Testimony on CAFE Program Reforms

Prepared by

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Washington, DC

For

Senate Committee on Commerce, Science, and Transportation

Subcommittee on Surface Transportation and Merchant Marine

May 9, 2006

Mr. Chairman,

Thank you for inviting me to testify. My name is Philip Sharp and I am president of Resources for the Future (RFF), a nonpartisan, social science think tank that has dealt with energy and resource issues for more than 50 years. As an institution, however, RFF does not take positions nor engage in advocacy, so the opinions expressed here are my own.

For the record, I have been involved with fuel economy issues in several ways.

During my service in Congress and on this committee (1975–1995), I participated in the creation of the Corporate Average Fuel Economy (CAFE) policy and in the few legislative changes made since then.

More recently, I was a member of the CAFE review panel sponsored by the National Research Council, an arm of the National Academy of Sciences. Its 2002 report recommended the government take further action to improve passenger-vehicle fuel economy and suggested possible reforms in the CAFE policy. (See: Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards at www.nap.edu)

Currently, I am also a member of the National Commission on Energy Policy, a private bipartisan panel funded by the Hewlett Foundation, which in 2004 recommended a significant increase in CAFE standards along with reforms to the current policy.
(See: Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges at www.energycommission.org.)

Both the Academy committee and the Energy Commission recommended federal action to improve fuel economy for the purpose of mitigating two major concerns: oil security and growing carbon dioxide (CO_2) emissions.

Our growing consumption of oil, concentrated in the transportation sector, entails major risks associated with our dependence on the global oil market. And this consumption is a major contributor of CO_2 to the atmosphere and hence to global climate change.

Among oil-market concerns is the possibility of a serious supply disruption caused by political turmoil or terrorism with severe economic consequences; the pressure to compromise important U.S. foreign policy goals for the sake of oil supply; the possibility that oil production will peak and dramatically intensify global competition for supplies; and other issues.

Among the uncertainties we face is where oil prices will go in the years ahead. Just as the dramatic rise in oil and natural gas prices over the last two years was not predicted, it is now unclear whether oil prices will rise further, drop back in the $40-per-barrel range as some have predicted, or take a real nose dive as they did in 1986 and 1999.

The history of price uncertainty has meant a history of on-again, off-again interest by consumers, investors, and government in fuel efficiency.

In the face of such uncertainty, many, including the Bipartisan commission, have concluded that it is prudent for the United States to maintain policies that push markets to improve fuel efficiency, to advance alternative fuels, and to expand public transit options in order to mitigate against global market risks and to reduce CO_2 emissions growth.

Action now by Congress on fuel economy standards obviously will have no immediate impact on gasoline prices. Indeed, it will take some years for changes in the policy to have an impact at all.

But action now on fuel economy standards can help the United States address our long-term national interests.

CAFE is currently getting a lot of attention because people are looking for immediate relief from high prices at the pump, but there is no fast or cheap way to escape the risks of oil dependence. Undoubtedly, one of the most expedient ways to reduce dependence would be to welcome higher oil and gasoline prices rather than decry them – an unlikely prospect for today's consumers or leaders.

The Academy Report

Let me call your attention to a few of the findings and recommendations of the Academy committee, which may be useful in your consideration today. Attached, as Appendix A, is a portion of that report.

The study notes in Finding 5, "technologies exist that if applied to passenger cars and light duty trucks, would significantly reduce fuel consumption within 15 years."

It notes in Finding 6 that much of this could be accomplished with the consumer breaking even – meaning that the savings in gasoline costs would offset the added cost to a new vehicle. And that calculation was made assuming gasoline only costs $1.50 per gallon. Furthermore, the hybrid car has greatly advanced since the report; given its costs in 2001, the committee did not consider it a realistic near-term option.

The committee recommended several possible CAFE reforms (Recommendation 2), such as trading fuel economy credits, which has also been a recommendation of RFF researchers (see Fischer, Carolyn and Paul R. Portney, 2004, "Rewarding Automakers for Fuel Economy Improvements," chapter 6 in *New Approaches on Energy and the Environment: Policy Advice for the President*, RFF Press).

The committee cautioned that a major redesign (Recommendation 3) required more study than the committee had been able to devote to it.

To avoid harmful effects on companies, on employment, and on consumers, the committee suggested allowing plenty of time for industry to meet stiffer requirements.

And finally, the government should continue to fund research on breakthrough technologies.

Delegation to NHTSA

Neither the National Academy committee nor the Energy Commission was willing or able to agree on recommended numerical CAFE targets – in part, because the task is a complex one and, in part, because the targets represent tradeoffs among various societal values and therefore are a political decision.

The commission, in fact, recommended delegation of that responsibility: " Congress should instruct NHTSA to significantly strengthen federal fuel economy standards…to take full advantage of the efficiency opportunities provided by currently available technologies and emerging hybrid and advanced diesel technologies" (see Appendix B).

Given the considerable burden of legislating in this area, it seems appropriate that setting the targets and redesigning the policy could be delegated to the National Highway Safety Transportation Authority with legislative guidance and strong congressional oversight.

Possibilities for policy redesign were laid out before the House Committee on Energy and Commerce last week by my colleague, Dr. William Pizer (see Appendix C).

Conclusion

CAFE has been a very imperfect, but important, policy in dealing with fuel consumption. The Academy concluded, in 2002, that our oil imports would have been 2.8 million barrels a day higher had the policy not existed. (See Finding l in the attached Appendix A).

Many experts believe that a more effective approach to reducing fuel consumption – and a more cost-effective approach for the U.S. economy – would be stronger gasoline tax or oil tax, either as an alternative to CAFE or in conjunction with CAFE. The impact would not only encourage consumers to purchase more efficient vehicles but also encourage them to be more economical in their driving, a critical component that CAFE does nothing to address. Indeed, such a tax would have a more rapid impact on consumption than is possible through CAFE alone. These experts, of course, are not subject to popular election.

Mr. Chairman, after 20 years of stalemate on fuel economy issues, we finally have a moment where change is possible. Let's do it!

APPENDIX A

Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards

Committee on the Effectiveness and Impact of Corporate
Average Fuel Economy Standards (CAFE)

Board on Energy and Environmental Systems
Division on Engineering and Physical Sciences

Transportation Research Board

National Research Council

2002

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Excerpted from the
EXECUTIVE SUMMARY

FINDINGS

Finding 1. The CAFE program has clearly contributed to increased fuel economy of the nation's light-duty vehicle fleet during the past 22 years. During the 1970s, high fuel prices and a desire on the part of automakers to reduce costs by reducing the weight of vehicles contributed to improved fuel economy. CAFE standards reinforced that effect. Moreover, the CAFE program has been particularly effective in keeping fuel economy above the levels to which it might have fallen when real gasoline prices began their long decline in the early 1980s. Improved fuel economy has reduced dependence on imported oil, improved the nation's terms of trade, and reduced emissions of carbon dioxide, a principal greenhouse gas, relative to what they otherwise would have been. If fuel economy had not improved, gasoline consumption (and crude oil imports) would be about 2.8 million barrels per day greater than it is, or about 14 percent of today's consumption.

Finding 2. Past improvements in the overall fuel economy of the nation's light-duty vehicle fleet have entailed very real, albeit indirect, costs. In particular, all but two members of the committee concluded that the downweighting and downsizing that occurred in the late 1970s and early

1980s, some of which was due to CAFE standards, probably resulted in an additional 1,300 to 2,600 traffic fatalities in 1993. [2] In addition, the diversion of carmakers' efforts to improve fuel economy deprived new-car buyers of some amenities they clearly value, such as faster acceleration, greater carrying or towing capacity, and reliability.

