Statement of the Honorable David Garman

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U.S. Department of Energy

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Mr. Chairman and Members of the Committee, I appreciate the opportunity to appear before you today to discuss the role of the Department of Energy (DOE or Department) in the development of advanced technologies for energy efficient vehicles.

Recently, President Bush spoke on energy policy and economic security at the Calvert Cliffs nuclear power plant and said that to make this country less dependent on foreign sources of oil, we need the following things: 1) to encourage conservation with the help of new technology; 2) to diversify our energy supply by increasing the use of alternative and renewable sources like ethanol and biodiesel; and 3) to develop a hydrogen-powered automobile over the next decade or two. The President envisioned that a child born today would be "able to take a driver's test in a hydrogen-powered automobile that has zero emissions, and at the same time will make us less dependent on hydrocarbons which we have to import from foreign countries."

The Petroleum Challenge

The President's remarks make clear the petroleum challenge that faces this country. The world is not running out of oil, at least not yet, but worldwide demand is increasing faster than production and prices are rising. Unless we reduce our dependence on foreign oil we risk that our energy economic security will be compromised.

The most urgent need is to address our transportation sector, which consumes two-thirds of all U.S. oil and is still growing. Petroleum imports already supply more than 57 percent of U.S. domestic needs, and those imports are projected to increase to more than 68 percent by 2025 under a business-as-usual scenario. Because petroleum based liquid fuels, like gasoline and diesel, have a high energy density and are easily transported, they are ideal for transportation. The Department of Energy is committed to finding suitable alternatives, and developing the technologies that will use today's oil more efficiently.

At the G8 Summit earlier this month, the President reiterated his policy of promoting technological innovation, like the development of hydrogen and fuel cell technologies, to address climate change, reduce air pollution, and improve energy security in the United States and throughout the world. The Department's research and development (R&D) in advanced vehicle technologies, such as hybrid electric vehicles, will help improve energy efficiency and reduce petroleum consumption in the near to mid term. But, for the long term, we ultimately need a substitute to replace petroleum. Hydrogen and fuel cells, when combined, have the potential to end petroleum dependence and provide carbon-free, pollution-free power for transportation.

Thus, our strategy for passenger vehicles has two components. For long-term energy independence, the Department is aggressively implementing the President's vision of working with industry to develop hydrogen-powered fuel cell vehicles. Hydrogen can be produced from a number of different feedstocks, and this supply diversity can help improve the Nation's energy security. Through the President's Hydrogen Fuel Initiative, research is being conducted step by step to eliminate the cost and technical barriers that need to be overcome before these vehicles can be widely available. Our near and mid-term strategy is to develop the component and infrastructure technologies necessary to enable significant improvements to the energy efficiency of the full range of affordable cars and light trucks. Such technologies as those used by hybrid electric vehicles can limit growth or begin to reduce our dependence on foreign oil right now, while also advancing some of the same technologies that will eventually be needed for fuel cells. These are described more fully in a document I am leaving with the Committee.

We are also working on technologies that will increase the energy efficiency of commercial vehicles, which due to their high performance needs, are unlikely to run on hydrogen. While the majority of commercial vehicles are powered by diesel engines, which have a higher efficiency than gasoline engines, there remains room for considerable efficiency improvements. Fuel cells could also play a role with commercial vehicles by saving fuel and reducing emissions from engine idling.

Partnerships

Partnering with industry creates a common understanding of technical capabilities and barriers, which increases the likelihood that industry will pick up DOE's energy-saving technologies and that Federal research will target industry needs. To address the passenger vehicle market, we joined with the three domestic auto manufacturers and five energy companies to establish the FreedomCAR and Fuel Partnership. To address the commercial vehicle sector, we have the 21st Century Truck Partnership in which the Department teams with three other Federal agencies and 15 industry partners representing vehicle and component manufacturers, truck and bus manufacturers, and hybrid vehicle powertrain suppliers.

We also partner internationally through the International Energy Agency (IEA) on research for motor fuels, internal combustion engines, advanced materials, and hybrid propulsion systems. Our hydrogen vision is now shared around the world. The International Partnership for the Hydrogen Economy (IPHE) was established in 2003 and currently includes 16 nations and the European Commission. The IPHE partners represent more than 85 percent of the world's gross domestic product and two-thirds of the world's energy consumption and greenhouse gas emissions. The Partnership leverages limited resources by bringing together the world's best intellectual skills and talents to coordinate multinational Research Development and Demonstration (RD&D) programs that advance the transition to a global hydrogen economy.

