DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Parts 523, 533 and 537

[Docket No. NHTSA 2006–24306]

RIN 2127–AJ61

Average Fuel Economy Standards for Light Trucks Model Years 2008–2011

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

ACTION: Final rule.

SUMMARY: This final rule reforms the structure of the corporate average fuel economy (CAFE) program for light trucks and establishes higher CAFE standards for model year (MY) 2008–2011 light trucks. Reforming the CAFE program will enable it to achieve larger fuel savings, while enhancing safety and preventing adverse economic consequences.

During a transition period of MYs 2008–2010, manufacturers may comply with CAFE standards established under the reformed structure (Reformed CAFE) or with standards established in the traditional way (Unreformed CAFE). This will permit manufacturers and the agency to gain experience with implementing the Reformed CAFE standards. In MY 2011, all manufacturers will be required to comply with a Reformed CAFE standard.

Under Reformed CAFE, fuel economy standards are restructured so that they are based on a measure of vehicle size called ''footprint,'' the product of multiplying a vehicle's wheelbase by its track width. A target level of fuel economy is established for each increment in footprint. Smaller footprint light trucks have higher targets and larger ones, lower targets. A particular manufacturer's compliance obligation for a model year will be calculated as the harmonic average of the fuel economy targets for the manufacturer's vehicles, weighted by the distribution of manufacturer's production volumes among the footprint increments. Thus, each manufacturer will be required to comply with a single overall average fuel economy level for each model year of production.

The Unreformed CAFE standards are: 22.5 miles per gallon (mpg) for MY 2008, 23.1 mpg for MY 2009, and 23.5 mpg for MY 2010. To aid the transition to Reformed CAFE, the Reformed CAFE standards for those years are set at levels intended to ensure that the industry-wide costs of the Reformed standards are roughly equivalent to the industry-wide costs of the Unreformed CAFE standards in those model years. For MY 2011, the Reformed CAFE standard is set at the level that maximizes net benefits. Net benefits includes the increase in light truck prices due to technology improvements, the decrease in fuel consumption, and a number of other factors viewed from a societal perspective. All of the standards have been set at the maximum feasible level, while accounting for technological feasibility, economic practicability and other relevant factors.

Since a manufacturer's compliance obligation for a model year under Reformed CAFE depends in part on its actual production in that model year, its obligation cannot be calculated with absolute precision until the final production figures for that model year become known. However, a manufacturer can calculate its obligation with a reasonably high degree of accuracy in advance of that model year, based on its product plans for the year. Prior to and during the model year, the manufacturer will be able to track all of the key variables in the formula used for calculating its obligation (*e.g.*, distribution of production and the fuel economy of each of its models). This final rule announces estimates of the compliance obligations, by manufacturer, for MYs 2008–2011 under Reformed CAFE, using the fuel economy targets established by NHTSA and the product plans submitted to NHTSA by the manufacturers in response to an August 2005 request for updated product plans.

This rulemaking is mandated by the Energy Policy and Conservation Act (EPCA), which was enacted in the aftermath of the energy crisis created by the oil embargo of 1973–74. The concerns about reliance on petroleum imports, energy security, and the effects of energy prices and supply on national economic well-being that led to the enactment of EPCA remain very much alive today. America is still overly dependent on petroleum. Sustained growth in the demand for oil worldwide, coupled with tight crude oil supplies, are the driving forces behind the sharp price increases seen over the past several years and are expected to remain significant factors in the years ahead. Increasingly, the oil consumed in the U.S. originates in countries with political and economic situations that raise concerns about future oil supply and prices. In the long run, technological innovation will play an increasingly larger role in reducing our dependence on petroleum.

We recognize that financial difficulties currently exist in the motor vehicle industry and that a substantial number of job reductions have been announced recently by large full-line manufacturers. Accordingly, we have carefully balanced the costs of the rule with the benefits of conservation. Compared to Unreformed CAFE, Reformed CAFE enhances overall fuel savings while providing vehicle manufacturers with the flexibility they need to respond to changing market conditions. Reformed CAFE will also provide a more equitable regulatory framework by creating a level-playing field for manufacturers, regardless of whether they are full-line or limited-line manufacturers. We are particularly encouraged that Reformed CAFE will reduce the adverse safety risks generated by the Unreformed CAFE program. The transition from the Unreformed CAFE to the Reformed CAFE system will begin soon, but ample lead time is provided before Reformed CAFE takes full effect in MY 2011.

DATES: Today's final rule is effective August 4, 2006. Petitions for reconsideration must be received by May 22, 2006.

ADDRESSES: Petitions for reconsideration must be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, SW., Nassif Building, Washington, DC 20590–001.

FOR FURTHER INFORMATION CONTACT: For technical issues, call Ken Katz, Lead Engineer, Fuel Economy Division, Office of International Vehicle, Fuel Economy, and Consumer Standards, at (202) 366–0846, facsimile (202) 493–2290, electronic mail *kkatz@nhtsa.dot.gov.* For legal issues, call Stephen Wood or Christopher Calamita of the Office of the Chief Counsel, at (202) 366–2992, or e-mail them at *swood@nhtsa.dot.gov* or *ccalamita@nhtsa.dot.gov.*

SUPPLEMENTARY INFORMATION:

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I. Executive Summary

A. Events Leading to Today's Final Rule

In the notice of proposed rulemaking (NPRM) that the agency published on August 30, 2005, the agency proposed to reform the light truck CAFE program. The Reformed CAFE standard was to be based on a step function.[1] To aid the transition to the Reformed CAFE system, we proposed to provide manufacturers with two alternative compliance options (Unreformed and Reformed) for manufacturers in MYs 2008–2010. The agency proposed requiring compliance with the Reformed CAFE system, beginning in MY 2011. The agency noted in the NPRM that it was publishing a separate notice inviting the manufacturers to submit more updated product plans and stated that it recognized that the new plans might differ enough from the previously submitted plans to necessitate changes in the shape of the step function as well as in the levels of stringency of the standards.

In addition, the agency invited public comment on a number of additional changes to the CAFE program. One was whether to base the Reformed CAFE on a continuous function instead of a step function. A second was whether to include large sport utility vehicles (SUVs) in the CAFE standards. A third was whether to revise the ''flat floor'' criterion for classifying vehicles as light trucks so that minivans and passenger vans would be treated as light trucks.

In response to the NPRM and request for new product plans, the agency

[1] As proposed, the structure of Reformed CAFE for each model year would have three basic elements—

(1)—six footprint categories of vehicles.

(2)—a target level of average fuel economy for each footprint category, as expressed by a step function (see figure 1 below).

(3)—a Reformed CAFE standard based on the harmonic production-weighted average of the fuel economy targets for each category.

obtained a great deal of new information. Compared to the plans that the manufacturers submitted to the agency in early 2004, the new plans submitted in November 2005 contained a significant increase in the variety and amount of efforts to improve fuel economy. The agency also received critiques of the analyses it performed to determine the fuel economy capabilities of the manufacturers in MYs 2008–2011.

In response to the public comments, the agency revised its analyses and assumptions including those related to the rate at which increased amounts of fuel saving technologies can be added to a manufacturer's fleet. The new assumptions are closer to the assumptions made by the National Academies of Science in a 2002 study of the CAFE program, and provide increased assurance that the standards adopted today will be economically practicable.

NHTSA also made other changes. It decided to base Reformed CAFE on a continuous function instead of a step function in order to reduce the incentive under Reformed CAFE for manufacturers to downsize (thus reducing safety) or upsize (thus reducing fuel economy) vehicles. It also decided to add the larger SUVs and passenger vans to the mandatory Reformed CAFE program in MY 2011 and beyond to increase long-term energy savings.

B. Today's Final Rule

The final rule adopted today reforms the structure of the CAFE regulatory program so that it achieves higher fuel savings while enhancing safety and preventing adverse economic consequences. We have previously set forth our concerns about the way in which the current CAFE program operates and sought comment on approaches to reforming the CAFE program. We have also previously increased light truck CAFE standards, from the ''frozen'' level of 20.7 mpg applicable from MY 1996 through MY 2004, to a level of 22.2 mpg applicable to MY 2007. In adopting those increased standards, we noted that we were limited in our ability to make further increases without reforming the program.

The Reformed CAFE structure established and institutionalized in this document minimizes those limitations by establishing a system based on light truck size, which allows us to establish higher CAFE standards for MY 2008–2011 light trucks and achieve greater fuel savings across the industry. In addition to the improved energy savings, this CAFE program enhances safety by eliminating the previous regulatory incentive to downsize vehicles and by raising the light truck standards so that there is no regulatory incentive from the CAFE program to design small vehicles as light trucks instead of passenger cars. It prevents adverse economic consequences by incorporating greater consideration of economic practicability issues into the projections of the timing and rate at which manufacturers can introduce fuel economy improving technologies into their fleets, and by setting the Reformed CAFE standards, beginning in MY 2011, at the level at which marginal benefits equal marginal costs.

During a transition period of MYs 2008–2010, manufacturers may comply with CAFE standards established under the reformed structure (Reformed CAFE) or with standards established in the traditional way (Unreformed CAFE). This will permit manufacturers to gain experience with the Reformed CAFE standards. The Reformed CAFE standards for those model years are set at levels intended to ensure that the industry-wide costs of those standards are roughly equivalent to the industry-wide costs of the Unreformed CAFE standards for those model years. The additional lead time provided by the transition period will aid, for example, those manufacturers that, for the first time, face a binding CAFE standard (*i.e.*, one set above their planned level of CAFE) and will be required to make fuel economy improvements to achieve compliance. In MY 2011, all manufacturers are required to comply with a Reformed CAFE standard. The Reformed CAFE standard for that model year is set at the level that maximizes net benefits by setting the fuel economy targets at the point at which marginal benefits of the last added increment of fuel savings equal the marginal costs of the added technology that produced those savings.

As in prior CAFE rulemakings establishing Unreformed standards, this final rule sets the Unreformed standards for MYs 2008–2010 with particular regard to the capabilities of and impacts on the ''least capable'' full line manufacturer (*i.e.*, a full line manufacturer is one that produces a wide variety of types and sizes of vehicles) with a significant share of the market. A single CAFE level, applicable to each manufacturer, is established for each model year.

The Unreformed CAFE standards for MYs 2008–2010 are:

MY 2008: 22.5 mpg
MY 2009: 23.1 mpg
MY 2010: 23.5 mpg

We estimate that compliance with these standards will save 4.4 billion gallons of fuel over the lifetime of the vehicles sold during those model years, compared to the savings that would occur if the standards remained at the MY 2007 level of 22.2 mpg.

Under Reformed CAFE, each manufacturer's required level of CAFE is based on target levels set according to vehicle size. The targets are assigned according to a vehicle's ''footprint''—the product of the average track width (the distance between the centerline of the tires) and wheelbase (basically, the distance between the centers of the axles). Each vehicle footprint value is assigned a target specific to that footprint value. This differs from what we proposed. The proposed reform was based on a discontinuous (or ''step'') function. The proposal segmented the light truck fleet into six discrete categories based on ranges of footprint and assigned a target fuel economy value for each category. The reform adopted in today's final rule is based on a continuous function. Under it, targets are assigned along the continuum of footprint values in the light truck fleet. Each footprint value has a different target. The target values reflect the technological and economic capabilities of the industry. The target for a given footprint value is the same for all manufacturers, regardless of differences in their overall fleet mixes. Compliance is determined by comparing a manufacturer's harmonically averaged fleet fuel economy in a model year with a required fuel economy level calculated using the manufacturer's actual production levels and the category targets.

The Reformed CAFE standards adopted today are more stringent than those proposed in the NPRM. Under the Reformed CAFE system in the NPRM, we estimated that the average CAFE level required of light truck manufacturers would be 23.9 mpg. It is important to note that the MY 2011 standard as adopted in this rule applies to a larger population of vehicles than that in the NPRM. Today's final rule includes medium duty passenger vehicles (MDPVs) (*i.e.*, larger passenger vans and SUVs) as part of the MY 2011 regulated fleet. We estimate that the average CAFE level required of manufacturers under this rule in MY 2011 will be 24.0 mpg. Thus, the MY 2011 standard is more stringent than that proposed while regulating more vehicles, *i.e.*, larger vehicles with typically low fuel economy performance.

As stated above, manufacturers provided updated product plans that reflect changes made to the evaluated light truck fleet used in the NPRM, partly in response to changes in fuel prices. Changing market conditions, a regulatory landscape revised by our proposal, and the more stringent fuel efficiency levels required under Reform CAFE will result in the production of MY 2008–2011 light truck fleets that will consume approximately 11 billion fewer gallons of fuel over their lifetimes than the fleets that were originally planned in 2004.

Apart from the updated product plans, the agency has revised some of the assumptions inputted into the Reformed CAFE analysis. In response to comments and consistent with the findings of the National Academy of Sciences, we revised the phase-in rates to provide for additional lead-time when projecting technology applications. The agency also revised fuel prices and the vehicle miles traveled schedule, which is used to calculate fuel savings, in response to higher fuel price forecasts.

Given the revised product plans, the revisions to the model assumptions, and the more stringent standards adopted in this rule, the Reformed standards will save approximately 7.8 billion additional gallons of fuel over the lifetime of the vehicles sold during those four model years. The Reformed standards for MYs 2008–2010 will save approximately 500 million more gallons of fuel than the Unreformed standards for those model years. As noted above, the Reformed standard for MY 2011 is the first Reformed standard set through a process the explicitly maximizes net benefits. It will save more than 2.8 billion gallons of fuel over the lifetime of vehicle sold in that model year.

In order to provide a comparison of the fuel savings of the final rule versus the proposed rule, we recalculated the fuel savings from the proposed Reformed CAFE standards using the updated product plans and the final rule assumptions. Under this analysis, we calculated that the proposed Reformed standards would save 5.4 billion gallons under these more current assumptions. This compares to the 7.8 billion gallons of fuel saved under the more stringent Reformed CAFE standards adopted today.