Finding 3. Certain aspects of the CAFE program have not functioned as intended:

- The distinction between a car for personal use and a truck for work use/cargo transport has broken down, initially with minivans and more recently with sport utility vehicles (SUVs) and cross-over vehicles. The car/truck distinction has been stretched well beyond the original purpose.
- The committee could find no evidence that the two-fleet rule distinguishing between domestic and foreign content has had any perceptible effect on total employment in the U.S. automotive industry.
- The provision creating extra credits for multifuel vehicles has had, if any, a negative effect on fuel economy, petroleum consumption, greenhouse gas emissions, and cost. These vehicles seldom use any fuel other than gasoline yet enable automakers to increase their production of less fuel efficient vehicles.

Finding 4. In the period since 1975, manufacturers have made considerable improvements in the basic efficiency of engines, drive trains, and vehicle aerodynamics. These improvements could have been used to improve fuel economy and/or performance. Looking at the entire light-duty fleet, both cars and trucks, between 1975 and 1984, the technology improvements were concentrated on fuel economy: It improved by 62 percent without any loss of performance as measured by 0–60 mph acceleration times. By 1985, lightduty vehicles had improved enough to meet CAFE standards. Thereafter, technology improvements were concentrated principally on performance and other vehicle attributes (including improved occupant protection). Fuel economy remained essentially unchanged while vehicles became 20 percent heavier and 0–60 mph acceleration times became, on average, 25 percent faster.

Finding 5. Technologies exist that, if applied to passenger cars and light-duty trucks, would significantly reduce fuel consumption within 15 years. Auto manufacturers are already offering or introducing many of these technologies in other markets (Europe and Japan, for example), where much higher fuel prices ($4 to $5/gal) have justified their development. However, economic, regulatory, safety, and consumer-preference-related issues will influence the extent to which these technologies are applied in the United States.

Several new technologies such as advanced lean exhaust gas aftertreatment systems for high-speed diesels and direct-injection gasoline engines, which are currently under development, are expected to offer even greater potential for reductions in fuel consumption. However, their development cycles as well as future regulatory requirements will influence if and when these technologies penetrate deeply into the U.S. market.

The committee conducted a detailed assessment of the technological potential for improving the fuel efficiency of 10 different classes of vehicles, ranging from subcompact and compact cars to SUVs, pickups, and minivans. In addition, it estimated the range in incremental costs to the consumer that would be attributable to the application of these engine, transmission, and vehicle-related technologies.

Chapter 3 presents the results of these analyses as curves that represent the incremental benefit in fuel consumption versus the incremental cost increase over a defined baseline vehicle technology. Projections of both incremental costs and fuel consumption benefits are very uncertain, and the actual results obtained in practice may be significantly higher or lower than shown here. Three potential development paths are chosen as examples of possible product improvement approaches, which illustrate the trade-offs auto manufacturers may consider in future efforts to improve fuel efficiency.

Assessment of currently offered product technologies suggests that light-duty trucks, including SUVs, pickups, and minivans, offer the greatest potential to reduce fuel consumption on a total-gallons-saved basis.

Finding 6. In an attempt to evaluate the economic trade-offs associated with the introduction of existing and emerging technologies to improve fuel economy, the committee conducted what it called cost-efficient analysis. That is, the committee identified packages of existing and emerging technologies that could be introduced over the next 10 to 15 years that would improve fuel economy up to the point where further increases in fuel economy would not be reimbursed by fuel savings. The size, weight, and performance characteristics of the vehicles were held constant. The technologies, fuel consumption estimates, and cost projections described in Chapter 3 were used as inputs to this cost-efficient analysis.

These cost-efficient calculations depend critically on the assumptions one makes about a variety of parameters. For the purpose of calculation, the committee assumed as follows: (1) gasoline is priced at $1.50/gal, (2) a car is driven 15,600 miles in its first year, after which miles driven declines at 4.5 percent annually, (3) on-the-road fuel economy is 15 percent less than the Environmental Protection Agency's test rating, and (4) the added weight of equipment required for future safety and emission regulations will exact a 3.5 percent fuel economy penalty.

One other assumption is required to ascertain cost-efficient technology packages—the horizon over which fuel economy gains ought to be counted. Under one view, car purchasers consider fuel economy over the entire life of a new vehicle; even if they intend to sell it after 5 years, say, they care about fuel economy because it will affect the price they will receive for their used car. Alternatively, consumers may take a shorter-term perspective, not looking beyond, say, 3 years. This latter view, of course, will affect the identification of cost-efficient packages because there will be many fewer years of fuel economy savings to offset the initial purchase price.

The full results of this analysis are presented in Chapter 4. To provide one illustration, however, consider a midsize SUV. The current sales-weighted fleet fuel economy average for this class of vehicle is 21 mpg. If consumers consider only a 3-year payback period, fuel economy of 22.7 mpg would represent the cost-efficient level. If, on the other hand, consumers take the full 14-year average life of a vehicle as their horizon, the cost-efficient level increases to 28 mpg (with fuel savings discounted at 12 percent). The longer the consumer's planning horizon, in other words, the greater are the fuel economy savings against which to balance the higher initial costs of fuel-saving technologies.

The committee cannot emphasize strongly enough that the cost-efficient fuel economy levels identified in Tables 4-2 and 4-3 in Chapter 4 are *not* recommended fuel economy goals. Rather, they are reflections of technological possibilities, economic realities, and assumptions

about parameter values and consumer behavior. Given the choice, consumers might well spend their money on other vehicle amenities, such as greater acceleration or towing capacity, rather than on the fuel economy cost-efficient technology packages.

Finding 7. There is a marked inconsistency between pressing automotive manufacturers for improved fuel economy from new vehicles on the one hand and insisting on low real gasoline prices on the other. Higher real prices for gasoline—for instance, through increased gasoline taxes—would create both a demand for fuel-efficient new vehicles and an incentive for owners of existing vehicles to drive them less.

Finding 8. The committee identified externalities of about $0.30/gal of gasoline associated with the combined impacts of fuel consumption on greenhouse gas emissions and on world oil market conditions. These externalities are not necessarily taken into account when consumers purchase new vehicles. Other analysts might produce lower or higher estimates of externalities.

Finding 9. There are significant uncertainties surrounding the societal costs and benefits of raising fuel economy standards for the light-duty fleet. These uncertainties include the cost of implementing existing technologies or developing new ones; the future price of gasoline; the nature of consumer preferences for vehicle type, performance, and other features; and the potential safety consequences of altered standards. The higher the target for average fuel economy, the greater the uncertainty about the cost of reaching that target.

Finding 10. Raising CAFE standards would reduce future fuel consumption below what it otherwise would be; however, other policies could accomplish the same end at lower cost, provide more flexibility to manufacturers, or address inequities arising from the present system. Possible alternatives that appear to the committee to be superior to the current CAFE structure include tradable credits for fuel economy improvements, feebates, [3] higher fuel taxes, standards based on vehicle attributes (for example, vehicle weight, size, or payload), or some combination of these.

Finding 11. Changing the current CAFE system to one featuring tradable fuel economy credits and a cap on the price of these credits appears to be particularly attractive. It would provide incentives for all manufacturers, including those that exceed the fuel economy targets, to continually increase fuel economy, while allowing manufacturers flexibility to meet consumer preferences. Such a system would also limit costs imposed on manufacturers and consumers if standards turn out to be more difficult to meet than expected. It would also reveal information about the costs of fuel economy improvements and thus promote better-informed policy decisions.