Two DOE programs under the Office of Energy Efficiency and Renewable Energy (EERE) are leading the Department's R&D efforts for advanced vehicle technologies. The Hydrogen Program has the challenging task of fulfilling the President's vision of transforming our transportation system from dependence on petroleum fuels to a future with sustainable, pollution-free vehicles. The FreedomCAR and Vehicle Technologies Program is meeting the mid-term challenges of efficiency and alternative fuels for developing the best technology options for reducing the petroleum consumption of light duty vehicles over the next 20 years. Progress in such areas as advanced internal combustion engines and emission control systems, lightweight materials, power electronics and motor development, high-power/energy battery development, and alternative fuels will also contribute to fuel cell hybrids.

Together, these two DOE programs provide a continuum of technologies that will revolutionize the way we drive.

FreedomCAR and Vehicle Technologies (OFCVT) Program

The following descriptions sample the range of technologies the Department is developing that will enable Americans to use less petroleum, reduce the impact on our environment, and still retain our mobility and freedom of choice when we purchase our vehicles.

Hybrid Systems technologies combining an internal combustion engine and a battery-powered electric motor can potentially reduce vehicle fuel use by 40 percent or more. Without building entire vehicles, we conduct our research in a vehicle systems context that enables us to determine the impact that improving a component has on overall energy efficiency. When I was at Argonne National Laboratory, I saw first hand how their Powertrain Systems Analysis Toolkit (PSAT) model, winner of a prestigious 2004 R&D 100 Award, is used in conjunction with their Hardware-In-the-Loop test facilities to validate vehicle components in a system, either virtually or with real devices.

Energy Storage technologies, especially batteries, are critical enabling technologies for the development of advanced, fuel-efficient, hybrid vehicles and ultimately fuel cell vehicles. Our energy storage research aims to overcome such technical barriers as cost, weight, performance, life, and abuse tolerance that the Department and the automotive industry have identified. DOE's technical research teams and battery manufacturers are collectively addressing these barriers.

Advancements we have made in batteries and electric drive motors, originally developed for battery-powered electric vehicles, have led to worldwide stimulation of hybrid vehicle technology. Every hybrid vehicle sold in the U.S. today, including those by foreign manufacturers, contains elements of battery technology licensed from one of our battery research partners. Other governments in both Europe and Asia have followed our example, creating partnerships with industry and supporting research in this area.

Power Electronics are at the heart of advanced technology vehicles. Advanced hybrid vehicles and fuel cell vehicles will require unprecedented improvements in both power electronics and electric drive motors. These new technologies must be compatible with high-volume manufacturing; must ensure high reliability, efficiency, and ruggedness; and must simultaneously reduce cost, weight, and volume. Of these challenges, cost is the greatest. Key components for hybrid vehicles (with either fuel cell or advanced combustion engines as the prime mover) include motors, inverters/converters, sensors, control systems, and other interface electronics.

Advanced materials are needed for structural components as well as powertrain components. The use of lightweight, high-performance materials will contribute to the development of vehicles that provide better fuel economy, yet are comparable in size, comfort, and safety to today's vehicles. The development of propulsion materials and enabling technologies will help reduce costs while improving the durability, efficiency, and performance of advanced internal combustion, diesel, hybrid, and fuel-cell-powered vehicles.

Because a 10 percent reduction in weight can save as much as 6 percent in fuel consumption, our materials research goal is to enable vehicle weight reductions of as much as 50 percent by 2010 compared to the weight of 2002 vehicles. Carbon fiber reinforced composites are an excellent candidate for these applications, but they are currently prohibitively expensive. To reduce these costs, we are developing a microwave assisted plasma (MAP) manufacturing technique which indicates a potential savings of 40 percent in direct production costs and an 18 percent reduction in the final carbon fiber cost because of faster processing speed, reduced processing energy demand, and a higher degree of product quality control. Other efforts focus on developing the new processes needed to recycle advanced materials.