If all manufacturers comply with the Reformed CAFE standards, the total costs would be approximately $6.7 billion for MYs 2008–2011, compared to the costs they would incur if the standards remained at the MY 2007 level of 22.2 mpg. The resulting vehicle price increases to buyers of MY 2008 light trucks would be paid back [2] in additional fuel savings in an average of 2.9 years and to buyers of MY 2011 light trucks in an average of 4,4 years, assuming fuel prices ranging from $1.96 to $2.39 per gallon (in 2003 dollars).[3] We estimate that the total benefits under the Unreformed CAFE standards for MYs 2008–2010 plus the Reformed CAFE standard for MY 2011 are approximately $7.6 billion (2003 dollars, discounted at 7%), and under the Reformed CAFE standards for MYs 2008–2011 are approximately $8.1 billion (2003 dollars, discounted at 7%).

We have determined that the standards under both Unreformed CAFE and Reformed CAFE represent the maximum feasible fuel economy level for each system. In reaching this conclusion, we have balanced the express statutory factors and other relevant considerations, such as safety concerns, effects on employment and the need for flexibility to transition to a Reformed CAFE program that can achieve greater fuel savings in a more economically efficient way.

The Reformed CAFE approach incorporates several important elements of reform suggested by the National Academy of Sciences in its 2002 report (Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards). The agency believes that these reforms give the Reformed CAFE approach four basic advantages over the Unreformed CAFE approach.

First, Reformed CAFE increases energy savings. The energy-saving potential of Unreformed CAFE is limited because only a few full-line manufacturers are required to make improvements. In effect, the capabilities of these full-line manufacturers, whose offerings include larger and heavier light trucks, constrain the stringency of the uniform, industry-wide standard. As a result, the Unreformed CAFE standard is generally set below the capabilities of limited-line manufacturers, who sell predominantly lighter and smaller light trucks. Under Reformed CAFE, which accounts for size differences in product mix, virtually all light-truck manufacturers will be required to use advanced fuel-saving technologies to achieve the requisite fuel economy for their vehicles. Thus, Reformed CAFE will continue to require full-line manufacturers to improve the overall fuel economy of their fleets, while also requiring limited-line manufacturers to enhance the fuel economy of the vehicles they sell.

Second, Reformed CAFE offers enhanced safety. Due to the structure of Unreformed CAFE standards, vehicle manufacturers that need to supplement their product plans in order to comply with the standards can increase their likelihood of compliance by pursuing a variety of compliance strategies that entail safety risks: Downsizing of vehicles, design of some vehicles to permit classification as ''light trucks'' for CAFE purposes, and offering smaller and lighter vehicles to offset sales of larger and heavier vehicles. The adverse safety effects of downsizing and downweighting have already been documented for passenger cars in the CAFE program. For example, when a manufacturer designs a vehicle to permit its classification as a light truck, it may increase the vehicle's propensity to roll over.

Reformed CAFE is designed to lessen each of these safety risks. Downsizing of vehicles is discouraged under Reformed CAFE since as vehicles become smaller, the applicable fuel economy target becomes more stringent. Moreover, Reformed CAFE lessens the incentive to design smaller vehicles to achieve a ''light truck'' classification, since many small light trucks are subject to targets that have at least the same degree of stringency as passenger car standards, if not higher stringency.

Third, Reformed CAFE provides a more equitable regulatory framework for

[2] The payback period represents the length of time required for a vehicle buyer to recoup the higher cost of purchasing a more fuel-efficient vehicle through savings in fuel use. When a more stringent CAFE standard requires a manufacturer to improve the fuel economy of some of its vehicle models, the manufacturer's added costs for doing so are reflected in higher prices for these models. While buyers of these models pay higher prices to purchase these vehicles, their improved fuel economy lowers their owners' costs for purchasing fuel to operate them. Over time, buyers thus recoup the higher purchase prices they pay for these vehicles in the form of savings in outlays for fuel. The length of time required to repay the higher cost of buying a more fuel-efficient vehicle is referred to as the buyer's ''payback period.''

The length of this payback period depends on the initial increase in a vehicle's purchase price, the improvement in its fuel economy, the number of miles it is driven each year, and the retail price of fuel. We calculated payback periods using the fuel economy improvement and average price increase for each manufacturer's vehicles estimated to result from the proposed standard, the U.S. Energy Information Administration's forecast of future retail gasoline prices, and estimates of the number of miles light trucks are driven each year as they age developed from U.S. Department of Transportation data. Energy Information Administration, Annual Energy Outlook 2005 (AEO 2005), Table 100, *http://www.eia.doe.gov/oiaf/aeo/supplement/index.html;* and U.S. Department of Transportation, 2001 National Household Travel Survey, *http://nhts.ornl.gov/2001/index.shtml*. Under these assumptions, payback periods for the final rule alternatives (*i.e.*, Unreformed and Reformed CAFE) range from 2.9 to 4.9 years. .

[3] The fuel prices used to calculate the length of the payback periods are those expected over the life of the MY 2008–2011 light trucks, not the current fuel prices. Those future fuel prices were obtained from the AEO 2006 (Early Report).

different vehicle manufacturers. Under Unreformed CAFE, the cost burdens and compliance difficulties have been imposed nearly exclusively on the full-line manufacturers. Reformed CAFE spreads the regulatory cost burden for fuel economy more broadly across the industry.

Fourth, Reformed CAFE is more market-oriented because it more fully respects economic conditions and consumer choice. Reformed CAFE does not force vehicle manufacturers to adjust fleet mix toward smaller vehicles unless that is what consumers are demanding. Instead, it allows the manufacturers to adjust the mix of their product offerings in response to the market place. As a result, as the industry's sales volume and mix changes in response to economic conditions (e.g., gasoline prices and household income) and consumer preferences (e.g., desire for seating capacity or hauling capability), the level of CAFE required of manufacturers under Reformed CAFE will, at least partially, adjust automatically to these changes. Accordingly, Reformed CAFE reduces the need that the agency might otherwise have to revisit previously established standards in light of changed market conditions, a difficult process that undermines regulatory certainty for the industry. In the mid-1980's, for example, the agency relaxed several Unreformed CAFE standards because fuel prices fell more than had been expected when those standards were established and, as a result, consumer demand for small vehicles with high fuel economy did not materialize as expected.

In addition to reforming the structure of the light truck CAFE program, we are also expanding its applicability. Starting in MY 2011, the CAFE program will include MPDVs, light trucks that have a gross vehicle weight rating (GVWR) less than 10,000 lbs., a GVWR greater than 8,500 lbs. or a curb weight greater than 6,000 lbs., and that primarily transport passengers. We estimate this will bring an additional 240,000 vehicles into the CAFE program in that model year.

C. Energy Demand and Supply and the Value of Conservation

As we noted in the notice of proposed rulemaking (NPRM),[4] many of the concerns about energy security and the effects of energy prices and supply on national economic well-being that led to the enactment of EPCA in 1975 persist today.[5] The demand for oil is steadily growing in the U.S. and around the world. By 2030, U.S. demand for petroleum products is expected to increase 33 percent compared to 2004.[6] World oil demand is expected to increase by nearly 44 percent between 2004 and 2025.[7] Most of these increases would occur in the transportation sector. To meet this projected increase in world demand, worldwide productive capacity would have to increase by more than 36 million barrels per day over current levels. OPEC producers are expected to supply nearly 40 percent of the increased production. By 2025, 60 percent of the oil consumed in the U.S. would be imported oil. Strong growth in the demand for oil worldwide, coupled with tight crude oil supplies, is the driving force behind the sharp price increases seen over the past four years. Increasingly, the oil consumed in the U.S. originates in countries with political and economic situations that raise concerns about future oil supply and prices.

Energy is an essential input to the U.S. economy and having a strong economy is essential to maintaining and strengthening our national security. Conserving energy, especially reducing the nation's dependence on petroleum, benefits the U.S. in several ways. Reducing total petroleum use decreases our economy's vulnerability to oil price shocks. Reducing dependence on oil imports from regions with uncertain conditions enhances our energy security. Reducing the growth rate of oil use will help relieve pressures on already strained domestic refinery capacity, decreasing the likelihood of future product price volatility.

Today's final rule is one piece of President Bush's strategy to move the nation beyond a petroleum-based economy. Aside from the fuel savings that will be realized by today's final rule, the Administration is focusing research on bio-based transportation fuels, improved batteries for hybrid vehicles, and the on-going hydrogen fuel initiative. The President's Advanced Energy Initiative and today's final rule will build on the progress made by the Administration's 2001 National Energy Policy and the increased CAFE standards for MY 2005–2007 light trucks.

II. Background

In proposing the CAFE standards for MYs 2008–2011, the agency provided a detailed summary of the history of fuel economy standards, and in particular, fuel economy standards for light trucks. Below we have provided a summary of that discussion. For more background on the light truck CAFE program, refer to the NPRM.

A. 1974 DOT/EPA Report to Congress on Potential for Motor Vehicle Fuel Economy Improvements

In 1974, the Department of Transportation (DOT) and Environmental Protection Agency (EPA) submitted to Congress a report entitled ''Potential for Motor Vehicle Fuel Economy Improvement (1974 Report).[8] This report was prepared in compliance with Section 10 of the Energy Supply and Environmental Coordination Act of 1974, Public Law 93–319 (the Act). In the 1974 Report, DOT/EPA said that performance standards regulating fuel economy could take either of two modes: a production-weighted average standard for each manufacturer's entire fleet of vehicles or a fuel economy standard tailored to individual classes of vehicles. Included as a possible form for a production-weighted standard was a variable standard based on the costs or potential to improve for each manufacturer (1974 Report, p. 77).

DOT/EPA concluded in the 1974 Report that a production-weighted standard establishing one uniform specific fuel economy average for all manufacturers would, if sufficiently stringent to have the needed effect, impact most heavily on manufacturers who have lower fuel economy, while not requiring manufacturers of current vehicles with better fuel economy to maintain or improve their performance. (1974 Report, p. 12) Production-weighted standards specifically tailored to each manufacturer would eliminate some inequities, but were considered to be difficult to administer fairly. (Ibid.)

B. Energy Policy and Conservation Act of 1975

Congress enacted the Energy Policy and Conservation Act (EPCA Pub. L. 94–163) during the aftermath of the energy crisis created by the oil embargo of 1973–74. The Act established an automobile fuel economy regulatory program by adding Title V, ''Improving Automotive Efficiency,'' to the Motor Vehicle Information and Cost Savings Act. Title V has been amended from time to time and codified without

[4] 70 FR 51414, August 30, 2005.

[5] The sources of the figures in this section can be found below in section VIII, ''Need for Nation to conserve energy.''

[6] Annual Energy Outlook 2006 with projections to 2030 (Early Release), *http://www.eia.doe.gov/oiaf/aeo/index.html*.

[7] Id.

[8] The 1974 report is available in the docket for this rulemaking.

substantive change as Chapter 329 of title 49, United States Code. Chapter 329 provides for the issuance of average fuel economy standards for passenger automobiles and separate standards for automobiles that are not passenger automobiles (light trucks).

For the purposes of the CAFE statute, ''automobiles'' include any ''4-wheeled vehicle that is propelled by fuel (or by alternative fuel) manufactured primarily for use on public streets, roads, and highways (except a vehicle operated only on a rail line), and rated at not more than 6,000 pounds gross vehicle weight.'' They also include any such vehicle rated at between 6,000 and 10,000 pounds gross vehicle weight (GVWR) if the Secretary decides by regulation that an average fuel economy standard for the vehicle is feasible, and that either such a standard will result in significant energy conservation or the vehicle is substantially used for the same purposes as a vehicle rated at not more than 6,000 pounds GVWR.[9]

The CAFE standards set a minimum performance requirement in terms of an average number of miles a vehicle travels per gallon of gasoline or diesel fuel. Individual vehicles and models are not required to meet the mileage standard. Instead, each manufacturer must achieve a harmonically averaged level of fuel economy for all specified vehicles manufactured by a manufacturer in a given MY. The statute distinguishes between ''passenger automobiles'' and ''non-passenger automobiles.'' We generally refer to non-passenger automobiles as light trucks.

In enacting EPCA and after considering the variety of approaches presented in the 1974 Report, Congress made a clear and specific choice about the structure of the average fuel economy standard for passenger cars. Congress established a common statutory CAFE standard applicable to each manufacturer's fleet of passenger automobiles.

Congress was considerably less decided and prescriptive with respect to what sort of standards and procedures should be established for light trucks. It neither made a clear choice among the approaches (or among the forms of those approaches) identified in the 1974 Report nor precluded the selection of any of those approaches or forms. Further, it did not establish by statute a CAFE standard for light trucks. Instead, Congress provided the Secretary with a choice of establishing a form of a production-weighted average standard for each manufacturer's entire fleet of light trucks, as suggested in the 1974 Report, or a form of production-weighted standards for classes of light trucks. Congress directed the Secretary to establish maximum feasible CAFE standards applicable to each manufacturer's light truck fleet, or alternatively, to classes of light trucks, and to establish them at least 18 months prior to the start of each model year. When determining a ''maximum feasible level of fuel economy,'' the Secretary is directed to balance factors including the nation's need to conserve energy, technological feasibility, economic practicability and the impact of other motor vehicle standards on fuel economy.

C. 1979–2002 Light Truck Standards

NHTSA established the first light truck CAFE standards for MY 1979 and applied them to light trucks with a GVWR up to 6,000 pounds (March 14, 1977; 42 FR 13807). Beginning with MY 1980, NHTSA raised this GVWR ceiling to 8,500 pounds. For MYs 1979–1981, the agency established separate standards for two-wheel drive (2WD) and four-wheel drive (4WD) light trucks without a ''combined'' standard reflecting the combined capabilities of 2WD and 4WD light trucks. Manufacturers that produced both 2WD vehicles and 4WD vehicles could, however, decide to treat them as a single fleet and comply with the 2WD standard.

Beginning with MY 1982, NHTSA established a combined standard reflecting the combined capabilities of 2WD and 4WD light trucks, plus optional 2WD and 4WD standards. Manufacturers had the option of complying under the combined fleet standard, or under the separate 2WD and 4WD standards. Although the combined standard reflected the combined capabilities of 2WD and 4WD light trucks, it did not necessarily reflect the combined capabilities of the 2WD and 4WD fleets of an individual manufacturer (e.g., a manufacturer may have found it easier to comply with the combined standard than the 2WD and 4WD standards separately, or vice versa). After MY 1991, NHTSA dropped the optional 2WD and 4WD standards.