Finding 12. The CAFE program might be improved significantly by converting it to a system in which fuel economy targets depend on vehicle attributes. One such system would make the fuel economy target dependent on vehicle weight, with lower fuel consumption targets set for lighter vehicles and higher targets for heavier vehicles, up to some maximum weight, above which the target would be weight-independent. Such a system would create incentives to reduce the variance in vehicle weights between large and small vehicles, thus providing for overall vehicle safety. It has the potential to increase fuel economy with fewer negative effects on both safety and consumer choice. Above the maximum weight, vehicles would need additional advanced fuel economy technology to meet the targets. The committee believes that although such a change is promising, it requires more investigation than was possible in this study.

Finding 13. If an increase in fuel economy is effected by a system that encourages either downweighting or the production and sale of more small cars, some additional traffic fatalities would be expected. However, the actual effects would be uncertain, and any adverse safety impact could be minimized, or even reversed, if weight and size reductions were limited to heavier vehicles (particularly those over 4,000 lb). Larger vehicles would then be less damaging (aggressive) in crashes with all other vehicles and thus pose less risk to other drivers on the road.

Finding 14. Advanced technologies—including direct-injection, lean-burn gasoline engines; direct-injection compression-ignition (diesel) engines; and hybrid electric vehicles—have the potential to improve vehicle fuel economy by 20 to 40 percent or more, although at a significantly higher cost. However, lean-burn gasoline engines and diesel engines, the latter of which are already producing large fuel economy gains in Europe, face significant technical challenges to meet the Tier 2 emission standards established by the Environmental Protection Agency under the 1990 amendments to the Clean Air Act and California's low-emission-vehicle (LEV II) standards. The major problems are the Tier 2 emissions standards for nitrogen oxides and particulates and the requirement that emission control systems be certified for a 120,000-mile lifetime. If direct-injection gasoline and diesel engines are to be used extensively to improve light-duty vehicle fuel economy, significant technical developments concerning emissions control will have to occur or some adjustments to the Tier 2 emissions standards will have to be made. Hybrid electric vehicles face significant cost hurdles, and fuel-cell vehicles face significant technological, economic, and fueling infrastructure barriers.

Finding 15. Technology changes require very long lead times to be introduced into the manufacturers' product lines. Any policy that is implemented too aggressively (that is, in too short a period of time) has the potential to adversely affect manufacturers, their suppliers, their employees, and consumers. Little can be done to improve the fuel economy of the new vehicle fleet for several years because production plans already are in place. The widespread penetration of even existing technologies will probably require 4 to 8 years. For emerging technologies that require additional research and development, this time lag can be considerably longer. In addition, considerably more time is required to replace the existing vehicle fleet (on the order of 200 million vehicles) with new, more efficient vehicles. Thus, while there would be incremental gains each year as improved vehicles enter the fleet, major changes in the transportation sector's fuel consumption will require decades.

RECOMMENDATIONS

Recommendation 1. Because of concerns about greenhouse gas emissions and the level of oil imports, it is appropriate for the federal government to ensure fuel economy levels beyond those expected to result from market forces alone. Selection of fuel economy targets will require uncertain and difficult trade-offs among environmental benefits, vehicle safety, cost, oil import dependence, and consumer preferences. The committee believes that these trade-offs rightfully reside with elected officials.

Recommendation 2. The CAFE system, or any alternative regulatory system, should include broad trading of fuel economy credits. The committee believes a trading system would be less costly than the current CAFE system; provide more flexibility and options to the automotive companies; give better information on the cost of fuel economy changes to the private sector, public interest groups, and regulators; and provide incentives to all manufacturers to improve fuel economy. Importantly, trading of fuel economy credits would allow for more ambitious fuel

economy goals than exist under the current CAFE system, while simultaneously reducing the economic cost of the program.

Recommendation 3. Consideration should be given to designing and evaluating an approach with fuel economy targets that are dependent on vehicle attributes, such as vehicle weight, that inherently influence fuel use. Any such system should be designed to have minimal adverse safety consequences.

Recommendation 4. Under any system of fuel economy targets, the two-fleet rule for domestic and foreign content should be eliminated.

Recommendation 5. CAFE credits for dual-fuel vehicles should be eliminated, with a long enough lead time to limit adverse financial impacts on the automotive industry.

Recommendation 6. To promote the development of longer-range, breakthrough technologies, the government should continue to fund, in cooperation with the automotive industry, precompetitive research aimed at technologies to improve vehicle fuel economy, safety, and emissions. It is only through such breakthrough technologies that dramatic increases in fuel economy will become possible.

Recommendation 7. Because of its importance to the fuel economy debate, the relationship between fuel economy and safety should be clarified. The committee urges the National Highway Traffic Safety Administration to undertake additional research on this subject, including (but not limited to) a replication, using current field data, of its 1997 analysis of the relationship between vehicle size and fatality risk.

NOTES

[1]Conference Report on H.R. 4475, Department of Transportation and Related Agencies Appropriations Act, 2001. Report 106-940, as published in the *Congressional Record*, October 5, 2000, pp. H8892-H9004.

[2]A dissent by committee members David Greene and Maryann Keller on the impact of downweighting and downsizing is contained in Appendix A. They believe that the level of uncertainty is much higher than stated and that the change in the fatality rate due to efforts to improve fuel economy may have been zero. Their dissent is limited to the safety issue alone.

[3]Feebates are taxes on vehicles achieving less than the average fuel economy coupled with rebates to vehicles achieving better than average fuel economy.

APPENDIX B

Ending the Energy Stalemate
A Bipartisan Strategy to meet America's Energy Challenges

The National Commission on Energy Policy

2004

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POLICY RECOMMENDATIONS
2. Reduce U.S. Oil Consumption through Increased Vehicle Efficiency and Production of Alternative Fuels

Reducing U.S. oil consumption is a critical complement to the measures described in previous sections for expanding and diversifying global supplies of oil. A key to slowing continued growth in U.S. oil consumption — which is otherwise projected to increase by more than 40 percent over the next two decades — is breaking the current political stalemate on changing Corporate Average Fuel Economy (CAFE) standards for new motor vehicles. Although recommendations in later chapters of this report — notably those aimed at promoting the development of alternative transportation fuels — will also help to reduce oil demand, improving passenger vehicle fuel economy is by far the most significant oil demand reduction measure proposed by the Commission.

The Commission's approach to vehicle efficiency builds on three decades of experience with fuel economy regulation and a record of impressive technological advances by the automobile manufacturing industry. As a result of CAFE standards introduced in the 1970s and high gasoline prices in the late 1970s and early 1980s, the average fuel economy of new lightduty vehicles improved from 15 miles per gallon (mpg) in 1975 to a peak of 26 mpg in 1987, a 73 percent increase over a time period that also saw substantial progress in improved vehicle performance and safety. The trend toward greater fuel economy, however, did not continue. Passenger car CAFE standards peaked in 1985 at 27.5 mpg and have not changed since. Light-duty truck standards were recently raised by 1.5 mpg to a new standard of 22.2 mpg which will go into effect in 2005 — prior to this increase they had remained essentially unchanged since 1987. Thus, for most of the last two decades overall fleet fuel economy has stagnated and continued technology gains — such as port fuel injection, front-wheel drive, valve technology, and transmission improvements — have been applied to increase vehicle size and power, rather than fuel economy. In fact, at 24 mpg on average, new vehicle fuel economy is

now no higher than it was in 1981, but vehicle weight has increased by 24 percent and horsepower has increased by 93 percent.

The Commission believes that three factors are largely responsible for the current CAFE stalemate: (1) uncertainty over the future costs of fuel-saving technologies; (2) fear that more stringent standards will lead to smaller, lighter vehicles and increased traffic fatalities; and (3) concerns that higher fuel-economy standards will put the U.S. auto industry and auto workers at a competitive disadvantage.

