Testimony to the United States Senate Committee on Environment and Public Works Legislative Hearing on America's Climate Security Act of 2007

IS CAP-AND-TRADE A SUFFICIENT CARBON POLICY FOR TRANSPORTATION?

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Good afternoon. Thank you for inviting me to discuss the adequacy of greenhouse gas (GHG) cap-and-trade as a policy for mitigating GHG emissions from the transportation sector, and the need for additional policy measure for the transportation sector. The views I express today will be entirely my own and do not necessarily reflect the views of Oak Ridge National Laboratory or the Department of Energy.

Our transportation system is the largest in the world. Each second, it burns 6,300 gallons of oil, producing more climate changing carbon dioxide emissions than any other nation's entire economy, except China (EIA, 2007, table H.1co2). The transportation sector was responsible for 28% of total U.S. greenhouse gas emissions in 2005 (USEPA, 2007a, table 2-16). Climate policy must effectively address the mitigation of emissions from transportation. Other policies will be needed in addition to a cap-and-trade system in order to make the reductions in GHG emissions that are likely to be necessary.

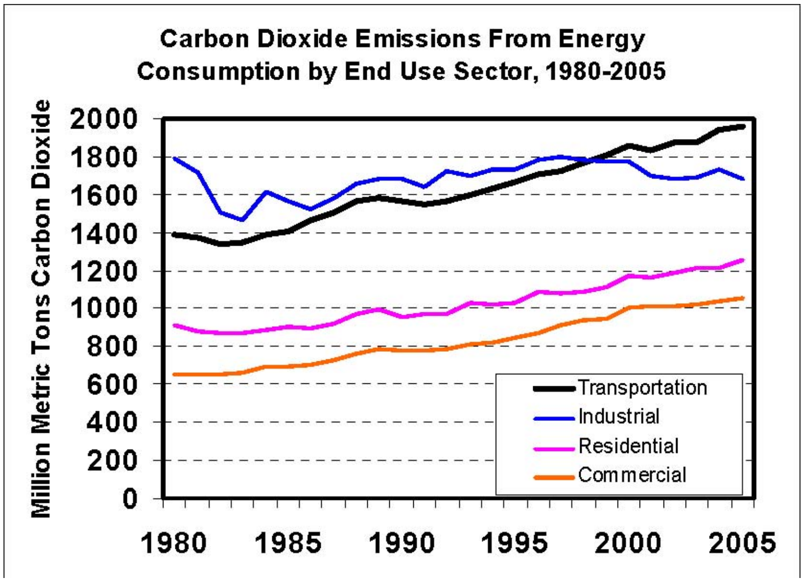

Figure 1. U.S. Carbon Dioxide Emissions by Energy End Use Sector, 1980-2005

Source: US EPA, 2007a. A policy that sends an economy-wide price signal to reduce greenhouse gas emissions, as the GHG cap-and-trade system of the America's Climate Security Act of 2007 will do, is the essential cornerstone of a meaningful climate change strategy. Analyses by the Department of Energy's Energy Information Administration (EIA, 2006), for example, estimate that such policies will bring about major reductions in GHG emissions from electric power generation (figure 2). Unfortunately, the same level of economic incentives that could cut electric utility GHG emissions in half by 2030 would have a much smaller impact on transportation's GHG emissions.