As explained in the NPRM, NHTSA twice found it necessary to reduce a light truck standard when it received new information relating to the agency's past projections. In 1979, the agency reduced the MY 1981 2WD standard after Chrysler demonstrated that there were smaller than expected fuel economy benefits from various technological improvements and larger than expected adverse impacts from other federal vehicle standards and test procedures (December 31, 1979; 44 FR 77199).

In 1984, the agency reduced the MY 1985 light truck standards after we concluded that market demand for light truck performance, as reflected in engine mix and axle ratio usage, had not materialized as anticipated when the agency initially established the MY 1985 standards. The agency said that this resulted from lower than anticipated fuel prices. The agency concluded that the only actions then available to manufacturers to improve their fuel economy levels for MY 1986 would have involved product restrictions likely resulting in significant adverse economic impacts. The reduction of the MY 1985 standard was upheld by the U.S. Circuit Court of Appeals for the District of Columbia. *Center for Auto Safety* v. *NHTSA*, 793 F.2d 1322 (D.C. Cir. 1986) (rejecting the contention that the agency gave impermissible weight to the effects of shifts in consumer demand toward larger, less fuel-efficient trucks on the fuel economy levels manufacturers could achieve).[10]

On November 15, 1995, the Department of Transportation and Related Agencies Appropriations Act for FY 1996 was enacted, which limited the ability of the agency to establish CAFE standards for light trucks (Section 330, Pub. L. 104–50). Pursuant to that Act, we then issued a final rule limited to MY 1998, setting the light truck CAFE standard for that year at 20.7 mpg, the same level as the standard we had set for MY 1997 (61 FR 14680; April 3, 1996). The same limitation on the setting of CAFE standards was included in the Appropriations Acts for each of FYs 1997–2001. The agency followed the same process as for MY 1998, established the light truck CAFE standard at 20.7 mpg, for MYs 1999–2002.

[9] In 1978, we extended the CAFE program to include vehicles rated between 6,000 and 8,500 pounds GVWR (March 23, 1978; 43 FR 11995, at 11997). Vehicles rated at between 6,000 and 8,500 pounds GVWR first became subject to the CAFE standards in MY 1980.

[10] NHTSA similarly found it necessary on occasion to reduce the passenger car CAFE standards in response to new information. The agency reduced the MY 1986 passenger car standard because a continuing decline in gasoline prices prevented a projected shift in consumer demand toward smaller cars and smaller engines and because the only actions available to manufacturers to improve their fuel economy levels for MY 1986 would have involved product restrictions likely resulting in significant adverse economic impacts. (October 4, 1985; 40 FR 40528) This action was upheld in *Public Citizen* v. *NHTSA*, 848 F.2d 256 (D.C. Cir. 1988). NHTSA also reduced the MY 1987–88 passenger car standards (October 6, 1986; 51 FR 35594) and MY 1989 passenger car standard (October 6, 1988; 53 FR 39275) for similar reasons.

While the Department of Transportation and Related Agencies Appropriations Act for FY 2001 (Pub. L. 106–346) contained a restriction on CAFE rulemaking identical to that contained in prior appropriation acts, the conference committee report for that Act directed NHTSA to fund a study by the NAS to evaluate the effectiveness and impacts of CAFE standards (H. Rep. No. 106–940, at p. 117–118).

In a letter dated July 10, 2001, following the release of the President's National Energy Policy, Secretary of Transportation Mineta asked the House and Senate Appropriations Committees to lift the restriction on the agency spending funds for the purposes of improving CAFE standards. The Department of Transportation and Related Agencies Appropriations Act for FY 2002 (Pub. L. 107–87), which was enacted on December 18, 2001, did not contain a provision restricting the Secretary's authority to prescribe fuel economy standards.

D. 2001 National Energy Policy

The National Energy Policy,[11] released in May 2001, stated that ''(a) fundamental imbalance between supply and demand defines our nation's energy crisis'' and that ''(t)his imbalance, if allowed to continue, will inevitably undermine our economy, our standard of living, and our national security.'' The National Energy Policy was designed to promote dependable, affordable and environmentally sound energy for the future. The Policy envisions a comprehensive long-term strategy that uses leading edge technology to produce an integrated energy, environmental and economic policy. It set forth five specific national goals: ''modernize conservation, modernize our energy infrastructure, increase energy supplies, accelerate the protection and improvement of the environment, and increase our nation's energy security.''

The National Energy Policy included recommendations regarding the path that the Administration's energy policy should take and included specific recommendations regarding vehicle fuel economy and CAFE. It recommended that the President direct the Secretary of Transportation to—

—Review and provide recommendations on establishing CAFE standards with due consideration of the National Academy of Sciences study released (in prepublication form) in July 2001. Responsibly crafted CAFE standards should increase efficiency without negatively impacting the U.S. automotive industry. The determination of future fuel economy standards must therefore be addressed analytically and based on sound science.

—Consider passenger safety, economic concerns, and disparate impact on the U.S. versus foreign fleet of automobiles.

—Look at other market-based approaches to increasing the national average fuel economy of new motor vehicles.

E. 2002 NAS Study of CAFE Reform

In response to direction from Congress, NAS published a lengthy report in 2002 entitled ''Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards.''[12]

The report concludes that the CAFE program has clearly contributed to increased fuel economy and that it was appropriate to consider further increases in CAFE standards. (NAS, p. 3 (Finding 1)) It cited not only the value of fuel savings, but also adverse consequences (i.e., externalities) associated with high levels of petroleum importation and use that are not reflected in the price of petroleum (e.g., the adverse impact on energy security). The report further concluded that technologies exist that could significantly reduce fuel consumption by passenger cars and light trucks within 15 years, while maintaining vehicle size, weight, utility and performance. (NAS, p. 3 (Finding 5)) Light duty trucks were said to offer the greatest potential for reducing fuel consumption. (NAS, p. 4 (Finding 5)) The report also noted that vehicle development cycles—as well as future economic, regulatory, safety and consumer preferences—would influence the extent to which these technologies could lead to increased fuel economy in the U.S. market. The report noted that the widespread penetration of even existing technologies will probably require 4–8 years. To assess the economic trade-offs associated with the introduction of existing and emerging technologies to improve fuel economy, the NAS conducted what it called a ''cost-efficient analysis''—''that is, the committee [that authored the report] 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.'' (NAS, p. 4 (Finding 6))

Recognizing the many trade-offs that must be considered in setting fuel economy standards, the report took no position on what CAFE standards would be appropriate for future years. It noted, ''(s)election of fuel economy targets will require uncertain and difficult trade-offs among environmental benefits, vehicle safety, cost, oil import dependence, and consumer preferences.''

The report found that, to minimize financial impacts on manufacturers, and on their suppliers, employees, and consumers, sufficient lead-time (consistent with normal product life cycles) should be given when considering increases in CAFE standards. The report stated that there are advanced technologies that could be employed, without negatively affecting the automobile industry, if sufficient lead-time were provided to the manufacturers.

The report expressed concerns about increasing the standards under the CAFE program as currently structured. While raising CAFE standards under the existing structure would reduce fuel consumption, doing so under alternative structures ''could accomplish the same end at lower cost, provide more flexibility to manufacturers, or address inequities arising from the present'' structure. (NAS, pp. 4–5 (Finding 10))[13] Further, the committee said, ''to the extent that the size and weight of the fleet have been constrained by CAFE requirements * * * those requirements have caused more injuries and fatalities on the road than would otherwise have occurred.'' (NAS, p. 29) Specifically, they noted: ''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 1300 to 2600 traffic fatalities in 1993.'' (NAS, p. 3 (Finding 2)).

To address those structural problems, the report suggested various possible

[11] *http://www.whitehouse.gov/energy/National-Energy-Policy.pdf.*

[12] The NAS submitted its preliminary report to the Department of Transportation in July 2001 and released its final report in January 2002.

[13] The report noted the following about the concept of equity:

Potential Inequities

The issue of equity or inequity is subjective. However, one concept of equity among manufacturers requires equal treatment of equivalent vehicles made by different manufacturers. The current CAFE standards fail this test. If one manufacturer was positioned in the market selling many large passenger cars and thereby was just meeting the CAFE standard, adding a 22-mpg car (below the 27.5-mpg standard) would result in a financial penalty or would require significant improvements in fuel economy for the remainder of the passenger cars. But, if another manufacturer was selling many small cars and was significantly exceeding the CAFE standard, adding a 22-mpg vehicle would have no negative consequences.

(NAS, p. 102).

reforms.[14] The report found that the ''CAFE program might be improved significantly by converting it to a system in which fuel targets depend on vehicle attributes.'' (NAS, p. 5 (Finding 12)). The report noted that a system in which fuel economy targets were dependent on vehicle weight, with lower fuel consumption targets set for lighter vehicles and higher targets for heavier vehicles, up to some maximum weight, would create incentives to reduce the variance in vehicle weights between large and small vehicles, thus providing for overall vehicle safety. (NAS, p. 5 (Finding 12)). The report stated that such a system has the potential to increase fuel economy with fewer negative effects on both safety and consumer choice.

The report noted further that under an attribute-based approach, the required CAFE levels could vary among the manufacturers based on the distribution of their product mix. NAS stated that targets could vary among passenger cars and among trucks, based on some attribute of these vehicles such as weight, size, or load-carrying capacity. The report explained that a particular manufacturer's average target for passenger cars or for trucks would depend upon the fractions of vehicles it sold with particular levels of these attributes (NAS, p. 87). For example, if weight were the criterion, a manufacturer that sells mostly light vehicles would have to achieve higher average fuel economy than would a manufacturer that sells mostly heavy vehicles.

The report illustrated an example of an attribute-based system using a continuous function (NAS, p. 109). Essentially, as illustrated, the continuous function was represented as a line, which graphed ''gallons per mile'' versus ''curb weight.'' Under the continuous function example, a vehicle's target fuel economy would be determined by locating the vehicle's curb weight along the line and identifying the corresponding gallons per mile value.

[14] In assessing and comparing possible reforms, the report urged consideration of the following factors:

Fuel use responses encouraged by the policy,
Effectiveness in reducing fuel use,
Minimizing costs of fuel use reduction,
Other potential consequences
—Distributional impacts
—Safety
—Consumer satisfaction
—Mobility
—Environment
—Potential inequities, and Administrative feasibility.
(NAS, p. 94).

In February 2002, Secretary Mineta asked Congress ''to provide the Department of Transportation with the necessary authority to reform the CAFE program, guided by the NAS report's suggestions.''

F. 2003 Final Rule Establishing MY 2005–2007 Light Truck Standards

On April 7, 2003, the agency published a final rule establishing light truck CAFE standards for MYs 2005–2007: 21.0 mpg for MY 2005, 21.6 mpg for MY 2006, and 22.2 mpg for MY 2007 (68 FR 16868; Docket No. 2002–11419; Notice 3). The agency determined that these levels are the maximum feasible CAFE levels for light trucks for those model years, balancing the express statutory factors and other included or relevant considerations such as the impact of the standard on motor vehicle safety and employment. NHTSA estimated that the fuel economy increases required by the standards for MYs 2005–2007 would generate approximately 3.6 billion gallons of gasoline savings over the 25-year lifetime of the affected vehicles.

We recognized in the final rule that the standard established for MY 2007 could be a challenge for General Motors. We recognized further that, between the issuance of the final rule and the last (MY 2007) of the model years for which standards were being established, there was more time than in previous light truck CAFE rulemakings for significant changes to occur in external factors capable of affecting the achievable levels of CAFE. These external factors include fuel prices and the demand for vehicles with advanced fuel saving technologies, such as hybrid electric and advanced diesel vehicles. We said that changes in these factors could lead to higher or lower levels of CAFE, particularly in MY 2007. Recognizing that it may be appropriate to re-examine the MY 2007 standard in light of any significant changes in those factors, the agency reaffirms its plans to monitor the compliance efforts of the manufacturers.

G. 2003 Comprehensive Plans for Addressing Vehicle Rollover and Compatibility

In September 2002, NHTSA completed a thorough examination of the opportunities for significantly improving vehicle and highway safety and announced the establishment of interdisciplinary teams to formulate comprehensive plans for addressing the four most promising problem areas.[15] Based on the work of the teams, the agency issued detailed reports analyzing each of the problem areas and recommending coordinated strategies that, if implemented effectively, will lead to significant improvements in safety.

[15] A fifth problem area was announced in 2004, improving traffic safety data.

Two of the problems areas are vehicle rollover and vehicle compatibility. The reports on those areas identify a series of vehicle, roadway and behavioral strategies for addressing the problems.[16] Among the vehicle strategies, both reports identified reform of the CAFE program as one of the steps that needed to be taken to reduce those problems:

> The current structure of the CAFE system can provide an incentive to manufacturers to downweight vehicles, increase production of vehicle classes that are more susceptible to rollover crashes, and produce a less homogenous fleet mix. As a result, CAFE is critical to the vehicle compatibility and rollover problems.

Recognizing the role of CAFE, we stated:

> It is NHTSA's goal to identify and implement reforms to the CAFE system that will facilitate improvements in fuel economy without compromising motor vehicle safety or American jobs. * * *
> * * * NHTSA intends to examine the safety impacts, both positive and negative, that may result from any modifications to CAFE as it now exists. Regardless of the root causes, it is clear that the downsizing of vehicles that occurred during the first decade of the CAFE program had serious safety consequences. Changes to the existing system are likely to have equally significant impacts. NHTSA is determined to ensure that these impacts are positive.

H. 2003 ANPRM

On December 29, 2003, the agency published an ANPRM seeking comment on various issues relating to reforming the CAFE program (68 FR 74908; Docket No. 2003–16128).[17] The agency sought comment on possible enhancements to the program that would assist in further fuel conservation, while protecting motor vehicle safety and the economic vitality of the automobile industry. The agency indicated that it was particularly interested in structural reform. That document, while not espousing any particular form of reform, sought specific input on various options aimed

[16] See *http://www-nrd.nhtsa.dot.gov/vrtc/ca/capubs/IPTRolloverMitigationReport/; http://www-nrd.nhtsa.dot.gov/departments/nrd-11/aggressivity/IPTVehicleCompatibilityReport/.*

[17] On the same date, we also published a request for comments seeking manufacturer product plan information for MYs 2008–2012 to assist the agency in analyzing possible reforms to the CAFE program which are discussed in a companion notice published today. (68 FR 74931) The agency sought information that would help it assess the effect of these possible reforms on fuel economy, manufacturers, consumers, the economy, motor vehicle safety and American jobs.

at adapting the CAFE program to today's vehicle fleet and needs.