With respect to the first of these factors — cost and technology potential — numerous recent analyses by the National Academy of Sciences and others have concluded that significant improvements in the fuel economy of conventional gasoline vehicles are achievable and cost-effective, in the sense that fuel savings over the life of the vehicle would more than offset incremental technology costs. Estimates of cost-effectiveness do not, however, account for — and thus cannot by themselves resolve — potential trade-offs in terms of vehicle performance, safety, and impacts on jobs and competitiveness.

Given these complexities, the Commission was unable to agree on a numerical fuel-economy standard.

The recommendations that follow nevertheless reflect the Commission's conclusion that a combination of improved conventional gasoline technologies and advanced hybrid-electric and diesel technologies presents an opportunity to significantly increase fuel economy without sacrificing size, power, safety, and other attributes that consumers value. Note that the Commission defines "advanced diesel" in this context as a diesel passenger vehicle that meets stringent new federal air polution control requirements — or so-called "Tier 2" standards — that are being phased in from 2004 to 2008 (no currently available passenger diesel vehicles meet these standards). Ultimately, the Commission believes that a combination of higher standards, CAFE reforms, and complementary incentive programs will allow the nation to capitalize on potentially "gamechanging" technologies such as hybrids and advanced diesels in a manner that greatly enhances its ability to achieve oil security and environmental goals, as well as its ability to sustain the future competitiveness of the U.S. automobile industry.

Specifically, the Commission recommends:

- ***Raising Passenger Vehicle Fuel Economy Standards26—*** Congress should instruct the National Highway Traffic Safety Administration (NHTSA) to significantly strengthen federal fuel economy standards for passenger vehicles to take full advantage of the efficiency opportunities provided by currently available technologies and emerging hybrid and advanced diesel technologies. Consistent with existing statutory requirements, NHTSA should — in developing new standards — give due consideration to vehicle performance, safety, job impacts, and competitiveness concerns. To allow manufacturers sufficient time to adjust, new standards should be phased-in over a five-year period beginning no later than 2010.

- ***Reforming CAFE —*** To facilitate compliance with higher standards, Congress should modify CAFE to increase program flexibility by allowing manufacturers to trade fuel economy credits with each other and across the light truck and passenger vehicle fleets. In addition, Congress should authorize NHTSA to consider additional mechanisms that could further simplify the program, increase flexibility, and reduce compliance costs. One such mechanism is a compliance "safety valve" that would permit manufacturers to purchase CAFE credits from the government at a pre-determined price. Such a mechanism would

effectively cap costs to consumers and manufacturers should fuel-saving technologies not mature as expected or prove more expensive than anticipated.

• ***Providing Economic Incentives for Hybrids and Advanced Diesels —*** Congress should establish a five- to ten-year, $3 billion tax incentive program for manufacturers and consumers to encourage the domestic production and purchase of hybrid-electric and advanced diesel vehicles that achieve superior fuel economy.

APPENDIX C

Testimony on CAFE Program Reforms

Prepared by

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For

The U.S. House of Representatives

Committee on Energy and Commerce

May 3, 2006

Thank you, Mr. Chairman, for the opportunity to offer testimony before the committee about the possibility of reforming the Corporate Average Fuel Economy (CAFE) program, with particular reference to the recently introduced reforms for light trucks. Over the past decade, I have had the privilege of working on energy and environment issues for organizations as diverse as the President's Council of Economic Advisers and the National Commission on Energy Policy. Currently, I am a senior fellow at Resources for the Future (RFF), a 54-year-old research institution, headquartered here in Washington, DC, which focuses on energy, environmental, and natural resource issues.

RFF is both independent and nonpartisan, and shares the results of its economic and policy analyses with members of both parties, environmental and business advocates, academics, members of the press, and interested citizens. RFF neither lobbies nor takes positions on specific legislative or regulatory proposals, although individual researchers are encouraged to express their individual opinions, which may differ from those of other RFF scholars, officers, and directors. I emphasize that the views I present today are mine alone.

Just a few weeks ago, the National Highway Traffic and Safety Administration (NHTSA) released a final CAFE rule for the years 2008–2011 that raises the standard from its 2007 level of 22.2 miles per gallon (mpg), to 22.5 mpg in 2008, 23.1 mpg in 2009, and 23.5 mpg in 2010. But what should be of more interest to this committee are two major changes to the structure of the program included in the final rule. First, the rule differentiated standards across manufacturers based on the size of the vehicles they produce, and second, starting in 2011, the rule set these standards based on an explicit cost-benefit analysis. Previously, there was a single standard for all light-truck manufacturers and that standard was set, based on the ability of the least capable manufacturer. In addition to these major structural changes, the rule will also for the first time include medium-duty passenger vehicles in the CAFE program starting in 2011. With the inclusion of these heavier and naturally less fuel-efficient vehicles, the estimated average fuel economy will be 24.0 mpg in 2011.

At the time the light-truck rule was proposed last fall, I offered my opinion – which I have appended to this statement – that the reforms were a clear move toward a more efficient system, and perhaps even an optimal one, given statutory constraints. I also indicated that, based on an analysis of the underlying data from the recent National Research Council (NRC) study, the 2011 fuel economy standard should be increased based on the recent, dramatic increase in forecasted oil price and, in turn, the dramatic increase in benefits from improved fuel economy. What I would like to do today is first review my previous comments on the design of the rule for light trucks and explain why they are equally relevant for cars. I will then discuss additional reforms possible in statute – the ability to trade CAFE credits across fleets, firms, and time, as well as a cost-limiting safety valve that were not possible in the light-truck rulemaking. I will briefly remark on the fact that dramatically higher oil prices did *not* lead to an noticeable increase in the 2011 fuel economy standard and finally offer a few reflections on the overall desirability of CAFE from an economist's perspective.

Light-truck CAFE before the recent reforms

To understand the recent reforms to the light-truck CAFE program, as well as the potential for further statutory reforms, it is useful to consider how "un-reformed" or traditional CAFE works. There is a single, one-size-fits-all fuel economy standard for light trucks that must be met, on average, by each manufacturer. That is, each manufacturer takes the fuel economy of each light-truck model they produce, and then averages those numbers weighted by production volume. That number must be at or above the mandated standard. If the manufacturer beats the standard, the manufacturer collects CAFE credits that can be used to make up any shortfall in the next three years. If the manufacturer misses the standard and does not have any credits, there is a penalty equal to $5.50 per 0.1 mpg per vehicle. The penalty is routinely paid by European manufacturers, but has never been adopted by domestic or Asian manufacturers, who have voiced concern about the penalization notion surrounding the fee.

For light trucks, the level of the traditional standard is set with an eye toward achieving the maximum possible fuel economy, but with considerable deference given to the ability of each manufacturer to meet that standard. The National Highway Traffic Safety Administration (NHTSA) has typically tailored the standard to be economically practicable for the least-capable vehicle manufacturer while also considering the nation's need to conserve energy, technological feasibility, and the impact of other motor vehicle standards on fuel economy. The actual analysis is based on confidential manufacturer product plans, data, and modeling.

One consequence of the traditional approach is that the single standard for light trucks is tougher—that is, more expensive—for manufacturers with a full line that includes large trucks with lower fuel economy, and easier for manufacturers focused on small trucks with higher fuel economy. For example, Honda has consistently beaten the existing light-truck CAFE standard by 4–5 mpg, suggesting that it has had no effect on their production decisions, while the major domestic manufacturers that produce a broader range of trucks have hovered right at the standard, suggesting a real impact.

The reformed CAFE rule

The recently finalized rule for light trucks makes two major changes to the traditional approach. The first is a shift from a single light-truck standard for all manufacturers to differentiated standards for each manufacturer based on the size of the vehicles they produce. The second is a shift to setting the standard based on an explicit and careful cost-benefit analysis, involving the costs to manufacturers, the value of fuel savings, and other consequences of gasoline and vehicle usage.

