QUESTIONS FOR THE RECORD

SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
MARCH 6 HEARING ON ENERGY USE IN THE TRANSPORTATION SECTOR

QUESTIONS FROM CHAIRMAN DOMENICI

Hydrogen Fuel Use

3. In the longer term, how we will generate all of the hydrogen we will need to meet projected transportation demand? Does nuclear energy have a role to play?

ANSWER: The issue of hydrogen generation is a Department of Energy (DOE) concern. DOT will work with DOE on matters related to the safety and security of the fueling and distribution system, independent of how hydrogen is generated.

4. Is it more likely that we will have hydrogen fueling stations, or will we see hydrogen generated in our garages from distributed energy resources?

ANSWER: It is more likely that we will see hydrogen refueling stations. However, home refueling could play a role in the future. Cost, safety, reliability, and regulatory factors will govern the development and utilization of hydrogen fueling stations and distributed production and delivery systems. The combination of production and delivery methods may differ for each regional area. DOT will work to ensure that there is a safe, functional, and secure national infrastructure available for both the consumer and commercial markets.

Alternative Fuel Vehicle Mandates

4. Is this "chicken-and-egg" problem [of requiring investment in alternative fuel vehicles and fueling infrastructure at the same time] also a problem for hydrogen and fuel cell vehicles?

ANSWER: In order to achieve a successful hydrogen economy, investment in fueling infrastructure is essential. A significant infrastructure issue is developing fueling stations that meet applicable codes and standards, while developing and deploying the unique fueling devices that will be necessary to support the long-term transition time from conventional liquid fuels to the hydrogen infrastructure.

5. If we are moving to a fuel-cell based transport fleet, should we still be interested in ethanol, biodiesel, natural gas, etc. -- or should we just use them to make hydrogen?

ANSWER: Until a fuel-cell based transportation fleet and supporting hydrogen delivery infrastructure are fully developed, we would need other forms of fuels for today's existing fleet, which would become a legacy fleet likely to be in use for several decades.

Corporate Average Fuel Economy (CAFE)

1. Should impacts on passenger safety, vehicle technology, consumer preferences, and market economics be considered when considering new fuel economy standards? Are these factors considered now?

ANSWER:

Yes, these factors should be and are considered by the Department's National Highway Traffic Safety Administration (NHTSA) when setting new fuel economy standards. Congress specified that CAFE standards must be set at the "maximum feasible level" in consideration of four factors:

(1) Technological feasibility;

(2) Economic practicability;

(3) Effect of other motor vehicle standards on fuel economy; and

(4) Need of the Nation to conserve energy.

Impacts on vehicle technology, consumer preferences, and market economies are considered under technological feasibility and economic practicability. While safety is not an express statutory criterion, NHTSA does give strong consideration to safety in determining the level at which CAFE standards should be set. The Administration supports changes in legislation to make safety an explicit criterion to ensure that safety is fully considered in future rulemakings.

2. Does the National Highway Traffic Safety Administration (NHTSA) have sufficient authority and expertise to consider these impacts? What statutory changes might be needed?

ANSWER:

NHTSA currently has the analytical expertise to consider these impacts. This was demonstrated in the recent light truck rule where the agency conducted detailed engineering and economic analyses of data supplied by light truck manufacturers and other sources to determine: (1) the fuel economy level each manufacturer was projecting for each model year; (2) technological improvements that could be added to the product plans to improve those projections; and (3) the maximum level at which fuel economy standards could be set without leading to job losses or negatively affecting vehicle safety.

In regard to statutory changes, we believe Congress should add safety and jobs to the list of express statutory criteria that the Department must consider in setting CAFE standards. While the Department considered safety and jobs in its recent rulemaking action setting new CAFE standards for light trucks, we believe Congress should include a legal requirement to assess safety and jobs impacts to ensure that these critical issues are always given the highest level of consideration.

Currently, the Department does not have the statutory authority necessary to consider and implement the full range of CAFE reforms suggested by the National Academy of Sciences CAFE committee. Accordingly, we believe Congress should provide the Department with expanded statutory authority to help ensure that the CAFE program is reformed in a way that will facilitate significant increases in fuel economy while protecting the safety and jobs of the American public. Under its current statutory authority, NHTSA will be constrained in terms of making the most effective reforms to the CAFE system.

3. Is there any reason to assume that the National Academy report on CAFE is less accurate now than it was when it was released a year ago?