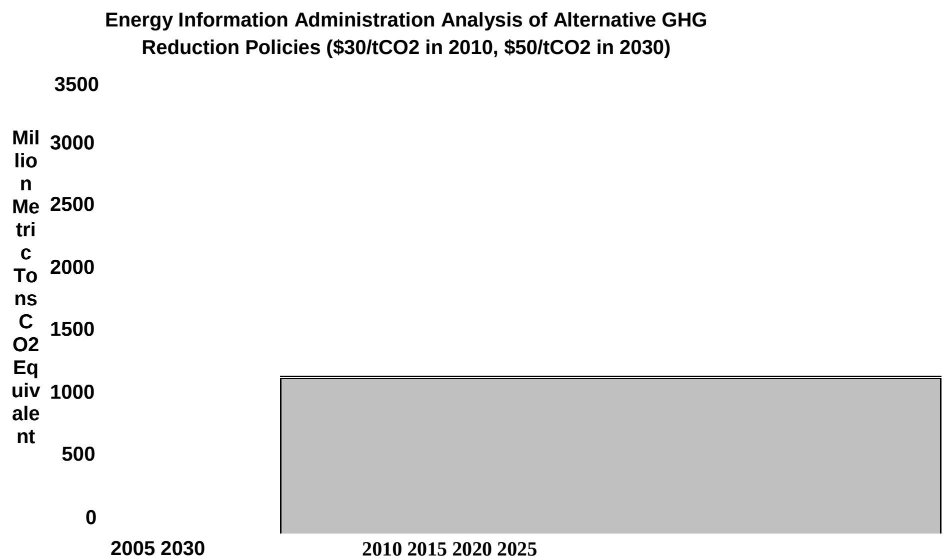

Figure 2. Energy Information Analysis of the Impacts of Carbon Prices on Greenhouse Gas Emissions from the Electric Power and Transportation Sectors through 2030.
Source: EIA, 2006.

A carbon price of $30 to $50 per ton of CO_2 equivalent greenhouse gas emissions, such as analyzed in the EIA study, translates into roughly $0.25 to $0.50 per gallon of gasoline. This is not a trivial price signal and it will help reduce demand for fossil carbon fuels and encourage energy efficiency.[1] However, recent statistical analyses (e.g., Small and Van Dender, 2007; Hughes et al., 2007) have shown that price signals of this magnitude will have constructive but insufficient impacts on vehicle travel and fuel consumption. It is important to understand why this is so, and to implement additional policies for transportation that can cost-effectively achieve the magnitude of reductions in transportation greenhouse gas emissions that are needed.

Fuel economy is relatively insensitive to the price of fuel because the market for fuel economy is not efficient. A recent national random sample survey of 1,000 U.S.

[1] The America's Climate Security Act of 2007 appropriately recognizes that steps must be taken to offset the regressive impact of carbon prices on lower income households.

households found that 39% did not consider fuel economy at all in their last vehicle purchase (Opinion Research, 2007). Of those who did, only 14% mentioned taking economic factors, like annual fuel costs or gasoline prices into consideration. In depth interviews of the car buying histories of 57 California households (Turrentine and Kurani, 2005) turned up none that had ever considered the value of fuel savings over the life of a vehicle, or that used concepts like a payback period when considering fuel economy. When I served on the National Academy of Sciences Committee on the Effectiveness and Impact of Corporate Average Fuel Economy Standards (NAS, 2002), manufacturers told us they believed consumers would pay for only 2-4 years of fuel savings. Survey evidence backs them up (Opinion Research, 2004). In a 2004 survey, half the respondents were asked how much they would be willing to pay for a more fuel efficient new vehicle that would save them $400 per year in fuel. The other half were asked how much a vehicle would have to save them in fuel each year to justify paying $1,200 more for it. The payback periods implied by the answers from the two groups were strikingly similar. Consumers wanted to be paid back in 1.5 to 2.5 years (figure 3). The expected lifetime of a U.S. passenger car or light truck is 15 years, or more (Davis and Diegel, 2007, tables 3.8 and 3.9).

