will remain above $2.00 per gallon for the next two decades. In terms of the pre-tax price used to measure societal costs and benefits, this represents a nearly 50 percent increase over the now seemingly out-of-date prices that NHTSA used in developing its Notice of Proposed Rulemaking for light truck Corporate Fuel Economy Standards?

- Does NHTSA plan to base the fuel economy targets in its final rule on the up to date gasoline price projections in EIA's Annual Energy Outlook 2006 reference case?
- If so, please describe in detail how much of an effect this will have on the final target levels in model year 2011?
- If not, why will they not be using the most up to date price projections?

Question 2. Mr. Shane, I understand that the present value of future fuel savings depends strongly on the interest rate used to discount those savings. OMB Circular A–4 states that when regulation primarily and directly affects private consumption, a lower discount rate than the standard 7 percent is appropriate. It also notes that the most common alternative is the social rate of time preference, and suggests a real rate of 3 percent for this.

- Why has NHTSA not followed this guidance in selecting the discount rate for its modeling?

Question 3. Mr. Shane, fuel savings from increasing fuel economy are partially eroded by the rebound effect, whereby the lower per-mile cost of driving results in an increase in miles driven. NHTSA's assumption of a 20 percent rebound effect is, by NHTSA's own admission, at the high end of the commonly accepted range. Moreover, recent research by Dr. Kenneth Small and Dr. Kurt Van Dender indicates that rising income levels have led to a reduction in rebound overtime. At a recent workshop in Washington D.C., Dr. Van Dender indicated that a rebound of just 10 percent would be more accurate, even accounting for current high gas prices.

- Why has NHTSA chosen to bias its results against increasing fuel economy by using such a high rebound value?

Question 4. Mr. Shane, consumers have been complaining that EPA's window sticker fuel economy ratings, which are reportedly 10 to 30 percent below the CAFE test results, are still unrealistically high. I understand EPA is currently in the process of developing a rule that will attempt to address this longstanding dissatisfaction by revising the way in which window-sticker values are determined. In its Annual Energy Outlook modeling, EIA assumes that on-road fuel economy is approximately 20 percent below the CAFE test values.

- If NHTSA is prepared to rely on EIA projections for gasoline prices, why are they not prepared to rely on EIA's estimates of on-road fuel economy?
- At a time when EPA has acknowledged that its current fuel economy ratings are not representative of real-world driving, why has NHTSA gone ahead and used EPA's on-road correction factor of 15 percent?
- What evidence is there that EPA's admittedly flawed estimates are superior to those of EIA?
- Does the proposed EPA update take into account the factors and general intent of Section 7260 of the Senate passed Transportation Bill?

Question 5. Mr. Shane, in its response to the peer review process for the CAFE Compliance and Effects Modeling System (CAFE–CEMS), NHTSA states that it "de-

fers to EPA/OTAQ to provide updated estimates of this parameter and its potential variation among vehicle types."

- Will NHTSA be employing the new on-road fuel economy ratings expected from EPA in setting the targets in its final rule?

Question 6. Mr. Shane, NHTSA's CAFE–CEMS includes the ability to value reductions in emissions of greenhouse gases in valuing fuel economy increases, but I understand the agency set the value of avoided emissions to zero. The agency cited the broad range of estimates of the value of GHG emissions in the current literature as its reason for setting this value to zero. However, there are broad ranges of estimates for the values of many externalities, such as criteria pollutants.

- Will NHTSA be adopting a substantial positive value for these emissions, recognizing the serious threat they pose to the economic and environmental health of the country?

Question 7. Mr. Shane, the U.S. Code requires NHTSA to set fuel economy standards for vehicles up to 10,000 lbs GVWR if doing so is feasible and would result in significant energy conservation.

- Will NHTSA be setting standards for all vehicles between 8,500–10,000 lbs in its final rule?
- Please explain why you believe doing so be infeasible?
- If vehicles above 10,000 GVWR were included, what would be the resulting oil savings?

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