ANSWER: No. In fact, NHTSA used some of the data from the National Academy of Sciences (NAS) report in its analysis supporting the recent final rule setting new light truck fuel economy standards. Further, to the extent it can under its current statutory authority, NHTSA is examining possible reforms to the CAFE system, including those recommended in the NAS CAFE report. We plan to issue an Advance Notice of Proposed Rulemaking later this year seeking public comment on a range of alternatives to the current CAFE system. Through detailed analyses and the administrative process, it is NHTSA's goal to identify and implement reforms to the CAFE system that will facilitate improvements in fuel economy without compromising motor vehicle safety or American jobs.

4. Rather than argue here in the Congress about statutory mile-per-gallon levels, shouldn't we just get out of the way and let the experts at NHTSA do their jobs?

ANSWER: In its National Energy Policy and during the legislative debates last year, the Administration took the position that fuel economy standards should be set through the administrative process and based on sound science. To avoid significant negative impacts on the economy, safety, and American jobs, the setting of fuel economy standards requires careful analysis of technological, economic, and safety considerations. This is why Congress statutorily requires NHTSA to take technological feasibility, economic practicability, and other criteria into consideration in establishing "maximum feasible" fuel economy standards.

NHTSA recently set new fuel economy standards for light trucks that were based on sound science and through the administrative process. This action marks the most significant increase in fuel economy standards in 20 years. The new standards will ensure improvements in fuel economy without negative impacts on safety and the economy. This clearly demonstrates that NHTSA has the expertise necessary to set CAFE standards and policy as guided by the statutory criteria established by Congress.

5. Should we consider CAFE credits for hydrogen vehicles as a way to encourage their manufacture and sale?

ANSWER: Under the current CAFE system, hydrogen vehicles would qualify for mileage credits that count towards a manufacturer's overall CAFE. As with other

dedicated alternative fuel vehicles, there is a different fuel economy calculation that rewards manufacturers for producing hydrogen vehicles. There is no cap on the program and it has no expiration date.

6. Should we remove the cap on CAFE credits for alternative fuel vehicles to provide a greater incentive for their sale?

ANSWER: There is no cap on CAFE credits for dedicated alternative fuel vehicles. The cap only applies to dual-fueled vehicles. Dual-fueled vehicles have the capability to operate on conventional petroleum and the capability to operate on an alternative fuel. In creating the CAFE credit incentive program for dual-fueled vehicles, Congress expressly limited the extent to which a manufacturer can avail itself of the incentive. This was done to ensure that any potential negative energy or environmental impacts from the incentive are minimized.

7. Is "miles per gallon" an appropriate efficiency metric if we are no longer using gallons in the future? Will CAFE be needed in a hydrogen-car based system?

ANSWER: The CAFE program was enacted in the mid-1970s to help reduce the Nation's dependence on foreign oil. A hydrogen-based car system is an alternative to the dependence on gasoline to power vehicles. It is not clear whether there will be a need for the continuation of the CAFE program in a hydrogen-based system. To the extent that the market for hydrogen and hydrogen-fueled vehicles works well, there may be no need for CAFE requirements.

ADDITIONAL QUESTIONS FROM CHAIRMAN DOMENICI

1. Aside from new R&D funding, what can/should Congress do to hasten development of hydrogen-fueled vehicles?

ANSWER: Aside from research and development (R&D) funding, Congress could facilitate a coordinated and focused effort for hastening the hydrogen economy by focusing on the hydrogen system from generation to end use. Congress could also support the national program of education and training the Administration has proposed (including the program at DOE), in response to recommendations in the National Energy Policy, including the benefits to the environment, public health, safety, and energy security of using hydrogen fuel.

2. Which policy actions are more important for deployment of advanced technology vehicles -- R&D, tax incentives, demonstration projects or regulations?

ANSWER: All of these policy actions can play an important and complementary role in encouraging the deployment of advanced technology vehicles. Each of these actions have been implemented and/or proposed by the Administration. R&D, tax incentives, and demonstration projects are generally more desirable than regulation because they create incentives for the adoption of advanced technologies through the open market.

3. Given the focus on hydrogen as the transportation fuel of the future, how much effort should we expend on using other alternative fuels? For example, should we use natural gas directly for transport or convert it to hydrogen first?

In the short term, investment in both hydrogen and alternative fuels complement developing the hydrogen market economy. If the hydrogen economy succeeds in the long term, investment in other alternative fuels would become less important.

4. How do you respond to claims that the Administration is focused on hydrogen in an attempt to avoid having to set higher CAFE standards?