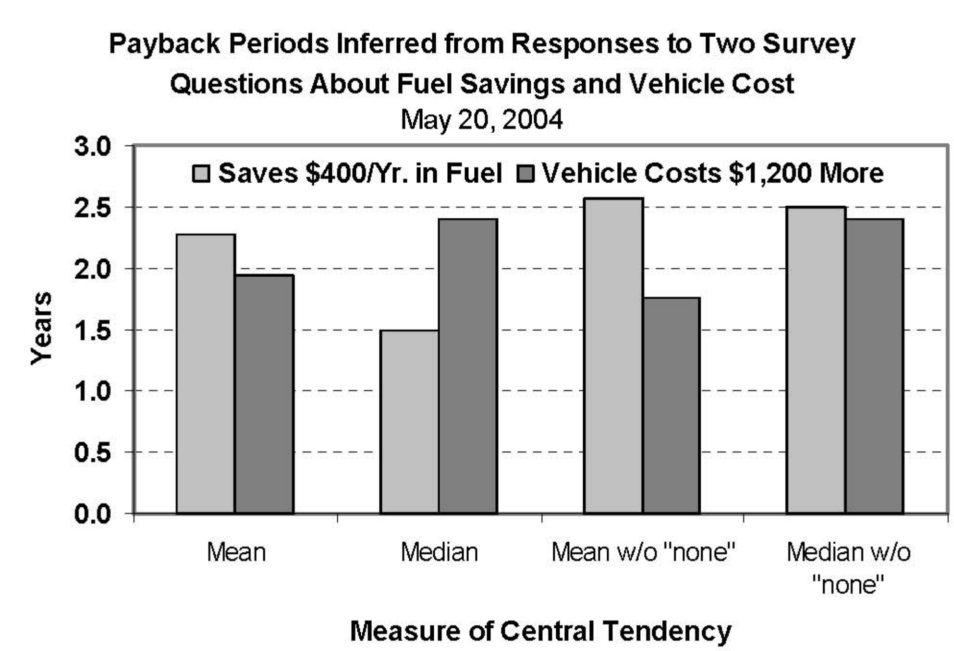

Figure 3. Consumers stated payback periods for increased automobile fuel economy. Source: Opinion Research Corporation, 2004.

Consumers are not irrational. The value of future fuel savings is highly uncertain, and consumers are in general loss-averse (Tversky and Kahneman, 1992). The economic value of increased fuel economy to a car buyer is the difference between the present value of future fuel savings and the price that must be paid for it at time of purchase. Using fuel economy cost data from the 2002 NAS study, figure 4 shows the expected fuel savings, increased vehicle cost and net present value for increasing the fuel economy of an average U.S. passenger car from 28 to 46 miles per gallon. While the value of fuel savings increases to more than $2,000, the expected net value is much smaller, varying between $500 and -$500. Between 32 mpg and 38 mpg, there is no more than a $100 difference in expected net value. But the value of future fuel savings is uncertain. The price of fuel, the fuel economy that will be achieved in real world driving, annual usage, the life of the vehicle, all of these factors and more are uncertain. From this perspective increased fuel economy looks like a risky bet to a car buyer. From the perspective of a typically loss-averse consumer, the expected $400 net benefit of increasing fuel economy from 28 to 35 mpg, because of uncertainty and loss aversion, turns out to have a value of -$30 (Greene, German and Delucchi, 2007). To the typical consumer, there is little reason to calculate the value of increased fuel economy, and no responsible automobile manufacturer would spend billions of dollars to retool and redesign its product lines to provide fuel economy for which consumers are not willing to pay.