Unlike the traditional CAFE rule for light trucks, the recently finalized rule differentiates standards for each manufacturer based on a continuous schedule of targets for different-sized vehicles. The size of the vehicle, or footprint, is defined by multiplying the track width (the distance between tires on the same axel) by the wheelbase (the distance between centerlines on each axel). In 2011, the fuel economy schedule ranges from 30.42 mpg for the smallest vehicle to 21.79 mpg for the largest vehicle (Table 4 in the Final Rule). Among manufacturers, this is forecast to result in a fleet standard ranging from 23.2 mpg for General Motors (GM) to 27.1 mpg for Suzuki (Table 13).

Differentiating manufacturers' standards based on the mix of large and small light trucks that they produce – so that Suzuki faces a higher standard than GM – has important distributional

consequences. Unlike the traditional light-truck CAFE rule, in which the single standard was much harder for GM and other manufacturers of large trucks to meet, the reformed rule allocates the overall burden more evenly by shifting some of it away from manufacturers of large trucks and toward manufacturers of small trucks.

This distributional change will also lower the cost of a given improvement in fuel economy across all fleets (or increase the overall improvement in fuel economy for a given total cost). By seeking larger fuel savings from small truck manufacturers, who previously faced little or no CAFE incentive to improve fuel economy, opportunities exist to improve fuel economy that previously were not being captured. Some of these efficiency improvements are cheaper than the ones previously achieved through almost exclusive reliance on improvements among manufacturers of large trucks. That is, the program achieves lower cost and/or more fuel savings (estimated at 15–20% in the Regulatory Impact Analysis, Table VII-1).

There is a third, important effect associated with differentiating standards based on the size of vehicles: It substantially alters the incentives to downsize. Downsizing is one way a manufacturer could comply with the traditional light-truck CAFE rule. As noted, smaller trucks naturally have higher fuel economy. Instead of using technology to improve fuel economy, manufacturers could simply choose to make smaller trucks. While some might applaud a shift to smaller vehicles, this frequently raises concerns about safety.

By making the standard higher for smaller trucks, the incentive to downsize to comply with the reformed CAFE rule is reduced if not eliminated, thereby addressing these concerns about safety. Making smaller trucks does not help a manufacturer meet their standard – the natural improvement in fuel economy associated with the smaller vehicle is offset by the reformed CAFE's requirement that smaller vehicles achieve higher fuel economy.

The second major change in the reformed CAFE rule comes in 2011, when fuel economy will be set, based on maximizing net benefits from reduced petroleum consumption, including the reduced consequences of oil-supply disruptions, the reduced market power of oil-exporting countries, and environmental concerns, as well as effects of fuel economy on congestion, accidents, and greater vehicle range. These benefits are weighed against the costs of installing new technologies to improve fuel economy. This is sharply contrasts the previous approach, which focused on the ability of the least-capable manufacturer – that is, the one making the largest trucks. In fact, with the shift to differentiated standards, the notion of a least-capable manufacturer disappears; instead, each company faces a standard that is tailored to be as difficult as any other. This latter change represents an unambiguous move toward greater efficiency in the light-truck CAFE program. While the traditional approach highlighted factors that should be considered when setting the standard, it did not suggest how they ought to be balanced, somewhat ironically using cost-benefit analysis as part of the regulatory impact analysis *after* the standard was set. The proposed reforms put the cost-benefit analysis front and center, stipulating that those factors should be balanced based on the best available valuations. By definition, such an approach is the most efficient possible approach to setting CAFE standards once the structure of the program is determined.

Applying the light-truck reforms to passenger cars

Both of the reforms adopted in the recent light-truck rule – differentiating manufacturer's standards based on their mix of large and small vehicles, as well as setting the standards based on careful cost-benefit analysis – provide similar opportunities to improve the passenger car CAFE program. Unlike the light-truck program, however, these changes must be made in statute. While NHTSA had the authority to differentiate manufacturer's standards and to shift to a cost-benefit approach for light trucks, the existing statute is much more specific for passenger cars.

As was the case for light trucks, differentiating the passenger car standard among manufacturers based on their mix of large and small cars provides three advantages. First, it creates a more equitable burden. Because large cars naturally have lower fuel economy than smaller cars, a single standard for all manufacturers would put a disproportionate burden on those who produce larger cars. In contrast, a differentiated standard would shift that burden toward small car manufacturers. Second, this shift in burden will also mean a shift from higher-cost improvements in large cars to lower-cost improvements in small cars. This will lower the cost of achieving a given overall level of fuel economy, or allow a greater improvement in overall fuel economy at a given total cost. Finally, by making the standard progressively higher for smaller cars, the incentive to downsize passenger cars is reduced if not eliminated. The natural fuel economy improvement associated with downsizing is now penalized by a higher standard. This addresses past concerns that CAFE produces smaller, less safe vehicles.

The use of a cost-benefit approach to set the passenger car standard would, by definition, create a program that maximized efficiency – that is, the net benefits to society – of the program, given the design (for example, differentiated standards and fleet averaging).

Going beyond the light-truck reforms

There are at least four areas where light-truck reform was limited by statute but where greater efficiency could be realized by changing the structure of the program. Three relate to simply giving manufacturers more flexibility to meet a given standard without affecting the outcome in terms of overall oil savings. The fourth addresses uncertainty about compliance costs, reducing the risk of high costs at the expense of possibly achieving lower oil savings.

The first of these further reforms would allow manufacturers to average fuel economy jointly over both cars and light-truck fleets. Currently, manufacturers must meet each standard separately, even though cheaper opportunities may exist in one fleet versus the other. From a national perspective, Congress should not care whether fuel savings are achieved in one fleet or the other. Allowing manufacturers to trade off cheaper improvements in one fleet against more expensive improvements in the other would lower overall costs without affecting oil savings.

Second, Congress could also allow credit trading among manufacturers. That is, when one manufacturer exceeds their standard, they earn credits that could then be sold to other manufacturers struggling to meet theirs. This reform reduces costs by shifting improvements to manufacturers with lower costs and away from manufacturers with higher costs. And like the first reform, this action has no effect on overall oil savings.

It is useful to note that historically there has been opposition to trading because it likely further exacerbates the disparity between manufacturers of large and small vehicles. That is, even though trading would generally benefit both buyers and sellers of CAFE credits, under traditional CAFE, it would tend to provide larger benefits to sellers – manufacturers of small cars who can easily if not effortlessly exceed the standard. However, with size-based CAFE, the initial compliance burden is more evenly distributed among manufacturers of both large and small vehicles, erasing the likely larger benefit to manufacturers of small vehicles.

Third, Congress could allow companies who exceed the standard in one year to bank credits for the indefinite future. Banking not only leaves the total volume of reduced oil consumption unchanged, it moves the savings *forward* in time – that is, we see the effects of energy conservation sooner. Banking has easily been the most successful element of the acid rain trading program used by electric utilities to reduce sulfur dioxide emissions. In that case, firms reduced emissions by twice as much as the law required to create flexibility for future compliance. Currently, banking is allowed in the CAFE program – but for only up to three years, after which time the banked credits expire, thereby reducing the incentive to over-comply and to reduce oil consumption earlier. New legislation could remove this restriction.

Finally, Congress could create a safety valve, whereby manufacturers could opt to pay a specified fee if compliance costs end up being unexpectedly high. This would allow manufacturers to avoid the risk of high costs in exchange for the possibility that fuel economy – and oil savings – might be lower if that turns out to be the case. As noted earlier, the current program already has such a fee, defined as a penalty, which is often used by European manufacturers but has been avoided by domestic and Asian manufacturers. By "decriminalizing" the fee, Congress could help allay manufacturer concerns and reduce the central debate about how much technology really costs – perhaps allowing higher standards to be introduced more quickly.