ANSWER: There is no basis for such claims. The hydrogen initiative announced by the President is only one component of the Administration's comprehensive approach to conserving fuel in the near- and long-term. In the near term, NHTSA recently set new light truck CAFE standards that represent the most significant increase in fuel economy standards in 20 years. This action will save approximately 3.6 billion gallons of gasoline over the lifetime of these trucks, without adversely affecting passenger safety or jobs. Because the auto market has changed in the 25 years since CAFE standards were first set, NHTSA is also looking to reform the CAFE system. Reform of the existing system may provide us with an opportunity to improve safety, protect American jobs, and save more fuel.

5. Is it absolutely certain that we'll have to build a whole new hydrogen-based pipeline infrastructure? Or will hydrogen carrier fuels, such as natural gas or methanol, play a role?

ANSWER: The future need for hydrogen pipelines will be determined by the sources of hydrogen, end-use technologies, research and development, and future deployment decisions. Hydrogen bearing fuels, such as natural gas, methanol and liquid hydrocarbons, will likely play a major role in building a hydrogen-based energy utilization infrastructure. At the present time these are the only major sources of hydrogen, other than water, that can be delivered essentially anywhere, anytime, through existing infrastructure. Long distance hydrogen pipelines could be required even if fossil fuels continue to be the major source of hydrogen for fuel cell applications, depending on the economics of production and transportation of hydrogen. The other major source of hydrogen is electrolysis of water, which requires substantial supplies of electricity -- generated from a variety of primary fuels, including fossil fuels, nuclear, hydropower, solar, wind, etc.

At present, there are about 700 miles of hydrogen pipelines in the United States, of which Air Products & Chemicals Inc. operates more than 300 miles. The Department's Research and Special Programs Administration's (RSPA's) Office of Pipeline Safety (OPS) stays abreast of research and development at DOE's national laboratories on separation technologies that will allow up to 20% hydrogen to be mixed with natural gas and separated out at refueling points. This would allow for transmission of hydrogen using existing infrastructure.

RSPA/OPS is also working with DOE's Office of Energy Efficiency and Renewable Energy (EERE) in addressing the strategic initiatives for hydrogen delivery.

6. Where is the U.S. compared to Europe and Japan in terms of competitiveness for the emerging hydrogen market? Will this new initiative push the U.S. ahead of its competitors?

ANSWER: Competitiveness can be analyzed from three perspectives --- the global economy, the European Union (EU), and Japan. In considering competitiveness in the global economy, one must take into account the fact that the U.S. transportation market, unlike the EU and Japan, is, for the most part, self-regulating. Both the EU and Japan rely heavily on regulations and standards that dictate most aspects of their mobility industry. This makes it very difficult to market a product that is based upon voluntary standards and self-regulation into a heavily regulated market sector. Consequently, the competitiveness of one's product can be attenuated as a result of regional nontariff trade barriers. Arguably, the U.S./North America has the greatest concentration of hydrogen-related companies, corporations, and research/demonstration institutions/associations. However, a significant number of these are already experiencing a diminishing or negative cash flow due to difficulties in the commercialization of their products. These difficulties stem from the lack of needed technological breakthroughs, inadequate standards/recommended practices -- guidelines, lack of validation of protocols, excessive manufacturing costs, and inadequate support structure/infrastructure.

The EU, although gaining in its ability to operate as a single entity through its ability to provide compromise within its group, does not yet have the single focused critical mass that the Japanese political/industrial partner relationship has. Because of this, Japan arguably poses the greatest near-term as well as long-range challenge to U.S. prominence in a global hydrogen economy. The Japanese have charted a timeline complete with attainable milestones that rely heavily on cooperative agreements between its government and industry partners. This partnership has exercised vision, commitment, and expended significant resources to meet these milestones. Furthermore, the Japanese government-industry partnership has demonstrated success in deploying (at some risk) hybrid propulsion technology in mass-market automobiles. As part of their unified vision, they have methodically researched and committed resources into national and international standards and regulatory bodies that will dictate the future path of this emerging industry. The ability to influence international standards, global technical regulations, and their related processes, in which the U.S. is now becoming increasingly involved, will be a significant factor in determining which nations will maintain the competitive advantage.

The President’s Hydrogen Fuel initiative has the potential to push the U.S. ahead of its competition. Development of national and international rules that are favorable to U.S.-based technology and processes are critical to the U.S. gaining significant global advantage in the emerging hydrogen/fuel cell industry. Consistent long-term support with a long-term strategic vision and leadership is necessary.

9. What lessons have we learned from the demonstration projects that DOT has funded with SunLine Transit Agency and other fleets?