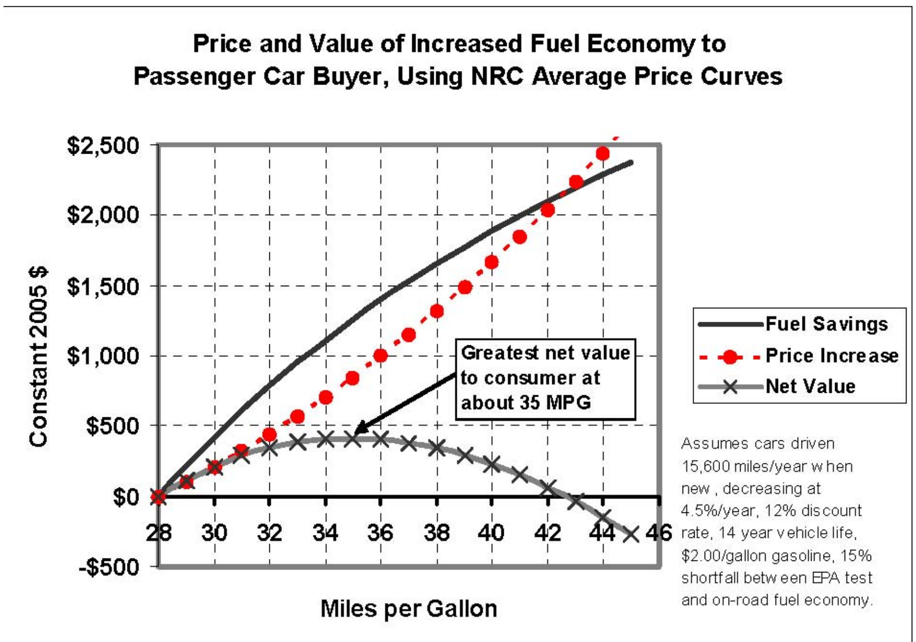

Figure 4. Price, Present Value of Fuel Savings and Net Value of Fuel Economy.
Source: authors calculations based on NRC, 2002.

This is why the world's major economies, the European Union, Japan, China, Canada and the United States, even those with fuel prices substantially higher than the U.S., have all implemented fuel economy standards for light-duty vehicles (An et al., 2007). Like the markets for energy efficiency in other durable consumer goods such as refrigerators or air conditioners, the market for automotive fuel economy is not efficient. As in these other markets, consumers do not fully value the savings fuel economy improvements provide over the lifetime of a vehicle. Because car buyers are generally not willing to pay the full value of fuel economy improvements, manufacturers do not provide them.

Fortunately, fuel economy standards work (Greene, 1998). Past fuel economy standards raised the fuel economy of U.S. light-duty vehicles by 50% (figure 4.) saving U.S. motorists approximately 60 billion gallons of fuel in 2005 (figure 5). Fuel economy standards are not the only policy that can correct the fuel economy market failure. A market-based policy, called "feebates" also has great promise (Greene, et al., 2006). A feebate system would reward vehicles with greenhouse gas emissions below a target fuel consumption (gallons per mile) value and charge a fee to vehicles above it. The amount of the rebate or fee would depend on the amount by which the vehicle's fuel consumption deviated from the target level. The target itself can be a function of vehicle attributes, such as the NHTSA's footprint metric. A significant advantage of feebates over fuel economy standards is that they provide a continuing incentive to develop and implement advanced fuel economy technology.

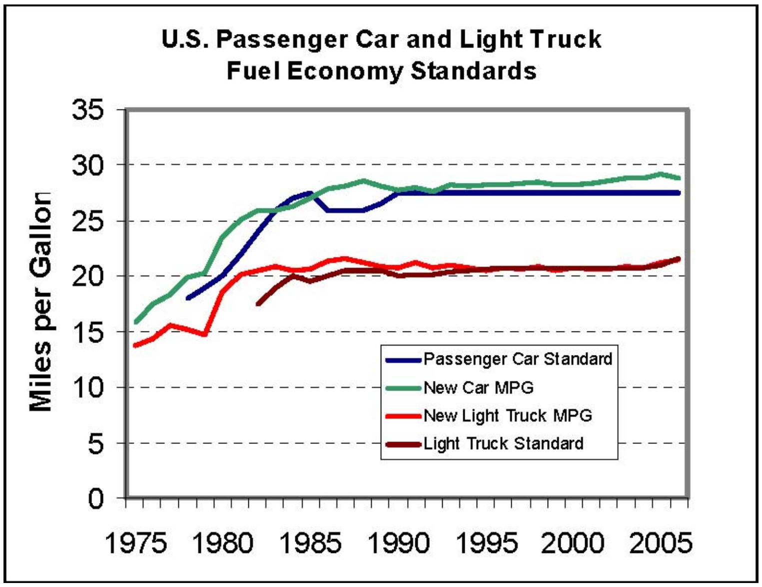

Figure 5. U.S. Passenger Car and Light Truck Fuel Economy and Standards. Source: Davis and Diegel, 2007; US EPA, 2007b.