Advanced Combustion Engines have the potential to contribute over 40 percent to the total efficiency improvements possible for both passenger and commercial vehicles. The most promising approach to reduce petroleum consumption in the mid term (10-20 years) is the introduction of high efficiency internal combustion engines in conventional and hybrid vehicles. Our goals are to improve the efficiency of internal combustion engines for passenger applications and commercial vehicles while meeting cost, durability, and emissions constraints. Accelerated research on advanced combustion regimes, including homogeneous charge compression ignition (HCCI) and other modes of low-temperature combustion, is aimed at realizing this potential and making a major contribution to improving the U.S. energy security, environment, and economy.

In parallel with fuels development, Advanced Combustion Engine research has made significant strides in the development of enabling technology to bring more efficient clean combustion engines into the market. Christina Vujovich, Vice President of Environmental Policy and Product Strategy of Cummins Engine Company, recently commented publicly, “We have achieved some impressive technology advances to meet the initial engine efficiency and emissions deliverables of the program. …The Department of Energy provided an invaluable level of cooperation throughout the program. It demonstrates just how much can be achieved when federal agencies and industry work together toward a common goal in the best interest of the Nation's environment and energy security."

Fuels Technology supports research on advanced petroleum and non-petroleum-based fuels and fuel blends to enable extremely high efficiency and the displacement of significant quantities of petroleum fuels. This work is coordinated with our EERE Biomass Program, which is developing technology to convert biomass (plant-derived material) to valuable fuels, chemicals, materials, and power.

The DOE-managed Advanced Petroleum Based Fuels - Diesel Emissions Control Project (APBF-DEC) has provided crucial data supporting the U.S. Environmental Protection Agency rulemaking that is leading to the nationwide introduction of low-sulfur fuel.

Hydrogen Program

The Department’s Hydrogen Program is developing advanced technologies for producing, delivering, and storing hydrogen, for affordable and reliable fuel cells, and for infrastructure technologies that will support the widespread introduction of hydrogen-powered vehicles. The use of hydrogen will get to the root causes of oil dependency, criteria pollutants and greenhouse gas emissions.

Since the President launched the Hydrogen Fuel Initiative in 2003, we have made significant progress. The Department has developed a comprehensive technology development plan, the *Hydrogen Posture Plan*, fully integrating the hydrogen research of the Offices of Energy Efficiency and Renewable Energy; Science; Fossil Energy; and Nuclear Energy, Science, and Technology. This plan identifies technologies, strategies, and interim milestones to enable a 2015 industry commercialization decision on the viability of hydrogen and fuel cell technologies. Each Office has, in turn, developed a detailed research plan which outlines how the high-level milestones will be supported.

Ongoing research has already led to important technical advances. As highlighted by Secretary Bodman in earlier Congressional testimony, I am pleased to report that our fuel cell activities achieved an important technology cost goal this past year- the high-volume cost of automotive fuel cells was reduced from $275 per kilowatt to $200 per kilowatt. This was achieved by using innovative processes developed by national labs and fuel cell developers for depositing platinum catalyst. This accomplishment is a major step toward the Program's goal of reducing the cost of transportation fuel cell power systems to $45 per kilowatt by 2010.

In hydrogen production, we have demonstrated our ability to produce hydrogen at a cost of $3.60 per gallon of gasoline equivalent at an integrated fueling station that generates both electricity and hydrogen. This is down from about $5.00 per gallon of gasoline equivalent prior to the Initiative.

In the short term, the use of more efficient technologies, such as hybrid vehicles, will mitigate increases in greenhouse gas emissions. In the long term, hydrogen produced from renewables, nuclear, or coal with carbon sequestration can eliminate oil dependency, significantly reduce vehicular criteria air pollutants, and help stop and reverse the growth in greenhouse gas emissions.

I will now briefly describe the activities of the Department to support the President's Hydrogen Fuel Initiative, which addresses both the development needed for the hydrogen infrastructure and for fuel cell technology.

Hydrogen Production: The overall goal is to produce hydrogen in a way that is carbon neutral. To address energy security and environmental needs, an array of feedstocks and technologies such as solar, wind, and biomass, nuclear, and fossil fuels (with sequestration) are being examined for hydrogen production. The research focus for the transition to a hydrogen infrastructure is on distributed reforming of natural gas and renewable liquid fuels, and on electrolysis, to meet initial lower volume hydrogen needs with the least capital investment. Renewable feedstocks and energy sources are being investigated for the long term, with more emphasis on centralized options to take advantage of economies of scale when an adequate hydrogen delivery infrastructure is in place.