ANSWER: The Department's Federal Transit Administration (FTA) continues to foster research, development, and demonstration of hydrogen fuel cell buses. From the earliest efforts to demonstrate feasibility and proof of concept, through the Chicago Transit Authority's initial demonstration of three fuel cell buses, to SunLine Transit Agency's recent demonstration of three different types of fuel cell buses, FTA has developed a good deal of experience and expertise. These demonstrations have proven that, with proper training for drivers and mechanics, transit agencies can successfully operate and maintain fuel cell buses. The demonstrations have generated a good deal of interest within the industry and amongst the local communities in which the fuel cell buses have operated. Both the operators and the general public have embraced the zero-emission virtues of these fuel cell buses, their quieter operations, and their increased fuel efficiencies.

Obviously, however, there is much work to be done before a commercially viable fuel cell transit bus is realized, especially in the areas of cost, reliability, and durability. Therefore, FTA is pursuing a Hydrogen and Fuel Cell Bus Initiative to address these requirements in partnership with the transit industry, fuel cell suppliers, bus manufacturers, electric drive suppliers, and the research community. This initiative will set a strategic plan for accelerating the commercial introduction of fuel cell buses.

10. Does hydrogen pose a greater or lesser safety threat in vehicle crashes? What safeguards are needed?

ANSWER: As with any fuel, the use of hydrogen requires careful consideration in the design of the vehicle and the supporting facilities and infrastructure. There are no inherent properties or characteristics of hydrogen that makes it unsafe for application as a transportation fuel. Clearly, however, hydrogen poses different risks and safety concerns than those for gasoline, diesel, compressed natural gas, or other types of fuel. In some situations, hydrogen may be safer; in other situations, hydrogen may pose a greater risk to safety. We are confident, nonetheless, that a proper engineering design of the vehicle, facilities, and infrastructure, with the properties of hydrogen in mind, will achieve the necessary safeguards for operation, maintenance, and refueling of hydrogen vehicles.

The Department is familiar with potential safety issues pertaining to hydrogen-fueled vehicles, largely due to our familiarity with compressed natural gas vehicle systems. To augment this knowledge, the Department is working proactively with the Department of Energy to ensure that the development of hydrogen vehicle technology is safe. In addition to active involvement in codes and standards activities, we are developing a research plan to layout the concerns that hydrogen vehicles may pose. Areas of particular interest include further characterization of hydrogen leakage rates from onboard storage systems, hydrogen's propensity to disperse quickly, and the implications of hydrogen's wider flammability limits.

Current activities include participation in international codes and standards efforts. The Department, through the National Highway Traffic Safety Administration (NHTSA)

represents the U.S. on the UN/Economic Commission for Europe World Forum for Harmonization of Vehicle Regulations (WP. 29), and plays an active role in the Hydrogen/Fuel Cells Working Group.

On the domestic level, NHTSA participates in the Society of Automotive Engineers activities pertaining to hydrogen fuel cell vehicles. NHTSA also closely monitors efforts by the American Society of Mechanical Engineers and the National Fire Protection Association to develop codes and standards for pipelines, stationary storage containers, and refueling stations.

NHTSA has established agency-wide working groups to develop its research plan, and to conduct research plan activities. The information developed by NHTSA through its own research, coupled with knowledge derived from the codes and standards process, will be the basis for NHTSA standards in the future, as deemed appropriate.

11. How are we looking to "early adopters" like the military, to help accelerate the market development of hydrogen and fuel cell technologies?

ANSWER: We expect transit buses to be one of the earliest markets for the introduction of hydrogen and fuel cell technologies. Transit buses are centrally fueled and maintained, thus, they have finite requirements for infrastructure. Professional drivers operate transit buses, and professional mechanics perform the maintenance on those buses. Even the refueling is performed by trained personnel. Conversely, drivers of private and commercial automobiles expect to be able to re-fuel their vehicles anytime, anywhere. Logically, the start up market for transit buses will be quicker and less rigorous than that which will be required for personal automobiles.

As opposed to the use of personal automobiles, the fixed route and fixed schedule operation of transit buses clearly delineate their operational requirements and service area. In transit bus operations we need not be concerned about the possibilities that a vehicle would stray beyond its service area and the availability of refueling facilities. Moreover, the size and weight of transit buses ease the packaging requirements of the maturing technology, enabling earlier "real world" testing.

The development of fuel cell propulsion for transit buses has also attracted the interest of the military because of comparable size and weight requirements for its applications. Thus, FTA is coordinating certain efforts with the Department of Defense (DoD) in fuel cell vehicle technologies, building upon established relationships in both industries to further enhance the development of heavy-duty fuel cell vehicles, including, specifically, hybrid-electric transit buses and military vehicles. We expect hybrid electric technologies to provide a path for transition to the hydrogen fuel cell vehicles of the future.