Transparency about costs

The recent light-truck rule highlighted the fact that the cost estimates used to set fuel economy standards remain something of a mystery. Despite the fact that the benefits of improving fuel economy increased by 50 percent between when the proposed and final rules were published, due to dramatic increases in forecast oil prices, the estimated aggregate fuel economy standard for 2011 increased by only 0.2 mpg, from 23.9 to 24.1 mpg (excluding medium-duty vehicles, which were not included in the proposed rule). Yet, the standard is supposed to represent a balancing of costs and benefits.

The final rule indicates that there were countervailing changes in estimated costs – related to the costs of technologies and especially the time required to phase in those technologies – but those changes are difficult to judge because the underlying details of the cost model are not spelled out clearly. Without any countervailing effects, my comments last fall suggested that a 50-percent increase in benefits might lead to a 4–5 mpg increase in the standard. Having reviewed other cost

analyses, I might adjust that downward, closer to 2 mpg. In any case, a 0.2-mpg increase is surprisingly small despite the indicated countervailing modeling changes.

It might be desirable, therefore, for the Department of Transportation to be required to make public the cost modeling used in any rulemaking to set fuel economy standards. In the past, such disclosure would have been nearly impossible, as it entirely centered on the capabilities of one manufacturer. Now, there is presumably safety in numbers: Cost modeling for particular vehicle sizes can be disclosed, on average, without necessarily revealing proprietary information. Such a requirement would facilitate a more informed debate in the rulemaking process.

Do fuel economy standards make sense?

So far the discussion has centered on how to improve CAFE through statutory reform – that is, how to get more fuel savings at lower cost, while addressing concerns about equity and safety. This is an extremely important question, given the likelihood that the CAFE program will not go away and will remain the main policy tool for addressing concerns about petroleum use in the transportation sector. Nonetheless, it is useful to ask whether CAFE makes sense compared to other choices, or whether Congress should instead focus on an entirely different policy.

The underlying motivation for CAFE is the desire to reduce oil demand because of concerns about costs, security, and the environment. Given this underlying motivation, many people, especially economists, often criticize CAFE policy for two related reasons: First, it does not encourage consumers, once they buy a vehicle, to drive less; and second, it implies that the government can do a better job of weighing the costs and benefits of fuel-saving vehicle technologies than the auto manufacturers and auto consumers who make and use those vehicles. These critics typically conclude that the better policy is to tax gasoline, where the tax rate reflects some or all of the additional cost to society associated with oil use – for example, the negative influence of oil supply disruptions on the economy, domestic and international environmental impacts, and highway congestion.

One response is to agree with the CAFE critics on principle, but note that political opposition to gasoline tax increases make them impractical. However, we can also take issue with the second criticism and argue that auto manufacturers and consumers are *not* really making good decisions about fuel economy. Several explanations for this failure stand out. The first is that consumers may not know, understand, or believe differences exist in fuel economy among vehicles. The recent controversy over the inaccuracy of EPA fuel economy ratings on information labels underscores this point.

Second, even understanding that those differences exist and are real, consumers may not rank fuel economy high enough to worry about when shopping for a car. Cargo capacity, power, and styling may be more important to consumers. Finally, even if consumers consider fuel economy, they may find it does not make a big enough difference to sway their choice of vehicle. Typical fuel economy decisions might represent an annual net gain per vehicle of about $50–500, depending on the payback period a consumer requires. On a $20,000 new car, this is analogous to an option for a fancy radio or improved styling.

Finally, consumers may not properly account for the full value of future fuel savings from a more fuel-efficient car, considering, for example, only the first few years of savings rather than the entire vehicle lifetime.

If consumers are systematically undervaluing fuel economy, it makes sense that vehicle manufacturers are not going to build more fuel-efficient cars. Based on that observation – an observation with which I tend to agree – fuel economy standards *are* a sensible policy and Congress should focus on reforming CAFE to make it more efficient.

It is worth noting that one argument that *cannot* be used to support CAFE is that stricter fuel economy standards will substantially lower gasoline prices. Recent estimates by the Energy Information Administration, for example, suggest that a 36-percent improvement in CAFE (6–7 mpg) would lower gasoline prices by at most $0.08 by 2025. More modest CAFE improvements, such as the recent 1.8-mpg increase in light-truck standards, would lower gasoline prices even less (although the impact is larger with reforms than without). However, CAFE will lower *expenditures* on gasoline, as the quantity consumed will decline even if the price remains relatively insensitive. More importantly, it will reduce the *vulnerability* of the economy to future oil price shocks by reducing the share of gasoline expenditures in overall economic activity.

Overall conclusions

Following on the heels of recent regulatory reforms to the light-truck CAFE program, Congressional action to similarly reform the CAFE program for passenger cars – as well as to enact further reforms that were not possible in the light-truck rulemaking – has a large potential to improve program efficiency, to make the program more equitable, and to do all of this without sacrificing safety. The light-truck rule provides a model for two improvements: differentiating manufacturers' standards based on their mix of large and small vehicles, and setting the overall level of the standards based on an explicit and careful cost-benefit analysis. Further reforms include trading between the passenger car and light-truck fleets, trading among manufacturers, unrestricted banking of CAFE credits earned by exceeding the standard, and a cost-limiting safety valve.

It is surprising that the recent final rule for light-truck fuel economy in 2011, based on balancing costs and benefits, demonstrated remarkably little sensitivity to a 50-percent increase in the value of fuel saving benefits. This surprise, along with other concerns about how NHTSA would set the standards, has led to calls for Congress to directly set the standard in statute. Nonetheless, I find the complexity of the standard-setting process, as well as the need to regularly revisit the level of the standard, to be more suitable for agency rulemaking than Congressional action. Congress can instead reform the structure of CAFE to increase efficiency, continue to give NHTSA clear guidance on the key costs and benefits it should consider, and perhaps require greater transparency with regard to the cost modeling.

Lastly, critics often argue that CAFE is not the right policy to address petroleum use in the transportation sector, because it improperly focuses on creating more fuel-efficient vehicles rather than alternatively or additionally encouraging consumers to drive those vehicles less. Such a criticism is based on an assumption that consumers and manufacturers will make good

decisions about fuel economy based on technology and fuel costs. Yet, there are a variety of reasons why this assumption might be false; based on my belief that these reasons have credibility, a CAFE program continues to make sense.

In summary, Congress has a great opportunity to improve the efficiency of an extremely significant program to reduce oil consumption in the United States, namely by reforming the fuel economy program for cars and light trucks. Such reforms will reduce the costs of achieving a given standard and allow us to pursue greater fuel economy without sacrificing safety. In contrast to other policies being promoted to address concerns about higher fuel prices and oil dependency, such improvements attack the problem directly by reducing both our expenditures on oil and our vulnerability to future price increases.

I thank you again for the opportunity to appear before this committee, and I would be pleased to answer any questions.

Appendix I. Understanding Proposed CAFE Reforms for Light Trucks
FR Doc. 05-17005

By William A. Pizer and Madeleine Baker,* Resources for the Future

Summary

On August 23, 2005, the National Highway Traffic Safety Administration (NHTSA) released a Notice of Proposed Rulemaking (NPR) on corporate average fuel economy (CAFE) standards for light trucks along with a Preliminary Regulatory Impact Analysis (PRIA) (NPRM: *Federal Register* 05-17005, vol. 70, no. 167, August 30). Relative to the existing 2007 standard of 22.2 miles per gallon (mpg), the proposed changes include fuel economy standards of 22.5-23.5 mpg over 2008-2010 using the current program design.