Hydrogen Delivery: Hydrogen must be transported from the point of production to the point of use, including storing and dispensing at fueling stations. Due to its relatively low volumetric energy density, delivery can be one of the significant cost and energy inefficiencies associated with using hydrogen as an energy carrier. There are three primary options for hydrogen delivery. One option is to deliver hydrogen as a gas in pipelines or high-pressure tube trailers. A second option is to liquefy it and deliver it in cryogenic tank trucks. Gaseous and liquid truck deliveries are used today, but there is only a very limited hydrogen pipeline infrastructure. A third option is to use carriers such as natural gas, methanol, ethanol, or other liquids derived from renewable biomass, that can be transported to the point of end use and reformed to hydrogen. Further R&D is required for each of these options so that we can reduce cost, improve reliability, and determine the best approach. Carriers are the focus for the nearer term; pipelines and other options are being researched for the longer term.

Hydrogen Storage is a critical enabling technology for the advancement of hydrogen and fuel cell power technologies for transportation, stationary, and portable applications. The Department is focused on the research and development of on-board vehicular hydrogen storage systems that will allow for a driving range of greater than 300 miles without compromising passenger or cargo space. Development targets include compressed hydrogen tanks for near-term storage of hydrogen. However, the Program emphasizes R&D on advanced materials such as metal hydrides, chemical hydrides, and carbon-based materials to allow low-pressure hydrogen storage options in the long-term. As progress is made on solid-state or liquid-based materials, other issues such as vehicle refueling, thermal management or byproduct reclamation will need to be addressed.

Codes and Standards will be necessary in the implementation of the hydrogen economy. Our DOE codes and standards activity will facilitate their development, and support publicly-available research that will be necessary to develop a scientific and technical basis for such codes and standards. DOE is working with the Department of Transportation (DOT) in support of their regulatory role in vehicle safety standards, hydrogen pipelines, and global technical regulations. The DOE and the DOT are working closely together in the International Partnership for the Hydrogen Economy to promote uniform global hydrogen technology codes and standards.

Safety is of paramount importance. The development of codes and standards is critical to ensuring the safety of hydrogen production and delivery processes, as well as hydrogen storage technologies for both transportation and stationary applications. Like other fuels in use today, hydrogen can be used safely with appropriate handling and systems design. Because of the smaller size of the molecule and the greater buoyancy of the gas, hydrogen requires storage and handling techniques that are different than those traditionally employed. The aim of our program is to ensure the safe use of hydrogen, and to understand, communicate and provide training on the safety hazards related to the use of hydrogen as a fuel. DOE is working with the DOT as well as other agencies, such as the Environmental Protection Agency, the National Institute of Standards and Technology, and the Department of Agriculture to promote and ensure the development of safe hydrogen and fuel cell technologies.

Education is critical to the successful introduction of any new technology. DOE's hydrogen education effort focuses on providing information and training, with a focus on safety, to the specific target audiences involved in the transition to a hydrogen economy, including first responders, code officials, state and local government representatives, and local communities where near-term hydrogen demonstration projects are located. Over the long-term, the program also seeks to raise public awareness and foster the development of university and other education programs that will ensure the next generation of scientists, engineers, and technicians needed to develop and sustain the hydrogen economy.

Fuel Cells have the potential to replace the internal combustion engine in passenger vehicles because they are energy efficient, clean and fuel flexible. Hydrogen or any hydrogen-rich fuel can be used by this emerging technology. For transportation applications the focus is on direct hydrogen fuel cells, in which hydrogen is stored on board and is supplied by a hydrogen generation, delivery, and fueling infrastructure. Fuel cell R&D activities address key barriers, including cost and reliability, to fuel cell systems for transportation applications. Activities support the development of individual component technology critical to systems integration, as well as systems-level modeling activities that guide R&D activities, benchmark systems progress, and explore alternate systems configurations on a cost-effective basis.

Polymer electrolyte membrane fuel cell cost projections at high-volume (500,000 units per year) have been reduced from $275 per kilowatt in 2002 to $200 per kilowatt in 2005. Performance improvements are based on progress in areas such as electrocatalyst design and materials, which reduce expensive platinum content; gas diffusion layer design, which reduces materials content; and advanced low-cost membranes. Changes in operating conditions have reduced the size of the fuel cell stack, resulting in lower raw materials costs. Manufacturing advances include molded bipolar plates manufactured by a net-shape molding process and economies of scale for membrane manufacturing. These advances set the stage for meeting the $45 per-kilowatt target for 2010.