Early adoption by the Federal Government would be the right first step for accelerating market adoption to new hydrogen and fuel cell technologies. RSPA's Volpe National Transportation Systems Center has maintained cooperation with the Department of

Defense (DoD) on alternate fuel vehicles for several years, and will be providing support to multiple DoD projects.

DoD cost drivers and usage applications have a different cost structure than does the civilian market. For DoD, these technologies may be cost effective much sooner. Consequently, DoD may adopt earlier and help drive the cost down through market penetration and R&D. DoD also has administrative vehicles that are captive fleets, and can operate with central refueling. DOT will still be responsible for regulating commercial transportation of fuel to military bases, and on the roads and rail system in the U.S., as well as the vehicle safety for commercial vehicles used by DoD. This is one area of potential early cooperation.

While the Federal Government should serve as "early adopters," this alone will not lead to the widespread commercial acceptance of the technology. However, it is a critical first step.

12. Has DOT considered reclassifying hydrogen from a hazardous material to a transportation fuel? Does its status as a hazardous material complicate efforts to introduce hydrogen fuel-cell vehicle technologies?

ANSWER: No. Hydrogen is a hazardous material, regardless of whether it is used as a transportation fuel. Other fuels, such as gasoline and compressed natural gas, are also hazardous materials. The Department is responsible for identifying and managing the risks presented by the transportation of hydrogen and other hazardous materials in commerce. The regulation of hydrogen as a hazardous material when transported as an article of commerce should not complicate the introduction of hydrogen fuel-cell vehicle technology, but rather will ensure that such transportation is conducted in a safe and secure manner.

13. How should codes and standards for safe handling, storage and use of hydrogen be developed? Is that process already under way?

ANSWER:

Hydrogen pipelines: Safe handling of hydrogen in pipelines and associated storage is already happening on a relatively small scale, mostly on short pipelines between industrial plants. And, hydrogen pipelines are already regulated by the Research and Special Programs Administration's (RSPA) Office of Pipeline Safety (OPS) under 49 CFR Part 192, which addresses all flammable gases, including hydrogen.

Hydrogen, of course, offers several technical issues of safety concern. For example, the small molecular size means that leaks are more likely, indicating that more attention needs to be paid to leak detection in hydrogen pipelines operating at transmission pressures. RSPA/OPS' proposed gas integrity management rule helps to address the leak detection issue. Also, hydrogen embrittlement of steel is more of a possibility for a pipeline carrying molecular hydrogen operating at higher pressures.

RSPA staff participates in the American Society of Mechanical Engineers (ASME) Hydrogen Steering Committee activities for developing various ASME standards to address design and construction of hydrogen storage and transportation systems, fuel cell standards, and coordination with international standards.

RSPA attended a DOE-sponsored hydrogen delivery workshop on May 7 – 8, 2003. This workshop determined the critical barriers and the R&D needed to resolve hydrogen delivery and feed stock issues.

Hazardous materials: Codes and standards for the safe handling, storage and use of hydrogen should be developed in a collaborative process with the input of all interested parties. The Department is actively participating in DOE's efforts to identify and develop the codes and standards necessary to support the President's Hydrogen Fuels Initiative.

The Department's Hazardous Materials Regulations (HMR) apply to the transportation in commerce of hydrogen. Under the HMR, hydrogen is classed as a flammable gas and is subject to packaging and hazard communication requirements appropriate to the hazard it presents in transportation. Hydrogen may be transported as a compressed gas in cylinders or as a cryogenic liquid in portable tanks, cargo tank motor vehicles, or rail tank cars. As is the case for gasoline, the HMR include design, manufacturing, and maintenance standards for packagings used for the transportation of hydrogen.

The process to develop codes and standards for the safe handling, storage, and use of hydrogen is multifaceted. Efforts are currently underway at both the international and domestic levels. The National Highway Traffic Safety Administration (NHTSA) is working closely with the Department of Energy to ensure that hydrogen safety is integrated into code and standard development. NHTSA is also formulating an independent research plan to develop information specific to areas of NHTSA involvement, including hydrogen vehicle safety (including onboard hydrogen storage), pipelines, and other infrastructure aspects.

NHTSA currently plays an active role in international codes and standards development. International codes and standards activities include representation of the U.S. in the United Nations Economic Commission for Europe (UN/ECE) World Forum for the Harmonization of Vehicle Regulations (WP.29). The WP.29 Working Group on Hydrogen was established in early 2002. NHTSA's objectives are to identify best practices and seek to harmonize its regulations with foreign regulations in order to improve safety and reduce costs with a global technical regulation for hydrogen-powered vehicles.