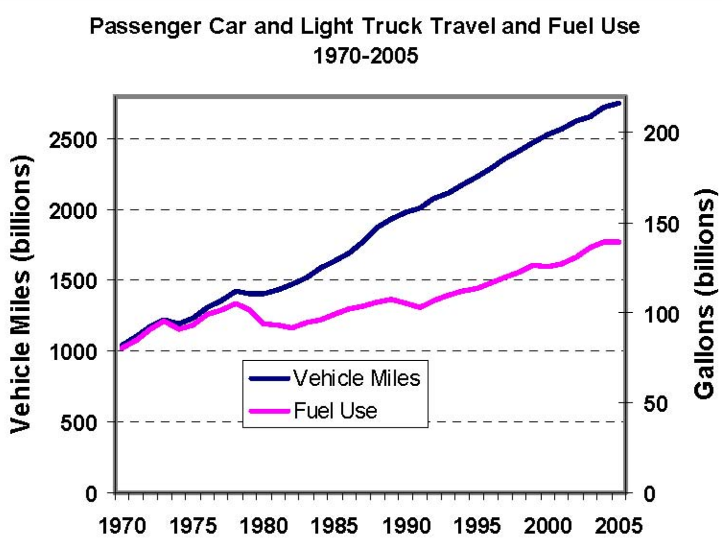

Figure 6. U.S. Passenger Car and Light Truck Travel and Fuel Use, 1970-2005. Source: FHWA, 2005; Davis and Diegel, 2007.

Medium and heavy trucks and buses account for 20% of transportation's greenhouse gas emissions (EPA, 2007, table 2-17). In the past, we have assumed that these markets do function efficiently and that there is no need for heavy vehicle fuel economy standards. The Japanese government, directly challenging that assumption, set weight-based fuel economy standards for heavy trucks in March 2006 (Goto, 2007). The standards call for an average 12% increase in new heavy truck fuel economy over the 2002 level by 2015. In my opinion, we should investigate this option, as well. Significant energy efficiency improvements are also possible in air travel, rail and shipping. According to the International Air Transport Association aircraft CO_2 emissions could be reduced by 12% through improved air traffic management, and by 6% through operational improvements that could be made by airlines and airports (JITI, 2007). The Advisory Council for Aeronautics Research in Europe has set a goal of reducing the fuel consumption of new commercial aircraft by 50% by 2020 (JITI, 2007).

Land Use and Transportation Infrastructure

Another important reason we should not expect a cap-and-trade policy alone to bring about an efficient reduction in transportation GHG emissions is the central role that local, state and national governments play in providing and operating transportation infrastructure and influencing development. The geographic distribution of people and places, especially the density of development, strongly influences the demand for transportation. The way settlements are designed – whether neighborhoods have sidewalks and bikepaths, whether homes are within walking distance of shops or public transportation – influences both the amount of travel and the modes chosen. To have the greatest beneficial impact on travel in metropolitan areas, development policies should be coordinated with investments in public transportation. Changes in the spatial structure of the built environment take time but can pay large dividends. Based on a review of the literature, it appears that vehicle travel could be reduced by about 5% in 10 years and by 10% in 25 years, versus what it would otherwise have been (Greene and Schafer, 2003). Given more time, even greater impacts should be achievable.

Low Carbon Fuels

How strongly the cap-and-trade policy will affect the carbon content of transportation fuels is not yet clear. Without a doubt, the GHG permit price will provide an economic incentive to reduce the carbon content of transportation fuels. However, especially in the early years, permit prices may not be sufficient to cause significant reductions, nor will they reflect the need of the nation to reduce its dependence on petroleum.

In 2006, the U.S. used 5.5 billion gallons of fuel ethanol, more than a three-fold increase over the year 2001. Still, ethanol supplied only 2.5% as much energy for transportation as gasoline. The Renewable Fuels Standard calls for a further increase in renewable fuel use to 7.5 billion gallons by 2012, although the EPA projects that renewable fuel use will exceed 11 billion gallons in that year (EPA, 2007c). But the greenhouse gas impacts of renewable fuels vary greatly depending on precisely how they are produced and the feedstocks used (Farrell et al., 2006). Biofuels unquestionably have a role to play in reducing GHG emissions, as well as U.S. oil dependence. However, the best strategy for using biomass to power transportation vehicles is not yet clear. In view of that, a low carbon fuels standard appears to be a better option than a renewable fuels mandate. The advantage of a low carbon fuels standard is that it does not dictate to fuel suppliers how they should reduce the fossil carbon content of their fuels. Instead, it allows them to use their ingenuity to find the most economically efficient solution.