1. Need for Reform

The 2003 ANPRM discussed the principal criticisms of the current CAFE program that led the agency to explore light truck CAFE reform (68 FR 74908, at 74910–13). First, the energy-saving potential of the CAFE program is hampered by the current regulatory structure. The Unreformed approach to CAFE does not distinguish between the various market segments of light trucks, and therefore does not recognize that some vehicles designed for classification purposes as light trucks may achieve fuel economy similar to that of passenger cars. The Unreformed CAFE approach instead applies a single standard to the light truck fleet as a whole, encouraging manufacturers to offer small light trucks that will offset the larger vehicles that get lower fuel economy. A CAFE system that more closely links fuel economy standards to the various market segments reduces the incentive to design vehicles that are functionally similar to passenger cars but classified as light trucks.

Second, because weight strongly affects fuel economy, the current light truck CAFE program encourages vehicle manufacturers to reduce weight in their light truck offerings to achieve greater fuel economy.[18] As the NAS report and a more recent NHTSA study have found, downweighting of the light truck fleet, especially those trucks in the low and medium weight ranges, creates more safety risk for occupants of light trucks and all motorists combined.[19]

Third, the agency noted the adverse economic impacts that might result from steady future increases in the stringency of CAFE standards under the current regulatory structure. Rapid increases in the light truck CAFE standard could have serious adverse economic consequences. The vulnerability of full-line manufacturers to tighter CAFE standards does not arise primarily from poor fuel economy ratings within weight classes, *i.e.*, from less extensive use of fuel economy improving technologies. As explained in the 2003 ANPRM, their overall CAFE averages are low compared to manufacturers that produce more relatively light vehicles because their sales mixes service a market demand for bigger and heavier vehicles capable of more demanding utilitarian functions. An attribute-based (weight and/or size) system could avoid disparate impacts on full-line manufacturers that could result from a sustained increase in CAFE standards.

2. Reform Options

In discussing potential changes, the agency focused primarily on structural improvements to the current CAFE program authorized under the current statutory authority, and secondarily on definitional changes to the current vehicle classification system and whether to include vehicles between 8,500 to 10,000 lbs. GVWR. The NPRM explored the various reform options raised in the ANPRM. It is worth noting again several of those options.

Included in the reform discussion was an attribute-based ''continuous-function'' system, such as that discussed in the NAS report. We chose various measures of vehicle weight and/or size to illustrate the possible design of an attribute-based system. However, we also sought comment as to the merits of using other vehicle attributes as the basis of an attribute-based system.

The 2003 ANPRM also presented potential reform options under which vehicles with a GVWR of up to 10,000 lbs. could be included under the CAFE program. One presented option would be to include vehicles defined by EPA as medium duty passenger vehicles [20] for use in the CAFE program. This definition would essentially make SUVs and passenger vans between 8,500 and 10,000 lbs. GVWR subject to CAFE, while continuing to exclude most medium- and heavy-duty pickups and most medium- and heavy-duty cargo vans that are primarily used for agricultural and commercial purposes.

Through the 2003 ANPRM, the agency intended to begin a public discussion on potential ways, within current statutory authority, to improve the CAFE program to better achieve our public policy objectives. The agency set forth a number of possible concepts and measures, and invited the public to present additional concepts. The agency expressed interest in any suggestions toward revamping the CAFE program in such a way as to enhance overall fuel economy while protecting occupant safety and the economic vitality of the auto market.

I. Recent developments

1. Factors underscoring need for reform

In the NPRM, we recognized two important complicating factors that underscore the need for CAFE reform. One factor is the fiscal problems reported by General Motors and Ford, while the other is the recent surge in gasoline prices, a development that may be exacerbating the financial challenges faced by both companies.

Two of the larger, full-line light-truck manufacturers, General Motors and Ford, have reported serious financial difficulties. The investment community has downgraded the bonds of both companies. Further, both companies have announced significant layoffs and other actions to improve their financial condition. While these financial problems did not give rise to the Administration's CAFE reform initiative, the financial risks now faced by these companies, including their workers and suppliers, underscore the importance to full-line vehicle manufacturers of establishing an equitable CAFE regulatory framework.

There has also been a sharp and sustained surge in gasoline prices since our last light truck final rule in April 2003 and the December 2003 ANPRM on CAFE reform. According to the Energy Information Administration (EIA), the retail price for gasoline in April 2003 was $1.59 per gallon and in December 2003 was $1.48 per gallon.[21] When the NPRM was published the weekly U.S. retail price was $2.55 per gallon.[22] While the retail price of gasoline has declined since publication of the NPRM it is still $2.34, which is $.75 per gallon higher than when the 2003 final rule was published.[23]

We noted in the NPRM that it is important to recognize that CAFE standards for MYs 2008–2011 should not be based on current gasoline prices. They should be based on our best forecast of what average real gasoline prices will be in the U.S. during the years that these vehicles will be used by consumers: The 36-year period beginning in 2008 and extending to 2034.[24] Since miles of travel tend to be

[18] Manufacturers can reduce weight without changing the fundamental structure of the vehicle by using lighter materials or eliminating available equipment or options. In contrast, reducing vehicle size, and particularly footprint, generally entails an alteration of the basic architecture of the vehicle.

[19] However, both studies also suggest that if downweighting is concentrated on the heaviest light trucks in the fleet there would be no net safety impact, and there might even be a small fleet-wide safety benefit. There is substantial uncertainty about the curb weight cut-off above which this would occur.

[20] The EPA's discussion of the MDPV definition is at 65 FR 6698, 6749–50, 6851–6852.

[21] See *http://tonto.eia.doe.gov/oog/info/gdu/gaspump.html.*

[22] See *http://www.eia.doe.gov/oil_gas/petroleum/data_publications/wrgp/mogas_home_page.html* and *http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp.*

[23] See id.

[24] To calculate the fuel savings for the light trucks manufactured in a model year, we consider the savings over a 26-year period. The number of light trucks manufactured during each model year that remains in service during each subsequent calendar year is estimated by applying estimates of the proportion of light trucks surviving to each age up

concentrated in the early years of a vehicle's lifetime, the projected gasoline price in the 2008–2020 period is particularly relevant for this rulemaking.

The Preliminary Regulatory Impact Analysis (PRIA) for the NPRM was based on projected gasoline prices from the then most recent Annual Energy Outlook 2005 (AEO2005) (published in 2004 before the recent price rises), which projected gasoline prices ranging from $1.51 to $1.58 per gallon.[25] The Final Regulatory Impact Analysis (FRIA) for today's rule is based on the revised forecast EIA published in the AEO2006 (Early outlook) (see FRIA p. XIII–26). The current forecasted price for gasoline ranges from $1.96 to $2.39 per gallon.[26]

2. Revised product plans

In response to a request for comment (RFC) [27] published in conjunction with the NRPM, the agency has received updated product plans from the vehicle manufacturers. While the NPRM was based on product plans received in response to the 2003 ANPRM, the final rule relied on product plans received in response to the August 2005 RFC.

III. Summary of the NPRM

On August 30, 2005, the agency published a notice of proposed rulemaking (NPRM) to establish CAFE standards for model years (MYs) 2008 through 2011, and more importantly to reform the CAFE program (70 FR 51414). The NPRM was one piece of the Department of Transportation's continuing effort to achieve higher fuel savings while enhancing safety and preventing adverse economic consequences. We noted that the previous rulemaking efforts increased the light truck CAFE standards, from the ''frozen'' level of 20.7 mpg applicable from MY 1996 through MY 2004, to a level of 22.2 mpg applicable to MY 2007. However, in order to continue moving forward with improved fuel savings while enhancing safety and preventing adverse economic consequences the agency proposed to reform the light truck CAFE system.

In the NPRM, we proposed fuel economy standards for light trucks in MYs 2008–2010, established under the traditional CAFE system (Unreformed CAFE system). We also proposed standards for MYs 2008–2010 established under a proposed reformed CAFE system (Reformed CAFE). During MYs 2008–2010, manufacturers would have an option of complying with standards established under the Unreformed or the Reformed CAFE system. We proposed that this period would serve as a transition period to provide manufacturers an opportunity to adjust to changes in the CAFE system and to provide this agency and the manufacturers' opportunity to gain experience with the new system. For MY 2011, we proposed standards established under Reformed CAFE only.

The Unreformed standards for MYs 2008–2010 were proposed with particular regard to the capabilities of and impacts on the ''least capable'' full-line manufacturer (a full-line manufacturer is one that produces a wide variety of types and sizes of vehicles) with a significant share of the market. A single CAFE level, applicable to each manufacturer, was proposed each model year as follows:

MY 2008: 22.5 mpg
MY 2009: 23.1 mpg
MY 2010: 23.5 mpg

We estimated that these standards could save 4.4 billion gallons of fuel over the lifetime of the vehicles sold during those model years, compared to the savings that would occur if the standards remained at the MY 2007 level of 22.2 mpg.

The proposed Reformed CAFE system relied on a category and target system in which the light truck fleet was segmented according to size and a manufacturer's required fuel economy level would be based on its actual fleet distribution across the categories as compared to applicable fuel economy targets. As proposed, the structure of Reformed CAFE for each model year would have three basic elements—

(1)—six footprint [28] categories of vehicles.

(2)—a target level of average fuel economy for each footprint category, as expressed by a step function (The step or ''staircase'' nature of the function can be seen in Figure 1 below.).

(3)—a Reformed CAFE standard based on the harmonic production-weighted average of the fuel economy targets for each category.

to 26 years (see Table VIII–2 in the PRIA). At the end of 26 years, the proportion of light trucks remaining in service falls below 10 percent.

[25] *http://www.eia.doe.gov/oiaf/aeo/index.html.*

[26] The EIA gasoline prices are provided in 2003 dollars. In terms of 2006 dollars (based on the 2003 GDP deflator; see, *http://www.gpoaccess.gov/usbudget/fy05/sheets/hist10z1.xls*) the forecasted range of fuel prices would be $2.04 to 2.49.

[27] 70 FR 51466; August 30, 2005; Docket No. NHTSA–2005–22144–03.

[28] Footprint is an aspect of vehicle size—the product of multiplying a vehicle's wheelbase by its average track width.

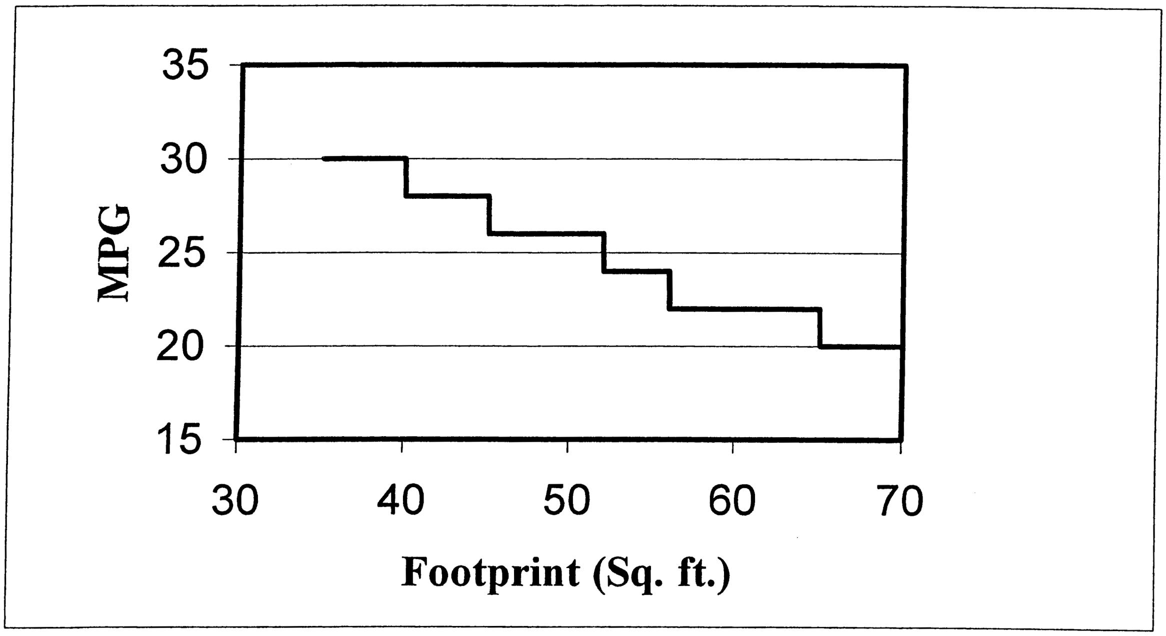

Figure 1—Illustration of the "shape" of the step function

To define the proposed category boundaries (step boundaries), we first plotted the light truck production volumes by footprint. We then sought to designate the category boundaries at points where there was low volume footprint immediately adjacent to and to left of a high volume footprint. Our intent in doing this was to reduce any incentive for manufacturers to increase footprint in order to move a model into a category with a lower fuel economy target. We sought to create a reasonable number of categories that would also combine, to the extent practicable, similar vehicle types into the same category. Each category was then assigned a fuel economy target.

The proposed fuel economy targets were determined by a three-step process. First, the agency applied feasible technology to each of the seven largest light truck manufacturers' fleets [29] individually until the marginal cost of the added technology equaled the marginal benefit of the additional technology. Next, initial targets were determined by placing all of the improved vehicles into the six categories and calculating a production-weighted fuel economy average within each category. Finally, the initial targets were adjusted by equal increments of fuel savings to a level at which marginal cost equaled marginal benefit for industry as a whole. This final level provided the targets as proposed, which would be used to determine a manufacturer's required fuel economy level.

Under the proposed reform, the required level of CAFE for a particular manufacturer for a model year would be calculated after inserting the following data into the standard for that model year: that manufacturer's actual total production and its production in each footprint category for that model year.[30] The calculation of the required level would be made by dividing the manufacturer's total production for the model year by the sum of the six fractions (one for each category) obtained by dividing the manufacturer's production in a category by the category's target.