The WP.29 Working Group on Hydrogen has made progress in developing component level regulations for on-board storage tanks of liquid and compressed gaseous hydrogen. The next steps are to address the full system fuel integrity crashworthiness aspects of the regulations.

Domestically, NHTSA is participating with automobile manufacturers in standards-development activities addressing vehicle safety for hydrogen powered motor vehicles. NHTSA is also closely monitoring efforts by the American Society of Mechanical Engineers and the National Fire Protection Association to develop codes and standards for pipelines, stationary storage containers, and refueling stations. Ventilation requirements for garaged vehicles are also being developed by building code organizations. NHTSA's domestic plan will be coordinated with its international partners in order to develop harmonized international regulations that will ensure safety and minimize divergence in national requirements, thus reducing the costs of compliance.

QUESTIONS FROM SENATOR AKAKA

Carbon Dioxide Emissions and Global Change

1. Within the transportation sector, what percentage of carbon dioxide (CO_2) emissions come from vehicles with lower Corporate Average Fuel Economy (CAFE) standards, such as sport utility vehicles (SUVs) and light trucks, or diesel engines,[1] compared to passenger cars with higher CAFE standards?

Vehicle	CAFE Standard miles/gallon (a)	2000 CO_2 Emissions (teragrams of CO_2 equivalent)	Percent of Total U.S. Transportation Emissions (b)	Percent of Total U.S. Emissions (c)
Passenger cars	27.5	691.7	38.6	11.8
Light Duty Trucks (d)	20.7 (e)	369.4	20.6	6.3

Notes:
a. Fleet average, new model car
b. Total transportation CO_2 emissions in 2000 = 1,792.2
c. Total U.S. CO_2 emissions in 2000 = 5,840.0
d. Light Duty Trucks includes SUVs, vans, and pickup trucks
e. New standard goes into effect with the 2005 model year

Emissions data is from: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000,* April 15, 2002.

2. If CAFE standards were increased for SUVs and light trucks or diesel engines in the U.S., would you predict any measurable outcomes for reducing (a) carbon dioxide loading in the atmosphere; (b) impacts on atmospheric warming; or (c) the rate of sea

[1] There are no CAFE standards specified for types of engines.

level rise? More generally, what other results could be correlated with reduced emissions from the transportation sector?

ANSWER: CAFE standards are set for different vehicle classes (e.g., cars, trucks), rather than for engine types (e.g., diesel, gasoline). DOT issued a new CAFE rule for light trucks on March 31, 2003, that increases light truck fuel economy to 22.2 miles per gallon (MPG) by model year (MY) 2007. This action will save approximately 3.6 billion gallons of gasoline over the lifetime of these vehicles. The gasoline savings translate into a small reduction of 9.4 MMTCe CO_2 emissions over the lifetime of the fleet. For calendar years 2005, 2010, 2015, and 2020, estimated decreases in CO_2 emissions from light trucks ranged between 0.019 percent and 0.127 percent of total U.S. transportation CO_2 emissions. The rule produces several other positive results, including decreases in some particulate matter and sulfur oxide (SO_x) emissions, increased energy independence, and other environmental benefits.

In general, increased vehicle fuel economy and thus lower overall fuel consumption has a direct relationship in reducing carbon dioxide emissions. However, understanding how carbon dioxide emissions relate to carbon dioxide concentrations (loading) in the atmosphere is outside the Department's mission. Within the Federal Government, the Climate Change Science Program Office is coordinating the investigation of such questions about how greenhouse gas emissions relate to atmospheric greenhouse gas concentrations.

Beyond fuel economy standards for highway vehicles, improvements in the overall transportation system can lead to system-level efficiency gains and thereby reduce greenhouse gas emissions. DOT is actively involved not only in fuel economy and technology programs to reduce vehicle emissions, but also in developing programs such as Intelligent Transportation Systems that will improve the efficiency of the transportation system as a whole.

3. In addition to automobiles, what other transportation sectors should we consider priorities for reducing carbon dioxide emissions?

ANSWER: The Department is currently working to identify strategies that will reduce greenhouse gas emissions from all the transportation modes. DOT will continue to develop programs to improve energy efficiency and reduce carbon dioxide emissions from all transportation sectors. In addition to highway vehicle programs, DOT has programs to improve energy efficiency and reduce greenhouse gas emissions in the aviation, transit, marine, and rail sectors.