More notable, however, are proposed changes to this design. Under the proposed changes, each manufacturer would still need to meet a single overall standard for their light truck fleet, but that standard would differ across manufacturers based on their production of different sized vehicles. Vehicles with different footprints (wheelbase times track width) would have different fuel economy targets and a manufacturer's overall standard would be based on these size-differentiated targets averaged over their specific fleet. During 2008-2010, manufacturers would have a choice of complying with either the old (unreformed) or new (reformed) CAFE standards.

Importantly, the fuel economy standards starting in 2011 would be set explicitly to maximize net benefits to society—including fuel savings, safety, security, and environmental concerns. Among other things, this shift implies that those standards will rise along with the price of oil. While the proposed 2011 targets assume $25-30 per barrel crude oil prices (based on available government forecasts) and are estimated to achieve a 24-mpg fuel economy, we estimate that an additional $20 per barrel (in line with recent long run private-sector forecasts) would raise the proposed targets by perhaps 4-5 mpg.

The proposed reforms also erase the current disparity between passenger automobile and light truck standards, as the smallest light truck category would have a target exceeding the current 27.5 mpg for passenger automobiles. This would remove the incentive for automakers to effectively design passenger cars that can be categorized as a light truck (by raising the height, making the seats removable, etc.) in order to face an easier fuel economy standard.

From an economic perspective, these reforms represent a remarkable shift toward a more efficient regulatory system. Still, potentially valuable, further improvements remain—trading of CAFE credits across manufacturers and between passenger cars and light trucks, for example. The proposed reforms also fail to address the larger economic questions of whether taxes or

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tradable permits (for gasoline usage) would be a better policy than a CAFE performance standard, and whether consumers and manufacturers are really making bad fuel economy decisions absent government intervention. The latter question could also have significant implications for whether technology costs and fuel economy benefits are correctly valued in the CAFE analysis.

The remainder of this memorandum walks through essential elements of the reform package, provides a quick economic analysis, and summarizes the economist's perspective.

Unreformed CAFE

Existing CAFE regulations establish a single mileage standard that must be met, on average, for every manufacturer's light truck fleet. That is, each manufacturer takes the fuel economy of each light truck model they produce, and then averages those numbers weighted by production volume. That number must be at or above the mandated standard. If the manufacturer beats the standard, the manufacturer collects CAFE credits that can be used to make up any shortfall in the next three years. If the manufacturer misses the standard and does not have any credits, there is a penalty equal to $5.50 per 0.1 mpg per vehicle. The penalty is routinely paid by European manufacturers but has never been utilized by domestic or Asian manufacturers.

The level of the standard is set with an eye toward achieving the maximum possible fuel economy, but with considerable deference given to the ability of each manufacturer to meet that standard. In particular, NHTSA has traditionally focused on the least capable vehicle manufacturer and tailored the standard to be "economically practicable" for that firm. The actual analysis is based on confidential manufacturer data and modeling. This approach was used in 2003 to set the 2005-2007 standards. Prior to that, Congressional riders prevented any changes to the CAFE levels for light trucks since 1996. The standard for passenger cars has remained unchanged since 1990.

One consequence of this approach is that the single standard for light trucks is tougher—more expensive—for manufacturers with a full line, including large trucks that have lower fuel economy, and easier for manufacturers focused on small trucks that typically have higher fuel economy. For example, Honda has consistently beaten the existing light-truck CAFE standard by 4-5 mpg, suggesting it has had no effect on their production decisions, while the major domestic manufacturers that produce a broader range of trucks have hovered right at the standard, suggesting a real impact.

The current NPR uses this approach to determine unreformed 22.5-23.5 mpg standards for 2008-2010.

Reformed CAFE

The proposed CAFE reforms involve two major changes. The first is a shift from a single standard for all manufacturers to differentiated standards for each manufacturer based on the composition of their fleet. This shift arguably eliminates the notion of a least capable manufacturer because standards are tailored to each manufacturer's vehicle mix. The second is a shift to an explicit cost-benefit analysis based on fuel savings and other consequences of gasoline and vehicle usage. While previous standards have utilized cost-benefit analysis as part of the regulatory impact analysis *after* the standard was set, the proposed reforms put the cost-benefit analysis front and center.

Differentiated Standards

The NPR proposes differentiating fuel economy standards for light trucks using six discrete size categories, but requests comments on the use of both alternative attributes and/or more size categories (or even a continuous function). The size of a vehicle, or "footprint," is defined by multiplying the track width (distance between tires on the same axel) multiplied by the wheelbase (distance between centerlines on each axel). The proposed ranges for each footprint category, according to NHTSA, were based on an effort to keep the majority of models in the low end of each range; that is, to avoid creating significant opportunities for firms to slightly increase the size of a vehicle and have it move into the next higher range with a correspondingly lower standard.

NHTSA then establishes the *relative* position of targets for each category. That is, category 2 is 0.8 mpg lower than category 1; category 3 is 3.4 mpg lower than category 2; etc. These relative positions are determined based on the difficulty / cost of achieving fuel economy levels in each category. The result is a schedule of fuel economy targets for different size categories, but only defined relative to each other.

Setting the Standards

The actual standards are determined by moving the absolute level of this schedule up or down in order to meet one of two criteria. From 2008-2010, the criterion is that the total cost to industry under the reformed regulation should equal the total cost to industry under the unreformed regulation, described earlier. From 2011 onward, the criterion is that benefits to society, minus costs, are maximized. Table 1 summarizes the resulting standards in the NPR.

With the target for each category in hand, the standard for each manufacturer is based on how many trucks the manufacturer produces in each category. Based on current projections by NHTSA, that results in the manufacturer-specific standards given in Table 2. Note that manufacturers do not have to meet the target in any one category, but underachievement in one category has to be offset by overachievement in another.

Analysis

Several questions naturally arise when evaluating the proposed reform package. Does it cost more or less than the unreformed policy? Even if the cost is roughly the same, is the *distribution* of costs different across manufacturers? Does it achieve more overall fuel economy for a given cost? Are these cost-benefit estimates consistent with other cost-benefit estimates? We briefly examine each question in turn based on available data.

Does Reformed CAFE Cost More?

There are no direct comparisons of costs under the proposed, cost-benefit approach to setting the standard versus costs based on the existing, least-capable manufacturer approach. A footnote in Table 3 highlights this fact—costs are similar in each year where both reformed and unreformed CAFE costs are reported *by design*.

However, looking at those same cost estimates in Table 3 *across years*, we do not see a dramatic difference moving from 2010 to 2011, when the new metric of maximizing net benefits is applied for the first time, versus moving from 2007 to 2008, 2008 to 2009, or 2009 to 2010, when the overall cost to industry is set based on unreformed CAFE. Costs per vehicle rise by

$89 from 2010 to 2011, but they rise by $88 from 2008 to 2009. That suggests, at the very least, that any increase in costs from the reformed approach is in line with the spending trend for fuel economy improvements over time under the unreformed program.

Is the distribution of costs different across manufacturers?

Unreformed CAFE sets a common standard for all manufacturers, whereas reformed CAFE will set differentiated standards based on each manufacturer's product line—higher standards for manufacturers specializing in smaller trucks. Other things equal, this suggests a shift in costs away from manufacturers of larger trucks and toward those which only manufacture smaller light trucks. Table 4 quantifies this shift using historical data on CAFE credits: Under both reformed and unreformed CAFE, manufacturers can earn credits equal to the amount by which their fleet exceeds the standard, expressed in tenths of a mile-per-gallon, per vehicle. These credits can then be used in future years to make up a deficit if they fail to meet the standard.