Technology Validation is conducted on components under real-world operating conditions in integrated systems to quantify the performance and reliability, document any problem areas, and provide valuable information to researchers to help refine and direct future R&D activities.

An example of a project that ties all of the R&D activities together and validates the status of hydrogen and fuel cell technologies is the National Hydrogen Learning Demonstration. The National Hydrogen Learning Demonstration is the first effort of its kind to bring together, at a national level, major automobile and energy companies in a hydrogen infrastructure and vehicle demonstration project. The project will help DOE focus its research and development efforts, provide insight into vehicle and infrastructure interface issues and help address codes, standards and safety issues. We have partnered with four industry teams to work on projects that would assess the status of hydrogen infrastructure and fuel cell technology, in parallel, against time-phased, performance-based targets.

This Learning Demonstration will collect data both on the open road and in controlled testing environments. Field validation of hydrogen-powered fuel cell vehicles in controlled vehicle fleets in both hot and cold climates will provide valuable information. Infrastructure validation also includes hydrogen production, storage and delivery processes, and hydrogen refueling station technologies. Each of these teams is sharing at least 50 percent of the project cost, which is estimated to be about $350 million between FY 2004 and FY 2009, with the government share subject to appropriation. Information from this demonstration will help DOE focus its R&D efforts on fuel cells and hydrogen production and provide valuable information to industry to make a 2015 commercialization decision. With a positive commercialization decision and a successful research program, it is not unreasonable to think we could see the beginning of mass-market fuel cell vehicle penetration by 2020.

Biomass Program

The Department's Biomass Program is the major EERE renewable effort that addresses the development of alternative liquid transportation fuels, namely ethanol and biodiesel. The development of these fuels has a direct bearing on our Nation's ability to reduce imported oil because they can be directly blended into gasoline and diesel fuels. The current domestic industry has the production capacity of about four billion gallons with capacity for almost another billion gallons under construction. Provisions in the conference version of the Energy Bill could provide an incentive to increase this supply to 7.5 billion gallons by 2012.

While the domestic renewable fuels industry has been growing at a rapid pace, there is little doubt that this industry will have a brighter future if R&D at USDA and DOE is successful. A recent report jointly conducted by the two departments indicates that over one billion tons of biomass could one day be sustainably produced from various biomass sources and meet at least 30 percent of today's U.S. transportation demand. In the longer term, when this renewable supply is coupled with advancements projected by the EERE vehicle and hydrogen technologies, a carbon neutral and renewable transportation suite of technologies could greatly reduce our dependence on imported oil.

Recent breakthroughs and accomplishments in ethanol and biobased products include technologies developed by the National Renewable Energy Laboratory, working with two of the major world industrial enzyme manufacturing companies. In 2004, these public private partnerships won a prestigious R&D 100 Award (shared by the three entities) for developing an innovative, lower cost method for transforming biomass into sugars that could then be fermented to produce ethanol and other chemicals. Before this breakthrough, this conversion step was considered a showstopper for biomass biological conversion.

More recently, there has been a stepped-up interest in combining the forces of DOE's Office of Science with EERE's Biomass Program to address research barriers facing biomass to ethanol technologies. It is believed that some of the fundamental tools and understanding being considered and developed by the Office of Science can be more directly targeted to the EERE Biomass Program and industry. This synergism could greatly reduce the time needed to make ethanol more economically competitive. The two DOE Offices are currently planning a joint workshop and a joint solicitation to occur before the end of the calendar year.

Biomass represents a bridge to the hydrogen economy. Ethanol and methanol from biomass are both potential hydrogen carriers that can also be used in fuel cells or can directly replace gasoline. Recently, DOE and USDA signed a Memorandum of Understanding aimed at developing more cost effective ways to produce hydrogen from biomass resources. Transitioning to hydrogen technologies in the agriculture industry and in rural communities is important for a number of reasons: hydrogen could be produced from renewable, farm-based biomass; agricultural vehicles could be fueled by hydrogen; and hydrogen fuel cell technology could potentially provide power for rural communities and remote farm and forest sites.