Research and Development

In the future, much greater reductions in emissions could be achieved with advanced technologies. Researchers at the Massachusetts Institute of Technology's Sloan Automotive Laboratory have estimated that by 2030 advanced internal combustion engine vehicles with the same size and performance as model year 2005 vehicles could achieve 80% better fuel economy (Kasseris and Heywood, 2007). MIT researchers also estimate that advanced hybrids could achieve three times the miles per gallon of today's internal combustion engine vehicles (Kromer and Heywood, 2007) (Figure 7). Beyond 2030, when our electricity sector is substantially de-carbonized, plug in hybrid vehicles could further reduce GHG emissions from motor vehicles. If carbon capture and storage is successful, hydrogen fuel cell vehicles may someday drive motor vehicle GHG emissions to zero. None of these technologies is ready for commercialization today. Substantial investments in research and development are necessary for reductions in transportation's GHG emissions of 50% to 80% over current levels to be achievable by 2050.

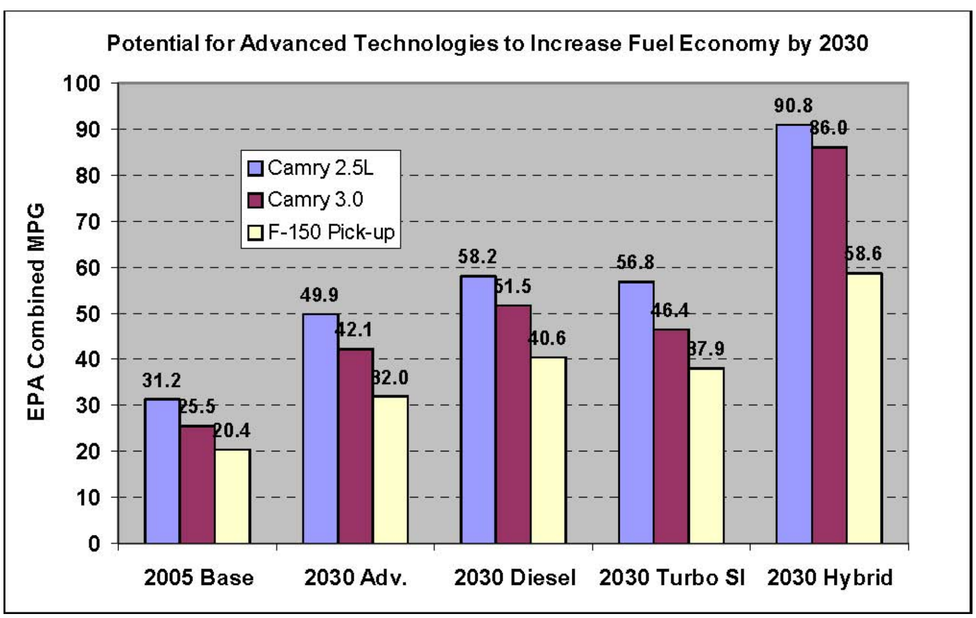

Figure 7. Potential for Advanced Technologies to Increase Automotive Fuel Economy by 2030 Based on MIT Analyses.

Sources: Kasseris and Heywood, 2007; Kromer and Heywood, 2007.

Concluding Observations

Creating an economy-wide price signal to reduce greenhouse gas emissions, as a capand-trade system will do, is the cornerstone of a comprehensive climate change strategy. However, cap-and-trade is not a sufficient policy for the transportation sector. An efficient response from transportation will be hindered by deficiencies in the market for fuel economy, together with the central role of land development policies and transportation infrastructure investments in driving demand for transportation. Fuel economy policy is essential. Intelligent land use and infrastructure policies that enhance the attractiveness of walking, biking, and public transport can also make an important and potentially critical difference by 2050. At present, it is not known how effective a cap-and trade system can be in reducing the carbon content of transportation fuels. Especially in the early years, a low carbon fuel standard may be needed. Ultimately, significant technological advances will be required if transportation's GHG emissions are to be reduced by 50% to 80% over current levels by 2050.

Thank you for the opportunity to present my views on this enormously important legislation.

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