Based on historic manufacturing data for 2002-2004, Table 4 shows the change in manufacturers' net CAFE credits position under the reformed versus unreformed program; positive numbers reflect a better outcome under reformed CAFE. What we see is that three manufacturers, Hyundai, Isuzu, and Suzuki, do noticeably worse, facing a deficit of perhaps 30 credits per vehicle absent changes. Meanwhile, GM, to a lesser extent Ford, and eventually Nissan, all see an improvement of 2-6 credits per vehicle. If we look at the underlying production data available in Tables III-3 through III-5 of the PRIA, the three manufacturers who face the greatest deficit are the ones whose trucks fall entirely in the smallest two of the six reformed CAFE categories. Meanwhile, GM, Ford, and Nissan have the largest share—more than one-third—in the largest two categories by 2004 (only 20 percent of DaimlerChrysler vehicles fell in those two categories in that year).

Does reformed CAFE achieve more fuel economy for a given cost?

Given that the costs of reformed CAFE are similar to the costs of unreformed CAFE, the delivered value of the proposed reforms turns on whether benefits are higher. Table 5 compares estimates of the fuel economy, gallons saved, and dollar benefits under the two programs. For all three metrics, we see reformed CAFE improvements that are 12-15 percent higher in 2008, 19-20 percent higher in 2009, and 6-7 percent higher in 2010. No comparison is possible in 2011, because only reformed CAFE estimates were provided.

Are the cost estimates consistent with other studies?

In an effort to benchmark the cost analysis in the NPR and PRIA, we used the data contained in the 2001 National Academy of Science (NAS) CAFE study to estimate cost curves for fuel economy improvements for different classes of light trucks (SUVs, trucks, and minivans). We compare these costs to the benefits from fuel savings in the NPR, ignoring all of the additions and subtractions for various externalities the PRIA considers that have a net effect of lowering benefits 2-4% (see PRIA Tables VIII-4 through VIII-10). We then estimate the net benefit maximizing level of fuel economy.

Despite the fact that our data is now five years old and that we could not replicate the size-based categories in the NPR, our results suggest a benefit-maximizing fuel economy squarely in the range of the 22.6-24.0 mpg levels forecast under the proposed rule. However, it is important to highlight that this estimate uses the NPR and PRIA oil price forecast of $25-30 from the *Annual*

Energy Outlook 2005. More recent private-sector forecasts suggest an increase of perhaps $20 per barrel, adding an additional $0.50 per gallon to the fuel economy savings and raising our estimate of the benefit-maximizing fuel economy by 4-5 mpg.

Perspective

From an economist's perspective, the proposed reforms represent a clear move toward greater efficiency, perhaps even an optimum given current statutory constraints. Moving beyond this constraint, however, the efficiency of the CAFE program could still be improved by allowing trades among manufacturers and between cars and trucks. Because the benefit per gallon is now the metric for setting the standard, one could also ask whether this value ought to be used to cap the cost of any compliance efforts by allowing manufacturers to pay that value (or some multiple) if they miss the standard. One might even want to back up and ask whether CAFE itself—that is a performance standard for vehicles rather than fuel taxes or emissions trading—is what we really want. Many economists argue that consumers and manufacturers already make the desired fuel economy decisions without regulation, excluding concerns over the environment, security, and safety. If so, the fuel economy savings and technology cost ought to balance at the margin, suggesting they have been incorrectly valued in this analysis.

Importantly, by raising the target for small trucks above the standard for passenger vehicles the proposed reforms eliminate the incentive to redesign what is essentially a passenger vehicle in order to be classified as a light truck and to face a lighter CAFE standard. Under the current program, such redesigns are often cited as a significant, adverse, and unintended consequence of the wide gap in standards between cars and trucks.

Finally, our calculations, showing that recent increases in long-run oil prices raise the desired fuel economy by 4-5 mpg, highlight the importance of assumptions about these prices. While it is unclear what role oil prices played in setting standards under the unreformed program, they *drive* the standards set by benefit maximization under the reformed program.

Tables and Figures

Table 1. Proposed Targets (in mpg)

Category	1	2	3	4	5	6
Range of vehicle footprint (sq. ft.)	≤ 43.0	> 43.0-47.0	> 47.0-52.0	> 52.0-56.5	> 56.5-65.0	> 65.0
MY 2008 Targets	26.8	25.6	22.3	22.2	20.7	20.4
MY 2009 Targets	27.4	26.4	23.5	22.7	21.0	21.0
MY 2010 Targets	27.8	26.4	24.0	22.9	21.6	20.8[62]
MY 2011 Targets	28.4	27.1	24.5	23.3	21.9	21.3

Source: NPR Table 6

Table 2. Estimates of Required Fuel Economy Levels (in mpg)

Manufacturer	MY 2008	MY 2009	MY 2010	MY 2011
BMW	23.8	24.8	25.1	25.7
Suzuki	26.0	26.7	26.8	27.5
Volkswagen	22.7	23.9	24.3	24.8
General Motors	22.2	22.8	23.2	23.7
Ford	22.4	22.9	23.1	23.6
DaimlerChrysler	22.8	23.5	23.7	24.2
Honda	23.1	24.0	24.2	24.8
Hyundai	24.2	25.9	25.7	26.3
Nissan	22.1	22.8	23.2	23.7
Toyota	23.2	24.1	24.5	25.0
Fuji (Subaru)	24.8	25.6	25.8	26.4
Porsche	22.3	23.5	24.0	24.5
Isuzu	22.3	22.9	23.2	23.7

Source: NPR Table 7

Table 3. Incremental Cost per Vehicle

	MY 2008	MY 2009	MY 2010	MY 2011
Unreformed CAFE in 2008-2010	56	130	185	NA
Reformed CAFE 2008-2011	54*	142*	186*	275

* By policy design, the proposed mpg levels under Reformed CAFE are set so that the industry-wide costs of Reformed CAFE are roughly equal to the industry-wide costs of Unreformed CAFE for MY 2008-2010.

Source: PRIA Table 1

Table 4. Effect of Reformed CAFE, Relative to Unreformed CAFE, on Manufacturer's CAFE Credit Position using Historic Data (change in credits per vehicle)

Manufacturer	Market share (2004)	2002	2003	2004
BMW	0.01	-4.29	-0.92	-16.23
DaimlerChrysler	0.19	-3.03	-6.00	-7.25
Ford	0.23	2.80	-1.00	3.01
GM	0.29	7.87	6.00	5.63
Honda	0.06	-3.51	-11.00	-9.91
Hyundai	0.02	-13.64	-30.05	-27.15
Isuzu	0.00	-14.32	-29.76	-27.21
Nissan	0.06	-9.89	-16.02	2.18
Suzuki	0.00	-16.71	-29.90	-29.40
Toyota	0.13	-4.50	-5.01	-7.99
Volkswagen	0.01	-8.53	-15.12	-8.14

Source: PRIA Tables III-3 through III-5

Table 5. Benefit Estimates, Reformed and Unreformed CAFE

	2008	2009	2010	2011
Fuel economy improvement versus baseline (mpg)				
unreformed	0.26	0.59	0.87	
reformed	0.29	0.71	0.88	1.34
Gallons saved over vehicle lifetime versus baseline (millions, undiscounted)				
unreformed	826	1860	2715	
reformed	942	2218	2892	4110
Benefits versus baseline				
($millions, net present value at 7% over vehicle life for each model year)				
unreformed	605	1366	2007	
reformed	694	1633	2144	3069

Source: PRIA Tables VI-1b, VI-2, VI-3 (Fuel Economy), PRIA Table 5 (Gallons), PRIA Table 3 (benefits)