Along with emerging activities that aid the development of a hydrogen-based transportation system, the Department is currently involved in a number of programs to develop fuel-cell and other advanced vehicle technologies. FTA and the Federal Highway Administration (FHWA) have already put hydrogen fuel cell buses on the road in demonstration projects, and FTA is working to integrate these vehicles into commercial fleets in several cities. DOT expects transit buses to be one of the earliest

markets for the introduction of hydrogen and fuel cell technologies, due to their finite requirements for infrastructure, clear delineation of operational requirements and service area, and their large size and weight, which ease the packaging requirements of the maturing technology, enabling earlier "real world" testing. DOT has six fuel cell buses currently in on-road testing, and seven additional transit buses will be entering demonstrations at Santa Clara VTA, AC Transit, and SunLine Transit in 2004. Similarly, the Maritime Administration (MARAD) and Federal Railroad Administration (FRA) are exploring fuel cell uses in ships and trains. As part of the U.S. effort, DOT is currently working with ICAO and IMO to develop strategies to reduce greenhouse gas emissions from the aviation and marine sectors.

Fleet Demonstration Programs

There has been discussion concerning the role of fleet vehicles -- particularly transit buses -- as a stepping stone to the deployment of personal vehicles. Compared to automobiles, transit buses are an easier application for fuel cell technology—in terms of size, weight, cost, and performance. They also offer the advantage of a central fueling operation and can act as a key milestone to gauge success in our ability to deploy fuel cell automobiles.

1. Do you agree that the transit bus and fleet vehicle applications should or will precede the automobile market?

ANSWER: Transit bus and fleet vehicle applications are ideally positioned to lead the introduction of fuel cells into surface transportation. Transit buses are centrally fueled and maintained, thus, they have finite requirements for infrastructure. Professional drivers operate transit buses, and professional mechanics perform the maintenance on those buses. Even the refueling is done by trained personnel. Conversely, drivers of private and commercial automobiles expect to be able to re-fuel their vehicles anytime, anywhere. Logically, the start-up market for transit buses will be quicker and less rigorous than that which will be required for personal automobiles.

Compared to the use of personal automobiles, the fixed route and fixed schedule operation of transit buses clearly delineate their operational requirements and service area. In transit bus operations we need not be concerned about the possibilities that a vehicle would stray beyond its service area and the availability of refueling facilities. Moreover, the sizes and weights of transit buses ease the packaging requirements of the maturing technology, enabling earlier "real world" testing. Additionally, since transit buses operate in densely populated areas and are highly visible to the public, they will provide a broad exposure to the benefits of hydrogen technology. We expect an earlier introduction of hydrogen fuel cell buses to help pave the way for successful commercialization of fuel cells in the automobile market.

2. What kind of coordination is occurring between the Departments of Transportation and Energy regarding the demonstration fleet vehicles including transit buses? Please

describe the respective programs and roles of the Department of Transportation and Energy relating to the development and implementation of fleet demonstration programs.

ANSWER: FTA continues to foster the research, development, and demonstration of hydrogen fuel cell buses. FTA and DOE worked closely together in demonstrating the feasibility of fuel cells to provide the necessary power for buses. FTA's and DOE's joint efforts led to the successful development and demonstration of three test bed buses. At the conclusion of these initial efforts, DOE, at the direction of Congress, focused its efforts on light-duty vehicles—cars and light trucks. Congress directed FTA to continue the development of fuel cell buses—which are heavy-duty vehicles. This division of labor takes advantage of each agency's experience and expertise to enhance the acceleration of the technology. Given the obvious synergy between the two efforts, however, FTA and DOE are continuing to collaborate with each other to advance the technology in tandem. Both agencies are key, active partners of the California Fuel Cell Partnership, which is the inaugural demonstration effort for fuel cell vehicles—both cars and buses. Indeed, the California Fuel Cell Partnership exemplifies the effective working relationship whereby FTA takes a lead role in fuel cell buses with DOE support for infrastructure issues, and DOE takes a lead role in fuel cell cars with DOT/FTA support for vehicle and infrastructure safety issues.

Similarly, FTA's Hydrogen & Fuel Cell Bus Initiative has received positive support from DOE. The Hydrogen & Fuel Cell Bus Initiative is a broad-based, national effort to coordinate, consolidate, and rationalize the diverse efforts in hydrogen and fuel cell buses to accelerate the commercial viability of these technologies, and help apply the hydrogen and fuel cell technologies to other forms of transportation. This particular initiative is seeking dramatic improvements in the energy efficiency, emissions, performance, and cost-effectiveness of the 40-foot heavy-duty transit bus, the most prevalent vehicle in transit agency use in the United States. Improvements to this 40-foot transit bus platform will benefit other transit and heavy-duty vehicle platforms, as well as other applications. This initiative perfectly complements and supports the President's FreedomCAR and Hydrogen Fuel Initiatives that are focused on light-duty vehicles: cars and light trucks. FTA's Hydrogen & Fuel Cell Initiative builds upon well-established, collegial relationships with DOE in both fuel cell vehicles and supporting infrastructure. Likewise, FTA's Hydrogen & Fuel Cell Initiative complements and supports DoD's efforts in fuel cell vehicle technologies for military application, building upon existing relationships in the industries to further their coordination and collaboration in heavy-duty fuel cell vehicles.