As proposed, a manufacturer's required fuel economy was represented as the following formula:

$$\frac{\text{Manufacturer X's Total Production of Light Trucks}}{\frac{\text{X's production in category 1}}{\text{Target for category 1}}+\frac{\text{X's production in category 2}}{\text{Target for category 2}}+\text{etc}} = \text{X's required level of CAFE}$$

During the MY 2008–2010 transition period, we proposed that manufacturers may comply with CAFE standards established under Reformed CAFE or with standards established under Unreformed CAFE. To further ease the transition, and to ensure that the Reformed standards were economically practical, the proposed Reformed CAFE standards were set at levels at which the industry-wide cost of those standards were roughly equivalent to the industry-wide cost of the Unreformed CAFE standards for those model years.

[29] The seven largest light truck manufacturers are General Motors, Ford, DaimlerChrysler, Toyota, Honda, Hyundai, and Nissan.

[30] Since the calculation of a manufacturer's required level of average fuel economy for a particular model year would require knowing the final production figures for that model year, the final formal claculation of that level would not occur until after those figures are submitted by the manufacturer to EPA. That submission would not, of course, be made until after the end of that model year.

As proposed, all manufacturers would be required to comply with a Reformed CAFE standard in MY 2011. The proposed Reformed CAFE standard for that model year was set at the level that maximized net benefits.

Under the NPRM, the range of targets for each model year was as follows:

MY 2008: From 26.8 mpg for the smallest vehicles to 20.4 mpg for the largest;
MY 2009: From 27.4 mpg for the smallest vehicles to 21.0 mpg for the largest;
MY 2010: From 27.8 mpg for the smallest vehicles to 20.8 mpg for the largest;
MY 2011: From 28.4 mpg for the smallest vehicles to 21.3 mpg for the largest

We estimated that the standards based on these targets would save approximately 10.0 billion gallons of fuel over the lifetime of the vehicles sold during those four model years, compared to the savings that would occur if the standards remained at the MY 2007 level of 22.2 mpg. The Reformed standards for MYs 2008–2010 were estimated to save 525 million more gallons of fuel than the Unreformed standards for those years. We estimated the proposed MY 2011 standard to save an additional 2.8 billion gallons of fuel.

We tentatively determined that the proposed standards under both Unreformed CAFE and Reformed CAFE represent the maximum feasible fuel economy level for each system. In reaching this conclusion, we balanced the express statutory factors and other relevant considerations, such as safety concerns, effects on employment and the need for flexibility to transition to a Reformed CAFE program that can achieve greater fuel savings in a more economically efficient way.

The proposed Reformed CAFE approach incorporated several important elements of reform suggested by the National Academy of Sciences in its 2002 report (Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards; NAS report). The agency outlined four basic advantages that the proposed Reformed CAFE approach has over the Unreformed CAFE approach: enlarged energy savings, enhanced safety, a more equitable regulatory framework for different vehicle manufacturers, and a more market oriented approach that more fully respects economic conditions and consumer choice. Reformed CAFE forces vehicle manufacturers to ensure that they are incorporating available technologies to enhance fuel efficiency in all the vehicles they produce.

In addition to the proposed step function approach, the agency also discussed a continuous function approach. We explained that under a continuous function approach there would be no categories, but instead each footprint value would be assigned a fuel economy target. We provided an example of a continuous function standard and requested comment on such an approach.

Aside from proposing structural changes to the CAFE program, the agency also discussed the potential of expanding the applicability of the program to include heavier and heavier rated light trucks in MY 2011. The agency requested comment on the inclusion of vehicles classified by the Environmental Protection Agency (EPA) as medium duty passenger vehicles (MDPVs) [31] in the light truck CAFE program.

Along with soliciting comment on the CAFE proposal, the agency also requested updated product plan information and other data to assist in developing a final rule. We noted that based on public comments and other information, new data and analysis, and updated product plans, the standards adopted in the final rule could well be different then those proposed.

IV. Summary of Public Comments

NHTSA received over 45,000 individual submissions to the rulemaking docket prior to the close of the comment period, including ones from vehicle manufacturers and associations, environmental and consumer advocacy groups, members of Congress, and private individuals. The vast majority of the submissions were letters or e-mails prepared by various organizations and submitted by private individuals to the docket.

Light truck manufacturers and their trade associations that commented on the proposal included General Motors Corporation (Docket No. 2005–22223–1493), Ford Motor Company (Docket No. NHTSA–2005–22223–1570), DaimlerChrysler (Docket No. 20005–22223–1573), Toyota (Docket No. NHTSA–2005–22223–1724), Honda (Docket No. NHTSA–2005–22223–1649), Nissan (Docket No. NHTSA–2005–22223–2058), Mitsubishi Motor Company (Docket No. NHTSA–2005–22223–1819), Hyundai (Docket No. NHTSA–2005–22223–2035), Porsche (Docket No. NHTSA–2005–22223–1688), BMW of North America (Docket No. NHTSA–2005–22223–1616), Volkswagen of North America (Docket No. NHTSA–2005–22223–1674), the Alliance of Automobile Manufacturers (Alliance; Docket No. NHTSA–2005–22223–1642), and the Association of International Automobile Manufacturers (Docket No. NHTSA–2005–22223–1645).

Manufacturers generally agreed that distinguishing vehicles within the light truck fleet according to a size metric, i.e., footprint, adequately recognized differences in manufacturers' compliance efforts due to differences in fleet mix. They stated that step-function standard based on footprint would provide manufacturers greater flexibility in complying with the CAFE requirements while at the same time, address safety concerns associated with the program. Contrary to their general support for the proposed step function standard, manufacturers expressed reservations with a continuous function standard as discussed in the NPRM. Manufacturers stated that a continuous function standard would be overly complex to administer and with which to comply.

While manufacturers expressed general support for the structure of the proposed Reformed CAFE, manufacturers generally expressed concern with the process, as well as the assumptions relied upon in that process, used to define the Reformed CAFE standards. Manufacturers argued that the agency's reliance on a cost-benefit analysis to determine the stringency of the light truck CAFE standards did not adequately account for the capabilities of the industry, and in some instances would not satisfy the ''economic practicability'' consideration required under EPCA. Additionally, manufacturers took issue with the economic and technological assumptions employed in the Reformed CAFE analysis, as well as in the Unreformed CAFE analysis. Manufacturers asserted that the agency did not properly account for technological and market risks that have the potential to render the standards infeasible.

With regard to the applicability of the light truck CAFE program, the vehicle

[31] In 40 CFR 86–1803–01, EPA defines ''MPDV'' as a light truck rated at more than 8,500 lbs GVWR, or that has a vehicle curb weight of more than 6,000 pounds, or that has a basic vehicle frontal area in excess of 45 square feet. ''MDPV'' does not include a vehicle that:

Is an ''incomplete truck'' as defined in this subpart; or

Has a seating capacity of more than 12 persons; or

Is designed for more than 9 persons in seating rearward of the driver's seat; or

Is equipped with an open cargo area (for example, a pick-up truck box or bed) of 72.0 inches in interior length or more. A covered box not readily accessible from the passenger compartment will be considered an open cargo area for purposes of this definition.

manufacturers generally opposed including vehicles with a GVWR greater than 8,500 lbs in the light truck program. Manufacturers asserted that standards were not practical for these vehicles; these vehicles are used in a substantially different manner than lighter vehicles, making the CAFE standards inappropriate; and that regulation of these vehicles would not result in significant fuel savings.

Environmental, consumer and safety advocacy groups commenting on the proposal included Environmental Defense (Docket No. NHTSA–2005–22223–1491, 1698–1703, 1805), Natural Resource Defense Council (NRDC; Docket No. NHTSA–2005–22223–1705 through 1710), the Union of Concerned Scientists (Docket No. NHTSA–2005–22223–1977, 1978), the Insurance Institute for Highway Safety (IIHS; Docket No. NHTSA–2005–22223–2082), Center for Biological Diversity (Docket No. NHTSA–2005–22223–1638 through 1641), National Environmental Trust (Docket No. NHTSA–2005–22223–1483, 1484), Sierra Club (Docket No. NHTSA–2005–22223–1623), U.S. PIRG (Docket No. NHTSA–2005–22223-1623), Alliance to Save Energy—American Council for an Energy-Efficient Economy (ACEEE; (Docket No. NHTSA–2005–22223–1711), the American Jewish Committee (Docket No. NHTSA–2005–22223–1420), Alliance for Affordable Energy *et al.* (Docket No. NHTSA–2005–22223–1726),[32] AAA (Docket No. NHTSA–2005–22223–1804), and Public Citizen (Docket No. NHTSA–2005–22223–2188, 2189).

In general, the environmental and consumer groups stated that the increased fuel prices, the need of the nation to conserve energy and the availability of ''effective technologies'' necessitate more stringent standards. Several of these commenters stated that the light truck standard should approach that for passenger cars or higher. These groups generally asserted that any reform proposal must include a mechanism to guarantee the fuel savings projected by the agency under the new standards. Many of these groups expressed concern that the proposed structure and reliance on vehicle footprint in the Reformed CAFE system would permit manufacturers to ''upsize'' their fleets, which would result in reduced fuel savings. Several commenters stated that the statutory requirement to set ''maximum feasible'' standards makes it impermissible for the agency to limit the level of the new standards based on the concepts of ''optimal economic efficiency'' or ''least capable manufacturer.'' They argued that setting the Reformed CAFE standards during the transition period at levels that impose the same costs as the Unreformed standards was inconsistent with the ''maximum feasible'' requirement. Additionally, some of these groups disagreed with the agency's statement regarding the preemption of State regulation of greenhouse gas emissions from motor vehicles. The Center for Biological Diversity asserted that the accompanying draft Environmental Assessment was inadequate.

IIHS expressed concern that the category system as proposed would provide an incentive for unsafe compliance strategies. IIHS stated that the category system still provided an incentive to downsize a vehicle within a category in order to improve its fuel economy. IIHS stated that downsizing, particularly among the smaller vehicles, can have a negative impact on safety. To address this issue, IIHS recommended that the agency adopt a continuous function approach as discussed in the NPRM.

A number of comments representing the interests of States were received. These comments generally voiced opposition to various parts of the NPRM. The New York State Department of Environmental Conservation (NY DEC; Docket No. NHTSA–22223–1646), the State of New Jersey Department of Environmental Protection (Docket No. NHTSA–22223–1651), NESCAUM[33] (Docket No. NHTSA–22223–1625), the Pennsylvania Department of Environmental Protection (PA DEP; Docket No. NHTSA–22223–1807), the California Air Resources Board (Docket No. NHTSA–22144–31), STAPPA/ALAPCO[34] (Docket No. NHTSA–22223–1494), and the Connecticut Department of Environmental Protection (Docket No. NHTSA–22223–1624) disagreed with the statement in the NPRM preamble about preemption of State greenhouse gas regulations for motor vehicles and requested that not include any such statement in the final rule. These commenters generally also requested that the agency increase the stringency of the final fuel economy requirements as well as regulate the fuel economy of light trucks with a GVWR up to 10,000 lbs. The Attorneys General for California, Massachusetts, New York, Connecticut, New Jersey, Maine, Oregon, Vermont, and the New York City Corporation Counsel (Attorneys General; Docket No. NHTSA–22223–2223) also objected to the preemption language, and further stated that the agency is obligated to perform an environmental impact statement under the National Environmental Policy Act. The California Energy Commission expressed support for the Reformed CAFE structure, but stated that, because of uncertainty in the economic assumptions relied upon by the agency, standards should be established at this time for model year 2008 only (Docket No. NHTSA–22144–19).

Members of Congress also submitted comment, expressing concern over the proposal. A letter signed by Representatives Tammy Baldwin, Jim McDermott, Susan Davis, Raul Grijalva, Barbara Lee, Michael Michaud, Ed Case, Robert Wexler, Pete Stark, Dennis Cardoza, Allyson Y. Schwartz, and Jim Moran stated that the proposal contains a number of positive aspects, particularly the use of footprint instead of weight as the basis for Reformed CAFE (Docket No. NHTSA–22223–1334). However, Representative Baldwin et. al asked that the agency establish more stringent standards and establish standards for vehicles with a GVWR between 8,500 and 10,000 lbs, stating that such revisions are necessary to reduce the nation's demand for foreign oil and to lower gasoline costs for consumers.

Comments were also received from a variety of additional organizations and interests. The Competitive Enterprise Institute (Docket No. NHTSA–22223–1682) commented that the proposal would provide more flexibility to manufacturers and be more accommodating to consumer preference, but argued that increased CAFE standards have the potential to affect motor vehicle safety adversely. The Mercatus Center (Docket No. NHTSA–22223–1632) and Criterion Economics (Docket No. NHTSA–22223–1976) raised concerns relating to many of the analytic assumptions used in the preliminary regulatory impact analysis. The Sport Utility Vehicle Owners of America (Docket No. NHTSA–22223–1599) and Marine Retailers Association of America (Docket No. NHTSA–22223–84) argued that there was a need to

[32] Signatories to the Alliance for Affordable Energy *et al.*, included representatives from Environmental and Energy Study Group, Environmental Energy Solutions, Global Possibilities, Institute for Environmental Research Education, Mainstay Energy, National Environmental Trust, North Carolina Solar Center, Oregon Environmental Council, Redwood Alliance, The Stella Group, Ltd., SUN DAY Campaign, SustainableBusiness.com, Triangle Clean Cities Coalition, and Vermont Energy Investment Corp.

[33] NESCAUM (Northeast States for Coordinated Air Use Management) is an interstate association of air quality control divisions representing the six New England States, as well as New York and New Jersey.

[34] State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials.

consider the utility of light trucks, particularly towing capacity.

As stated above, the vast majority of comments received were submitted by individual citizens. Private individuals expressed concern that the proposed standards would not be sufficient to meet the nation's need to conserve energy, would not protect the nation from future spikes in fuel prices, would negatively impact the environment, and would encourage manufacturers to build larger vehicles with lower fuel economy.

NRDC provided citizens with a letter requesting that the agency increase the light truck standard by 1 mpg a year over five years. These letters raised concern that the fuel economy standards as proposed would not adequately address the nation's need to conserve fuel.