Sugars Platform R&D

The Sugars Platform involves the breakdown of biomass into raw component sugars that can be fermented to produce a range of chemical and biological processes. The research target for the mid-term is to reduce the cost of sugars from 15 cents per pound in 2003 to 10 cents in 2012. The corn refining industry, which currently includes wet and dry mills, is an example of a sugars based industry that produces ethanol and other chemicals, as well as food and fiber. Ongoing research tasks in the Sugars Platform include feedstock conditioning, pretreatment, enzyme biomass degradation, process integration, and targeted fundamental research.

Thermochemical Platform R&D

The Thermochemical Platform's current emphasis is on converting non-fermentable biomass such as lignin to intermediate products such as synthesis gas. These intermediates can be used directly as raw energy, or may be further refined to produce fuels and products that are interchangeable with existing commercial commodities such as oils, gasoline, synthetic natural gas, and high purity hydrogen. Current R&D is focused on synthesis gas clean-up making it suitable for the production of high-valued mixed alcohols.

Products R&D

The area of biobased products represents a major market opportunity for domestically grown biomass resources. The Products R&D utilize the outputs from the Sugars and Thermochemical Platforms to develop higher valued products. The Products focus is on platform chemicals that can be converted to a multitude of high valued products. As an example of success, industrial partners have had a breakthrough in developing a novel microbial process that can convert corn sugars to a chemical intermediate. When fully commercialized, the industrial biotech process will convert dextrose derived from corn to a chemical intermediate known as 3, hydroxypropionic acid (3HP), one of the top chemical intermediates identified by the Biomass Program. The chemicals that can be produced from 3HP include acrylic acid, acrylamide, and 1,3 propanediol. Acrylic acid and its derivatives are used to create a wide range of polymer-based consumer and industrial products such as adhesives, paints, polishes, protective coatings, and sealants. The new process will use agricultural feedstocks instead of petroleum to produce 3HP.

Integrated Biorefineries

An integrated biorefinery is the ultimate deployment strategy of the Biomass Program. A biorefinery embodies a facility that uses biomass to make a range of fuels, combined heat and power, chemicals, and materials in order to maximize the value of biomass. Much like an oil refinery, the biorefinery has the flexibility to make adjustments to the quantities of the various products that it makes, depending on fluctuating market conditions. The barriers to an integrated biorefinery are largely addressed through the other R&D areas. However, certain barriers are specific to the integrated biorefinery such as the challenge of feedstock-to-product process integration and the financial, engineering, and marketing risks inherent in scaling up first-of-a-kind, pioneer technology. In FY 2002, the Biomass Program awarded six major biorefinery development projects to industry partnerships (minimum 50 percent cost-share).

When achievement of technical targets justifies industrial-scale demonstrations (again, with a minimum 50 percent cost share), the Biomass Program will conduct a competitive solicitation in order to: 1) complete technology development necessary for start-up demonstration of an integrated biorefinery; and 2) help U.S. industry establish the first large-scale sugars-based biorefinery based on cellulosic agricultural residues by 2010.

Benefits to the Nation

In conclusion, I believe that the Department of Energy is maintaining a balanced portfolio of near-term and long-term options to decrease oil consumption today, and to launch our Nation into a bold new energy future. Gasoline and diesel-hybrid electric vehicles are the most promising technology options over the next two decades, and hydrogen-powered vehicles offer the best potential to achieve long-term energy independence through use of diverse, domestic feedstocks. The Department's plan is ambitious but allows time to overcome the significant technical and economic challenges.

I continue to be excited by the Department's programs in advanced automotive technology and look forward to the security, economic, and environmental benefits that will accrue to our Nation as progress is made. Emissions reduction comes hand-in-hand with putting more efficient vehicles on the road. We estimate that the cumulative savings in oil by 2030 from several aspects of our research, assuming complete technical success, could be almost 20 billion barrels compared to a "business-as-usual" scenario. That's about a trillion dollars at $50 a barrel, or more at today's prices. Staying at the forefront of vehicle R&D can help keep the U.S. as the world's leader in vehicle production, provide future exports, protect U.S. jobs, and improve our national energy security.

Mr. Chairman, I look forward to working with you and the members of this Committee as we pursue our mission of providing for the Nation's energy future by reducing our dependence on foreign oil. I would be pleased to answer any questions you may have.