The necessary research, development, and demonstration efforts under FTA's Hydrogen & Fuel Cell Bus Initiative will be conducted under a Fuel Cell Bus Technologies (FCBT) Program. Specifically, the FCBT program is comprised of research and development; a national demonstration; data collection, evaluation, and information sharing; and training. Projects will be merit selected under a broad-based, competitive, public-private partnership approach using available contracting mechanisms and other types of transactions. Peer program reviews will be conducted under the FCBT.

Also, FTA's Clean Bus Deployment (CBD) Program provides a critical bridge between research, development, and demonstrations (the Fuel Cell Bus Technologies Program) and the mainstreaming of innovative clean buses into routine revenue service operations under the Hydrogen & Fuel Cell Initiative. Under the CBD Program, FTA will provide incentives to transit agencies in areas in non-attainment or maintenance for the National Ambient Air Quality Standards to purchase clean buses that advance the pathway to fuel cell buses. The CBD Program has the potential to affect a large number of transit bus purchases, enabling the deployment of several hundreds of advanced propulsion technology buses, thereby hastening the market for these technologies and allowing economies of scale to have a positive effect on pricing.

QUESTIONS FROM SENATOR BINGAMAN

QUESTION: What is the Department of Transportation doing to address the issue of safe handling of hydrogen? Where are we in our talks with the insurance industry as far as getting to a point in which the industry will consider insurance not only of these new hydrogen fuel cell vehicles themselves, but also the vehicles involved in transporting the fuel and related infrastructure?

ANSWER: The Department has established a departmentwide hydrogen fuels working group in support of its recognized responsibilities for transportation vehicle and infrastructure safety in all modes of transportation, and DOT's established regulatory authorities and responsibilities. The working group is chaired by the Administrator of the Research and Special Programs Administration. We expect to discuss all issues relevant to the safe and secure transportation of hydrogen in commerce.

QUESTION: In the near- to mid-term, increases to our vehicle fuel economy is one of the most viable and immediately accessible options for increasing the efficiency of petroleum-based fuels in our transportation sector. Given that carmakers have already embraced a number of more efficient vehicle technologies in products now coming into the marketplace (e.g., continuously variable transmissions; hybrid electric engines), what would be the argument against a national policy to use these technologies to reduce gasoline demand and increase our national security, instead of sitting by while they are used simply to increase vehicle weight even more and keep us in our current state of import dependence?

ANSWER: CAFE standards are presently determined taking new technologies, their costs, and manufacturer lead-time into account. In its recent light truck rulemaking, NHTSA conducted detailed analyses of manufacturers' product plans to determine which, and to what extent, advanced technologies could be utilized to improve upon the manufacturers' fuel economy projections. The resulting final rule, which was based on the increased application of advanced technologies, represents a significant increase in the fuel economy standard for light trucks. In fact, the 1.5 mpg increase (from 20.7 mpg to 22.2 mpg) during model years 2005-2007 more than doubles the increase in the light truck CAFE standard that occurred between model years 1986 and 1996, when it increased from 20.0 mpg to 20.7 mpg. The new light truck CAFE standards will save

approximately 3.6 billion gallons of gasoline over the lifetime of these trucks, without adversely affecting passenger safety or jobs.

Currently, the cost of some available technologies, such as hybrid vehicles, is a major obstacle to their large-scale penetration in the vehicle fleet. This is why the President has proposed tax incentives for the purchase of hybrid and fuel cell vehicles totaling more than $3 billion. Hybrid vehicles are a promising option for increasing new personal vehicle fuel economy without any tradeoffs in size, safety, performance, or emissions. However, hybrid vehicles are currently considerably more expensive due to R&D costs, extra components needed, and low economies of scale. Hybrids that increase fuel economy by 30% or more may cost manufacturers up to $5,000 more to produce; at this level most consumers will not get "paid back" in future fuel savings. The goal of a tax incentive program is not a permanent subsidy of a non-sustainable technology, rather the objective is to provide a temporary subsidy that will help manufacturers and consumers alike "jump-start the market" and launch a technology that will likely prove to be sustainable on its own merits in the long run.