The Union of Concerned Scientists also provided citizens with form letters that requested the agency to regulate vehicles with a GVWR greater than 8,500 lbs, to consider ''cost-efficient technologies'' for ''mid-size SUVs,'' and to provide a mechanism to ensure that manufacturers do not ''up-size'' vehicles. Other similar documents were also submitted to the docket.

Some expressed belief that sufficient technology is available that would enable the manufacturers to exceed the proposed CAFE standards.

While the above discussion very briefly describes the comments submitted by the various interested parties, more detailed discussions of the comments and the agency's responses are embedded in the analysis and discussion which follow.

V. The Unreformed CAFE Standards for MYs 2008–2010

The agency is establishing Unreformed CAFE standards of 22.5 miles per gallon (mpg) for model year (MY) 2008, 23.1 mpg for MY 2009, and 23.5 mpg for MY 2010. We estimate that these standards will save 4.4 billion gallons of fuel over the lifetime of vehicles sold during those model years, compared to the savings that would occur if the standards remained at the MY 2007 level of 22.2 mpg. We have determined that these requirements represent the maximum feasible fuel economy levels achievable by industry in those model years.

Consistent with the NPRM, the Unreformed CAFE standards in MYs 2008–2010 are one option for compliance during a transition period in which manufacturers may comply with either the Reformed or Unreformed CAFE systems. During the transition period, the requirements under the Reformed CAFE systems are linked to those of the Unreformed system, in the sense that the Reformed CAFE standards for MYs 2008–2010 are set at levels intended to ensure that the industry-wide cost of the Reformed standards are roughly equivalent to the industry-wide cost of the Unreformed CAFE standards in those model years.

As stated in the NPRM, this transition approach has several important advantages. We have determined the Unreformed standards to be economically practicable. The Reformed standards spread the cost burden across the industry to a greater extent. As such, equalizing the cost between the Unreformed and the Reformed CAFE systems ensures that the costs associated with the transition period do not result in economically severe compliance requirements. Further, this approach promotes an orderly and effective transition to the Reformed CAFE system since experience will be gained prior to MY 2011. In this section, we describe how we developed the Unreformed CAFE standards.

In arriving at the Unreformed CAFE standards, we used the same type of analyses as in the NPRM and as we employed in establishing light truck CAFE standards for MYs 2005–2007. First, we analyzed the confidential product planning data submitted by the manufacturers to ascertain the ''baseline'' capabilities and fuel economy of each manufacturer that has a significant share of the light truck market. Second, we conducted a three-stage manual engineering analysis (the Stage Analysis), in conjunction with a computer-based engineering analysis (the Volpe Analysis), to determine what technologies each company with a significant share of the market could use to enhance its overall fleet fuel economy average. In order to perform the two analyses, the agency relied on the National Academy of Sciences (NAS) report entitled, ''Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards,'' which contains costs and effectiveness estimates for various technologies that could be used to enhance vehicle fuel economy.

As explained in the August 2005 NPRM,[35] the Stage Analysis involves application of the agency's engineering expertise and judgment about possible adjustments to the detailed product plans submitted by individual manufacturers. More specifically, Stage I analysis involves the application of technologies which are deemed to be available for use by MY 2008 and which would not require significant changes to the vehicle's driveline components (*i.e.*, the engine and transmission). Stage II analysis involves the application of more advanced transmission upgrades and engine improvements that are readily available in the marketplace. Stage III analysis involves the application of diesel and hybrid powertrains to select products.

The Volpe Analysis was described in detail in the NPRM and Final Rule establishing light truck CAFE standards for MYs 2005–2007.[36] The Volpe analysis uses a technology application algorithm to systematically apply consistent cost and performance assumptions to the entire industry, as well as consistent assumptions regarding economic decision-making by manufacturers. The resultant computer model (the CAFE Compliance and Effects Model), developed by technical staff of the DOT Volpe National Transportation Systems Center in consultation with NHTSA staff, is used to help estimate the overall economic impact of the Unreformed CAFE standards. The Volpe analysis shows the economic impact of the standards in terms of increases in new vehicle prices on a manufacturer-wide, industry-wide, and average per-vehicle basis. Based on these estimates and corresponding estimates of net economic and other benefits, the agency is able to set the standards that are economically practicable and technologically feasible. The Stage Analysis and the Volpe Analysis rely on the same product plan information from manufacturers, consider many of the same technologies (the Stage Analysis considers some manufacturer-specific technologies not represented in the Volpe Analysis), and apply similar conditions regarding the applicability of those technologies.

We note that the Volpe model has been updated and refined with respect to its representation of some fuel-saving technologies, but remains fundamentally the same. The updated model has also been peer reviewed.[37] The model documentation, including a description of the input assumptions and process, as well as peer review reports and the agency's response to reviewers, were made available in the rulemaking docket for the August 2005 NPRM.[38]

We received a significant number of comments in response to the proposed

[35] 70 FR 51414 (August 30, 2005).

[36] See 67 FR 77015 (December 16, 2002) and 68 FR 16868 at 16871 (April 7, 2003). Docket Nos. NHTSA–2002–11419–55 and NHTSA–2002–11419–18361.

[37] The agency's response to the peer review is provided in the docket at NHTSA–2005–22223–52.

[38] See Docket Nos. NHTSA–20005–22223–3, 4, 5.

Unreformed CAFE standards, expressing a wide range of views. While some of those commenting argued that technology is available to set the standards higher, others argued that insufficient lead time, as well as technological and monetary constraints, make it unlikely that the proposed standards would be attainable. We have reviewed these comments and adjusted many aspects of the analyses used to determine the Unreformed CAFE standards in order to account for issues brought to our attention. Responses to comments that raised specific technology and economic assumptions issues are discussed in detail below in sections VIII. Technology issues, and IX.

Economic Assumptions

In the balance of this section, we describe in further detail how we developed the Unreformed CAFE standards. After considering the foregoing and taking into consideration the statutory criteria specified in 49 U.S.C. 32092(f) [39], we are adopting the Unreformed CAFE standards specified above, having concluded that they constitute the maximum feasible standards for MYs 2008–2010.

A. Legal Authority and Requirements Under EPCA

As previously stated, EPCA requires that the CAFE standards set a minimum performance standard at a level determined by the Secretary of Transportation to be the ''maximum feasible'' average fuel economy achievable by manufacturers in a given model year (49 U.S.C. 32902). To guide determinations of the maximum feasible fuel economy level, Congress specified four statutory criteria that must be considered: technological feasibility, economic practicability, the effect of other Federal motor vehicle standards on fuel economy, and the need of the United States to conserve energy. The agency is permitted to consider additional societal considerations and historically has considered the potential for adverse safety consequences when deciding upon a maximum feasible level.[40] The overarching principle that emerges from the enumerated factors and the court-sanctioned practice of considering safety and links them together is that CAFE standards should be set at a level that will achieve the greatest amount of fuel savings without leading to significant adverse societal consequences.

We have set the Unreformed standards with particular regard to the ''least capable manufacturer with a significant share of the market,'' in response to the direction in the conference report on the CAFE statute language to consider industry-wide considerations, but not necessarily base the standards on the manufacturer with the greatest compliance difficulties.[41] This approach is consistent with the Conference Report on the legislation enacting the CAFE statute:

> Such determination [of maximum feasible average fuel economy level] should take industry-wide considerations into account. For example, a determination of maximum feasible average fuel economy should not be keyed to the single manufacturer that might have the most difficulty achieving a given level of average fuel economy. Rather, the Secretary must weigh the benefits to the nation of a higher average fuel economy standard against the difficulties of individual manufacturers. Such difficulties, however, should be given appropriate weight in setting the standard in light of the small number of domestic manufacturers that currently exist and the possible implications for the national economy and for reduced competition association [sic] with a severe strain on any manufacturer.

S. Rep. No. 94–516, 94th Congress, 1st Sess. 154–155 (1975). The agency must consider the industry's ability to improve fuel economy, but with appropriate consideration given to the difficulties of individual manufacturers.

In response to this congressional direction, we have traditionally given particular regard to the ''least capable manufacturer with a substantial share of the market.'' The agency must take particular care in considering the statutory factors with regard to these manufacturers— weighing their asserted capabilities, product plans and economic conditions against agency projections of their capabilities, the need for the nation to conserve energy and the effect of other regulations (including motor vehicle safety and emissions regulations) and other public policy objectives.

The agency has historically assessed whether a potential CAFE standard is economically practicable in terms of whether the standard is one ''within the financial capability of the industry, but not so stringent as to threaten substantial economic hardship for the industry.'' [42] See, e.g., *Public Citizen*, 848 F.2d at 264. In essence, in determining the maximum feasible level of CAFE, the agency assesses what is technologically feasible for manufacturers to achieve without leading to significant adverse economic consequences, such as a significant loss of jobs or the unreasonable elimination of consumer choice.

At the same time, the law does not preclude a CAFE standard that poses considerable challenges to any individual manufacturer. The Conference Report makes clear, and the case law affirms: ''(A) determination of maximum feasible average fuel economy should not be keyed to the single manufacturer which might have the most difficulty achieving a given level of average fuel economy.'' *CAS*, 793 F.2d at 1338–39. Instead, the agency is compelled ''to weigh the benefits to the nation of a higher fuel economy standard against the difficulties of individual automobile manufacturers.'' Id. The statute permits the imposition of reasonable, ''technology forcing'' challenges on any individual manufacturer, but does not contemplate standards that will result in ''severe'' economic hardship by forcing reductions in employment affecting the overall motor vehicle industry.[43]

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[39] The statutory criteria, which are addressed elsewhere in this document, are: (1) The nation's need to conserve energy; (2) technological feasibility; (3) economic practicability (including employment consequences); and the impact of other regulations on fuel economy.

[40] See, e.g., *Center for Auto Safety* v. *NHTSA (CAS)*, 793 F. 2d 1322 (D.C. Cir. 1986) (Administrator's consideration of market demand as component of economic practicability found to be reasonable); *Public Citizen* 848 F.2d 256 (Congress established broad guidelines in the fuel economy statute; agency's decision to set lower standard was a reasonable accommodation of conflicting policies). As the United States Court of Appeals pointed out in upholding NHTSA's exercise of judgment in setting the 1987–1989 passenger car standards, ''NHTSA has always examined the safety consequences of the CAFE standards in its overall consideration of relevant factors since its earliest rulemaking under the CAFE program.'' *Competitive Enterprise Institute* v. *NHTSA (CEI I)*, 901 F.2d 107, 120 at n.11 (D.C. Cir. 1990).

[41] ''Least capable manufacturer'' is something of a misnomer as a major manufacturer could install substantial amounts of fuel saving technologies and still be the major manufacturer with lowest projected CAFE due to its mix of vehicles.

[42] In adopting this interpretation in the final rule establishing the MY 1981–1984 fuel economy standards for passenger cars (June 30, 1977; 42 FR 33534, at 33536–7), the Department rejected several more restrictive interpretations. One was that the phrase means that the standards are statutorily required to be set at levels solely on a cost-benefit basis. The Department pointed out that Congress had rejected a manufacturer-sponsored amendment to the Act that would have required standards to be set at a level at which benefits were commensurate with costs. It also dismissed the idea that economic practicability should limit standards to free market levels that would be achieved with no regulation.

[43] In the past, the agency has set CAFE standards above its estimate of the capabilities of a manufacturer with less than a substantial, but more than a de minimis, share of the market. See, e.g., *CAS*, 793 F.2d at 1326 (noting that the agency set the MY 1982 light truck standard at a level that might be above the capabilities of Chrysler, based on the conclusion that the energy benefits associated with the higher standard would outweigh the harm to Chrysler, and further noting that Chrysler had 10–15 percent market share while Ford had 35 percent market share). On other occasions, the agency reduced an established CAFE

By focusing primarily on the least capable manufacturer with a significant share of the market, this approach has ensured that the standards are technologically feasible and economically practicable for manufacturers with a significant share of the market. If a standard is technologically feasible and economically practicable for the ''least capable'' manufacturer, it can be presumed to be so for the ''more capable'' manufacturers. Together, the manufacturers with a significant share of the market represented a very substantial majority of the light trucks manufactured and thus were deemed to represent ''industry-wide considerations.''

B. Establishing Unreformed Standards According to EPCA—Process for Determining Maximum Feasible Levels

In establishing the Unreformed standards for MYs 2008–2010, the agency relied upon its historical standard setting process, which includes consideration of the ''least capable manufacturer with a significant share of the market.''

NRDC, Environmental Defense and the Union of Concerned Scientists stated that the ''least capable manufacturer'' approach applied by the agency in setting standards under the Unreformed CAFE standards violates EPCA and Congress' expressed intent. NRDC argued that ''while the agency is permitted to consider the single, least capable manufacturer in assessing economic practicability, it simply may not allow that manufacturer's capabilities to drive the standard setting process,'' and referred to *CAS.*

In *CAS*, the petitioners alleged that the agency had given ''impermissible weight to shifts in consumer demand toward larger, less fuel-efficient trucks''[44] in reducing the MY 1985 standard for light trucks and in establishing the MY 1986 standard for light trucks. In reducing the MY 1985 standard as well as in establishing the MY 1986 one, NHTSA considered the impacts of different levels of standards on the least capable manufacturer. The Court noted the conference report for EPCA ''states that the fuel economy standards delegated to NHTSA are to be the product of balancing the benefits of higher fuel economy levels against the difficulties individual manufacturers would face in achieving those levels,''[45] Then it quoted language to that effect from the conference report. In the end, the Court upheld the standards established through consideration of the least capable manufacturer with a significant share of the market, stating that ''a standard with harsh economic consequences for the auto[mobile] industry * * * would represent an unreasonable balancing of EPCA's policies.''[46]

As a first step toward ensuring that the CAFE levels selected as the maximum feasible levels under Unreformed CAFE will not lead to significant adverse consequences, we reviewed in detail the confidential product plans provided by the manufacturers with a substantial share of the light truck market (General Motors, Ford and DaimlerChrysler) and all other manufacturers that submitted confidential product plan data and assessed their technological capabilities to go beyond those plans. By doing so, we are able to determine the extent to which each can enhance their fuel economy performance using technology.

C. Baseline for Determining Manufacturer Capabilities in MYs 2008–2010

In order to determine the maximum feasible fuel economy levels for MYs 2008–2010 under the Unreformed CAFE system, we first determined each manufacturer's fuel economy baselines for MYs 2008–2010. That is, we determined the fuel economy levels that manufacturers were planning to achieve in those years.

The manufacturer baselines relied upon for the proposed Unreformed CAFE standards were based upon information submitted by manufacturers in response to the December 29, 2003 request for product plans[47], and any additional manufacturer updates. In conjunction with the August 2005 NPRM, we issued a RFC seeking updated product plans to enable NHTSA to use the most accurate and up-to-date product plan information in establishing the Reformed and Unreformed CAFE standards.[48]

In response to the RFC, we received product plans from DaimlerChrysler, Ford, General Motors, Honda, Hyundai, Mitsubishi, Nissan, Subaru and Toyota. To supplement the data provided in response to the RFC, we also relied on product data available from public sources. Taken together, it was this updated information that the agency used in development of the standards for today's final rule.

We note that BMW, Porsche, and Volkswagen previously paid fines in lieu of complying with the MY 2002 and 2003 light truck CAFE standards. The agency assumes that because of that past history and their low light truck production volumes Porsche and Volkswagen will continue to pay fines instead of bringing their fleets into compliance. For purpose of the NPRM, we also assumed that BMW would continue to pay fines. However, BMW has indicated that it does not intend to pay fines in the model years subject to this rulemaking. We have adjusted our analysis accordingly.

Finally, in response to a comment from DaimlerChrysler, we removed Mitsubishi's information from DaimlerChrysler's product plans due to DaimlerChrysler's recent sale of its entire share of Mitsubishi stock and adjusted DaimlerChrysler's baseline capabilities accordingly.

Based on the updated manufacturer's responses and the available public data, we determined the baseline capabilities as follows:

TABLE 1.—ESTIMATED MARKET SHARES AND PLANNED CAFE LEVELS (WITHOUT CREDITS)

Manufacturer	Market share*	MY 2008 (mpg)	MY 2009 (mpg)	MY 2010 (mpg)
General Motors	25.8	21.36	21.43	21.59
Ford	19.4	21.53	21.79	22.65
DaimlerChrysler	23.0	21.96	22.01	22.42
Toyota	11.6	22.51	22.44	22.65
Honda	6.5	24.56	24.56	24.56
Nissan	5.7	21.01	20.70	21.13

standard to address unanticipated market conditions that rendered the standard unreasonable and likely to lead to severe economic consequences. 49 FR 41250, 50 FR 40528, 53 FR 39275; see *Public Citizen*, 848 F.2d at 264.

[44] Id. at 1323–4.

[45] Id. at 1338.

[46] Id. at 1340.

[47] *See* 68 FR 74931; see also Docket No. NHTSA–2003–16709–1.

[48] *See* Docket No. NHTSA–2005–22144.

TABLE 1.—ESTIMATED MARKET SHARES AND PLANNED CAFE LEVELS (WITHOUT CREDITS)—Continued

Manufacturer	Market share*	MY 2008 (mpg)	MY 2009 (mpg)	MY 2010 (mpg)
Hyundai	3.6	23.22	23.49	23.36
Subaru	1.1	25.87	27.15	27.05
BMW	0.8	21.29	21.29	21.29
Porsche	0.2	16.80	16.80	16.80
Isuzu	0.4	20.38	20.24	20.14
Suzuki	0.3	21.93	21.93	21.93
Volkswagen	0.3	18.78	18.78	18.78
Mitsubishi	1.3	24.33	24.41	24.70

*Based on 2005 production data.

After ascertaining the baseline capabilities of individual manufacturers, the agency applied the Stage analysis to analyze the potential technological improvements to the product offerings for each manufacturer with a substantial share of the light truck market, as well as for the remaining light truck manufacturers.[49]

The Alliance and Ford argued that in establishing manufacturer baselines for our analysis, the agency erroneously assumed that each manufacturer's fleet average would be at 22.2 mpg for Model Year 2007. These commenters stated that this assumption is incorrect, because some manufacturers did not submit product plan information to support this assumption and other manufacturers achieve compliance with the CAFE requirements through the use of credits and payment of fines. The Alliance and Ford also stated that some manufacturers (in anticipation of future CAFE increases) might have taken steps in support of higher fleet averages and might have already incorporated fuel saving technologies.

In response, we note that the agency did not assume that each manufacturer's fleet average would be 22.2 mpg for MY 2007. We used the manufacturer's plans to determine the fleet average. When a manufacturer's plans were below 22.2 mpg, we estimated the technologies and costs necessary to bring their fleet average up to a 22.2 mpg baseline. These costs were assigned to the MY 2007 standards, and such costs were not included in the costs for MY 2008.

With respect to alternative fuel vehicles, we note that manufacturers may improve their calculated fuel economy performance by placing these vehicles into the market through MY 2012.[50] However, 49 U.S.C. 32902(h) prohibits us from taking such benefits into consideration in determining the maximum feasible fuel economy standard. Accordingly, the baseline projections cannot reflect those credits.[51]

D. Technologically Feasible Additions to Product Plans

As explained in the August 2005 NPRM, we performed a Stage analysis to determine what fuel-saving technologies could be applied to a manufacturer's baseline. At each of the three stages, we add technologies based on our engineering judgment and expertise about possible adjustments to the detailed product plans submitted by the manufacturers. Our decision on whether and when to add a technology reflects our consideration of the practicability of applying a specific technology and the necessity for sufficient lead-time in its application. In addition to considering lead time and practicability, the agency adds technologies in a cost-minimizing fashion. That is, we add technologies in order of lower to higher costs as explained in the FRIA (see FRIA p. VI–13).

While technologies are applied in order of ''effective cost,'' the level of technology added to a manufacturer's fleet is based on the agency's engineering expertise. Technologies are not added until net benefits are maximized as under the Reformed CAFE system. Instead, the agency uses engineering expertise to apply technology. We impose phase-in caps for applications of technology over time and do not make significant changes until a vehicle is refreshed or redesigned to account for product cycles. As such, the price of fuel does not directly factor into the application of technology under the Unreformed CAFE system to the degree that it does under the Reformed CAFE system.

New product plan data in response to the NPRM indicated that manufacturers had shifted the fleet mix and improved the fuel economy of some vehicles. These changes reduced the amount of technology available to be applied. For this reason, more costly technologies (diesel and hybrids) were projected onto the fleet. The agency feels justified in doing so because higher gasoline prices will increase the demand for these types of technologies.

In evaluating which technologies to apply, and the sequence in which to apply them, we follow closely the NAS report. The NAS report estimated the incremental benefits and the incremental costs of technologies that may be applicable to actual vehicles of different classes and intended uses.[52] The NAS report also identified what it called ''cost-efficient technology packages'' (i.e., combinations of technologies that would result in fuel economy improvements sufficient to cover the purchase price increases that such technologies would require).[53]

The Stage I analysis includes technologies that are available for use by MY 2008, but that some manufacturers are not currently choosing to use in their product plans or are using in a limited manner. However, many of these technologies are currently being used in today's light truck fleet. They include non-powertrain applications such as low-rolling-resistance tires, low-friction lubricants, aerodynamic drag reduction, and electric-power steering pumps.

[49] A more detailed discussion of these issues is contained in the Chapter VI of the FRIA, which has been placed in the docket for this notice. Some of the information included in the FRIA, including the details of manufacturers' future product plans, has been determined by the Agency to be confidential business information, the release of which could cause competitive harm. The public version of the FRIA omits the confidential information. The FRIA also discusses in detail the fuel-economy-enhancing technologies expected to be available during the MY 2008–2011 time period.

[50] The applicability of the alternative fuel provision in § 32905 was extended in the Energy Policy Act of 2005 (Pub. L. 109–58).

[51] Sec. 32902(h) states that when establishing fuel economy standards, the agency:

(1) May not consider the fuel economy of dedicated automobiles; and

(2) Shall consider dual fueled automobiles to be operated only on gasoline or diesel fuel.

[52] See NAS Report at p. 40. See also Docket No. 2005–22223–10, ''Fuel Economy Potential of 2010 Light Duty Trucks.'' This document was prepared under the auspices of the U.S. Department of Energy for NHTSA, in order to update the estimates provided by the 2001 NAS Report.

[53] See NAS Report at p. 64.

The Stage II analysis includes two major categories of technological improvements to the manufacturers' fleets. The first category is transmission improvements, which includes the introduction and expanded use of 5-speed and 6-speed transmissions and continuously variable transmissions (CVTs). The second category is engine improvements, which includes gradually upgrading light truck engines to include multi-valve overhead camshafts; introducing engines with more than 2 valves per cylinder; applying variable valve timing or variable valve lift and timing to multi-valve overhead camshaft engines; and applying cylinder deactivation to 6- and 8-cylinder engines.

The Stage III analysis includes projections of the potential CAFE increase that could result from the application of diesel engines and hybrid powertrains to select products. Both diesel engines and hybrid powertrains appear in several manufacturers plans within the MY 2008–2010 timeframe, and other manufacturers have publicly indicated that they are looking seriously into both technologies.

The Stage analysis also includes the possibility that manufacturers could utilize some vehicle weight reduction as a fuel economy improvement technology on light trucks with curb weights over 5,000 pounds.[54] However, the weight reduction was only applied in conjunction with a planned vehicle redesign, and sometimes in concert with a reduction in aerodynamic drag.

The agency again relied on the NAS report, which contains costs and effectiveness estimates for various technologies that could be used to enhance a vehicle's fuel economy. In most instances, NHTSA used the NAS report's mid-range estimate of the potential fuel economy benefits of specific technologies. However, if NHTSA projected the use of a technology specific to a manufacturer, NHTSA relied on effectiveness estimates provided by that manufacturer when applying that technology to that manufacturer and if appropriate, to other manufacturers.

In arriving at the Unreformed CAFE standard, the agency took into account the concerns raised by the manufacturers in response to the August 2005 NPRM. Specifically, the agency is aware that vehicle manufacturers require sufficient lead time to incorporate changes and new features into their vehicles. The agency is also aware that the vehicle manufacturers are unable to deploy new technologies throughout their entire light truck fleet in one model year. Similarly, NHTSA also recognizes that vehicle manufacturers follow design cycles when introducing or significantly modifying a product. In revising and applying the Stage Analysis, NHTSA took these concerns into consideration.

For each of the largest manufacturers that provided product plans with baselines below our proposed levels for at least one model year, the agency projected the use of several Stage I technologies, beginning with MY 2008, and several more technologies, beginning with MY 2009. We note that in performing the Stage Analysis, the agency relied on product plans submitted by the manufacturers as well as comments received in response to the August 2005 NPRM. The agency removed incompatible technologies and technologies already incorporated into manufacturers' product plans from the Stage Analysis. More importantly, the agency delayed and ''staggered'' applications of technologies such that they are not implemented across the entire fleet in one model year. Most new technologies were added in conjunction with model changes or vehicle introductions. That is, instead of adding technologies to existing vehicles in the middle of their product cycle, we added technologies to vehicles at the time the vehicles were undergoing major engineering changes or when they were introduced.

Aside from reliance on the NAS report, we also relied to a limited extent on technologies present in the manufacturers' confidential product plans. If a technology was present in a manufacturer's product plans, we evaluated the opportunity for additional application of the technology within that manufacturer's fleet, and if appropriate, other manufacturers' fleets. The following are examples of non-confidential technologies used in the Stage Analysis.

Stage 1

Electrical power steering—We first applied this technology to lighter vehicles that do not require a conversion to a 42-volt electrical system. The agency avoided using this technology for heavier vehicles in the near term. The power demands for lighter vehicles do not require a 42-volt system for operation of electric power steering. However, for larger vehicles it appears that a 42-volt system is required to accommodate electric power steering, and adding a 42-volt system was deemed a technology that can be only introduced in conjunction with model changes or product introductions.

In all cases, electric power steering was added to the Stage Analysis to coincide with model changes. By MY 2008, electrical power steering was included on some of the lighter vehicles undergoing model changes. By MYs 2009 and 2010, this technology was gradually added to heavier vehicles at the beginning of their respective product cycles. That way, installation of electrical power steering can coincide with the necessary conversion of these heavier vehicles to a 42-volt electrical system.

Low-friction lubricants—This technology does not require engineering changes to vehicle engines. Therefore, it was implemented in MYs 2008 and 2009 on a large percentage of the eligible fleet without ''staggering'' the implementation. That is, the agency believes that this technology can be implemented within a relatively short lead time. The agency did not apply low-friction lubricants to vehicles with engines that require higher-friction lubricants.

Aerodynamic drag reduction—This technology was applied to certain vehicles to coincide with a major vehicle redesign or a vehicle introduction. Because aerodynamic drag reduction typically involves actual vehicle body changes, we were especially careful not to attribute any aerodynamic drag reduction, except at the beginning of a new product cycle.

Low-rolling-resistance tires—This technology was added to lighter, passenger-car-based (unibody construction) light trucks that were deemed compatible with passenger-car-like tires. Due to compatibility concerns expressed by several manufacturers, these tires were not applied to light trucks intended for significant off-road duty or pickup trucks with substantial cargo carrying capabilities. Because this technology does not require vehicle engineering resources, we implemented this technology such that it does not necessarily coincide with a planned vehicle introduction or redesign. We believe that in this case, the lead time is sufficient for the manufacturers to make arrangements to purchase sufficient quantities.

Engine accessory improvement—The agency projected the use of this technology for several manufacturers. This technology category encompasses a variety of engine accessory

[54] Based on the results of Dr. Kahane's revised weight and safety analysis, the net weight-safety effect of removing 100 lbs. from a light truck—if footprint is held constant—is zero for all light trucks with curb weights above 3,900 lbs. However, the Stage analysis only considered weight reduction for vehicles with a curb weight in excess of 5,000 lbs. given the statistical uncertainty with the 3,900 lbs. figure. Further discussion of the application of weight reduction is provided below.

improvement technologies that several manufacturers are currently incorporating, such as improved fuel and oil pumps. If a manufacturer provided NHTSA with descriptions for these specific technologies, they were applied to that manufacturer's vehicles where appropriate. If manufacturers provided no information regarding their incorporation of engine accessory improvement technologies, NHTSA applied a potential engine accessory improvement to vehicles that had an engine and engine technologies that would benefit from and be compatible with specific engine accessory improvements. The agency believes that this technology is cost-effective. This technology generally affects the operation of the engine, thus this technology was added in conjunction with a planned introduction of new models.

Stoichiometric Spark Ignition Direct Injection—This technology was added to select vehicles, i.e., those vehicles produced by manufacturers that have product plans which reflect a familiarity with the technology. This technology was applied in conjunction with a planned vehicle redesign. Implementation of this technology was delayed in response to comments and in recognition of cost issues associated with insufficient lead time.

Weight reduction—As explained below, this fuel economy improvement method was used sparingly on vehicles with a curb weights in excess of 5,000 pounds and was applied in conjunction with a planned vehicle redesign.

Stage 2

5-speed and 6-speed automatic transmissions—These technologies were added to some vehicles that, based on the manufacturers' product plans, were projected to continue using 4-speed automatic transmissions. As with Stage I technologies, when a transmission upgrade is used in the Stage Analysis, it is timed to coincide with model changes. Further, we first implemented this technology in vehicles that share major mechanical components with vehicles already equipped with 5- or 6-speed transmissions. For example, we project this technology on certain pickup trucks that share their platforms and engines with multipurpose passenger motor vehicles already equipped with 6-speed transmissions, knowing that these transmissions were readily available to the manufacturer and were compatible with the basic vehicle architecture.

Cylinder deactivation—In response to comments, the agency did not apply this technology to vehicles with incompatible existing engine architecture. The agency applied this technology to select vehicles. In doing so, the agency took into account whether this technology was already available to the manufacturers. In some instances, this technology was already utilized by vehicle manufacturers on some of their light trucks, and the agency believes that adopting this technology to other light trucks would save costs, especially if the technology is implemented at the time of vehicle redesign.

Dual overhead cam (DOHC)—The agency did not use, or delayed the implementation of this technology in vehicles where the comments indicated that the change from single overhead cam (SOHC) would be too complicated and would not produce significant fuel economy improvements because of incompatibility with the existing engine architecture. In other vehicles, implementation of DOHC was timed to coincide with a planned vehicle or engine redesign. In applying this technology, the agency examined the manufacturers' current vehicles. In some instances the manufacturers carry both DOHC engines and SOHC engines of the same displacement and basic architecture. In these instances, the agency projected a gradual switch to only the DOHC engines.

Continuous Variable Transmission (CVT)—CVT technology was relied upon in the analysis for the NPRM. The agency did not apply CVTs in the final rule. The updated product plans reflected that manufacturers had applied CVTs or 6-speeds instead to all of those vehicles to which the agency's analysis applied CVTs in the NPRM.

Front Axle Disconnect—Where this technology was implemented, it was timed to coincide with planned vehicle redesign. In addition, in response to comments regarding the general effectiveness of this technology vis-á-vis its effectiveness in specific vehicle applications, we revised downward the projected fuel economy benefits attributed to this technology.

Variable Valve Lift and Timing—Based on comments, this technology was not used on certain vehicles because the basic engine architecture was incompatible. According to commenters, this technology is incompatible with overhead valve engines. Instead, this technology was applied to certain vehicles already equipped with overhead cam engines featuring variable valve timing.

Stage III

Stage III technologies were not included in the Stage Analysis for all manufacturers because some manufacturers can meet the Unreformed CAFE standards without the need to use any diesel or hybrid technology. For some vehicle manufacturers, we estimated higher sales of light trucks equipped with hybrid engines compared to the manufacturer's product plans. This revised estimate is based on continuing strong demand and increased popularity of hybrid vehicles. For other manufacturers, we projected the use of direct-injection diesel engines in place of large displacement gasoline V8 engines.

E. Improved Product Plans

The agency's revised Stage Analysis produced the following individual projections:

TABLE 2.—MANUFACTURERS' FUEL ECONOMY CAPABILITIES AS PROJECTED UNDER THE STAGE ANALYSIS

Manufacturer	Model year 2008	Model year 2009	Model year 2010
DaimlerChrysler	*22.475	23.059	23.599
Ford	22.455	23.060	23.935
General Motors	22.506	23.060	23.450
Nissan	22.452	23.091	23.470
Toyota	22.506	23.054	24.044

*While compliance is calculated with the standard is in tenths of a mile per gallon, our initial analysis projects fuel economy capabilities to thousandths of mpg.

The technologically-feasible fuel economy levels determined under the Stage Analysis provide the basis for the Unreformed CAFE standards. The Volpe model is then used to estimate benefits and costs of these standards. The Volpe model analyzes what technologies can be added to meet the standard determined by the Stage Analysis. More specifically, the Volpe model uses a technology application algorithm developed by Volpe Center staff in consultation with NHTSA staff to apply technologies to manufacturers' baselines in order to achieve the fuel economy levels produced under the Stage Analysis. This algorithm systematically applies consistent cost and performance assumptions to the entire industry, as well as consistent assumptions regarding economic decision-making by manufacturers. Technologies are selected and applied in order of "effective cost," (total cost − fine reduction − fuel savings value) ÷ (number of affected vehicles).[55] This formula is a private cost concept (i.e., it looks at costs to the manufacturer). It is used to predict how a manufacturer would sequence the addition of technologies to meet a given standard.

Although similar, the two analyses do not apply exactly the same technologies. Both are merely technologically feasible ways of achieving the given standard, not predictions of how manufacturers will actually meet it. As discussed below, additional analysis was performed to ensure that the Unreformed CAFE standards are economically practicable for the industry.

We note that the standards adopted today are the same as those proposed in the NPRM, even though the agency performed the Stage analysis on updated product plans as provided by the manufacturers. This result is largely due to the fact that there is a limited pool of technology that can be applied to the manufacturers' fleets in the time period subject to this rulemaking.

The updated product plans reflected that some technologies previously applied by the agency in the Stage analysis were now applied by the manufacturers in their product plans, which meant that these technologies were no longer available for the Stage analysis. Because the pool of feasible technologies that can be applied in the lead time provided is limited, the agency projected fewer additional technologies for the updated product plans beyond the improvements made by the manufacturers.

As a result of having limited technologies and practical constraints on how and when those technologies can be applied, the difference between the NPRM improved fleet and the final rule improved fleet is largely a matter of the level of technology voluntarily added by manufacturers in their revised product plans submitted in response to the NPRM. Consequently, the two improved fleets provide similar fuel economies.

F. Economic Practicability and Other Economic Issues

As explained above, the agency has historically viewed the question of whether a CAFE standard is economically practicable in terms of whether the standard is "within the financial capability of the industry, but not so stringent as to threaten substantial economic hardship for the industry." See, e.g., *Public Citizen*, 848 F.2d at 264. In the Stage analysis, technologies are applied to project fuel economy levels that would be technologically feasible for a manufacturer. When considering economic practicability, the agency assesses whether technologically-feasible levels may lead to adverse economic consequences, such as a significant loss of sales or the unreasonable elimination of consumer choice. The agency must "weigh the benefits to the nation of a higher fuel economy standard against the difficulties of individual automobile manufacturers." *CAS*, 793 F.2d at 1332.

The agency has estimated not only the anticipated costs that would be borne by General Motors, Ford, DaimlerChrysler, Nissan and Toyota to comply with the standards under the Unreformed CAFE system, but also the significance of the societal benefits anticipated to be achieved through fuel savings and other economic benefits from reduced petroleum use. The baselines provided by Honda and Hyundai for MYs 2008–2010 exceeded the standards in each of those model years. In regard to economic impacts on manufacturers and societal benefits, we have relied on the Volpe model to determine a probable range of costs and benefits.

The Volpe model is used to evaluate the standards initially produced under the Stage Analysis in order to estimate their overall economic impact as measured in terms of increases in new vehicle prices on a manufacturer-wide, industry-wide, and average per-vehicle basis. Like the Stage Analysis, the Volpe model relies on the detailed product plans submitted by manufacturers, as well as available data relating to manufacturers that had not submitted detailed information. The Volpe model is used to trace the incremental steps (and their associated costs) that a manufacturer would take toward achieving the standards initially suggested by the Stage Analysis. In applying technologies, the Volpe model is programmed to be as consistent as practical with the technology application method and constraints of the Stage analysis.

Based on the Stage and Volpe analyses, we have concluded that these standards would not significantly affect employment or competition, and that—while challenging—they are achievable and that they will benefit society considerably. For this analysis, we have, where possible, translated the benefits into dollar values and compared those values to our estimated costs for this proposed rule.

In estimating the costs and benefits of this rulemaking, the agency employed a variety of cost estimates (*e.g.*, the cost of technology, lead-time) and economic assumptions (*e.g.*, price of fuel, rebound effect). As the cost estimates and economic assumptions apply, in many cases, equally to the Unreformed and Reformed CAFE system analyses, we have addressed these comments below in Section VIII. Technology issues, and Section IX. Economic assumptions. The discussion that follows provides our estimates for the costs and benefits of the Unreformed CAFE standards adopted today.

1. Costs

In terms of vehicle costs for complying with the Unreformed CAFE standards, we estimate the average incremental cost per vehicle to be $64 for MY 2008, $185 for MY 2009, and $195 for MY 2010. The total incremental costs (the cost necessary to bring the corporate average fuel economy for light

[55] In the current model year, the system begins by carrying over any technologies applied in the preceding model year, based on commonality of engines and transmissions, as well as any identified predecessor/successor relationships among vehicle models. At each subsequent step toward compliance by a given manufacturer in the current model year, the system considers all engines, transmissions, and vehicles produced by the manufacturer and all technologies that may be applied to those engines, transmissions, and vehicles, where the applicability of technologies is governed by a number of constraints related to engineering and product planning. The system selects the specific application of a technology (i.e., the application of a given technology to a given engine, transmission, vehicle model, or group of vehicle models) that yields the lowest "effective cost", which the system calculates by taking (1) the cost (retail price equivalent) to apply the technology times the number of affected vehicles, and subtracting (2) the reduction of civil penalties achieved by applying the technology, and subtracting (3) the estimated value to vehicle buyers of the reduction in fuel outlays achieved by applying the technology, and dividing the sum of these components by the number of affected vehicles.

trucks from 22.2 mpg (the standard for MY 2007) to the final rule levels are estimated to be $536 million for MY 2008, $1,621 million for MY 2009, and $1,752 million for MY 2010.

Our cost estimates for the Unreformed CAFE system are based on the application of technologies and the resulting costs to individual manufacturers. We assumed that manufacturers would apply technologies on a cost-effectiveness basis (as described above). More specifically, within the range of values anticipated for each technology, as estimated by the NAS study, we selected the mid-point for cost and fuel consumption impacts during the model years under consideration.

Using the estimated costs and fuel savings for the different technologies, the agency then examined the projections provided by different manufacturers for their light truck fleet fuel economy for MYs 2008–2010. Although the details of the projections by individual manufacturers are confidential, we generally observed that present fuel economy performance indicates that some manufacturers will, if their planned fleets remain unchanged, be able to meet the proposed standards without significant expenditures. In contrast, other manufacturers will need to expend significantly more effort than they were planning to meet the final Unreformed CAFE standards.

Some manufacturers might achieve more fuel savings than others using similar technologies on a vehicle-by-vehicle basis due to differences in vehicle weight and other technologies present. However, this analysis assumes an equal impact from specific technologies for all manufacturers and vehicles. The technologies were ranked based on the cost per percentage point improvement in fuel consumption and applied where available and appropriate to each manufacturer's fleet in their order of rank. The complete list of the technologies and the agency's estimates of cost and associated fuel savings can be found in Table VI–4 of the FRIA.

2. Benefits

In Chapter VIII of the FRIA, the agency analyzes the economic and environmental benefits of the Unreformed CAFE standards by estimating fuel savings over the lifetime of each model year (approximately 36 years). Benefit estimates include both the benefits to consumers in terms of reduced fuel usage and other savings, such as the reduced externalities generated by the importing, refining, and consuming of petroleum products.

The total benefits of the increases in the levels of the Unreformed CAFE standards are estimated to be $577 million for MY 2008, $1,876 million for MY 2009 and $2,109 million for MY 2010, based on fuel prices ranging from $1.96 to $2.39 in 2003 dollars per gallon and a discount rate of seven percent.

3. Comparison of Estimated Costs to Estimated Benefits

Table 3 compares the incremental costs and benefits for the Unreformed CAFE standards.

TABLE 3.—COMPARISON OF INCREMENTAL COSTS AND BENEFITS FOR THE UNREFORMED CAFE STANDARDS

[In millions]

	MY 2008	MY 2009	MY 2010
Total Incremental Costs*	$536	$1,621	$1,752
Total Incremental Benefits*	577	1,876	2,109

* Relative to the 22.2 mpg standard for MY 2007.

These estimates are provided as present values determined by applying a 7 percent discount rate to the future impacts.[56] The discount rate is intended to measure the reduction in the value to society of benefits when they are deferred until some future date rather than received immediately. The benefits are discounted to provide an appropriate comparison of costs to the value of future benefits. To the extent possible, we translated impacts other than direct fuel savings into dollar values and then factored them into our cumulative estimates. We obtained forecasts of light truck sales for future years from AEO 2005.[57] Based on these forecasts, NHTSA estimated that approximately 8.6 million light trucks affected by this final rule would be sold in MY 2008. For MYs 2009 and 2010, we estimated 8.9 million and 9.0 million light truck sales, respectively.

We calculated the reduced fuel consumption of MY 2008–2010 light trucks by comparing their consumption under the final rule for those years to either the manufacturers' plans if they were above 22.2 mpg, or the consumption they would have if the MY 2007 CAFE standard of 22.2 mpg remained in effect during those years. First, the estimated fuel consumption of MY 2008–2010 light trucks was determined by dividing the total number of miles driven during the vehicles' remaining lifetime by the fuel economy level they were projected to achieve under the 22.2 mpg standard.

Then, we assumed that if these same light trucks were produced to comply with higher CAFE standards for those years, their total fuel consumption during each future calendar year would equal the total number of miles driven (including the increased number of miles driven because of the "rebound effect," the tendency of drivers to respond to increases in fuel economy in the same manner as they respond to decreases in fuel prices, *i.e.*, by driving more),[58] divided by the higher fuel economy they would achieve as a result of that standard. The fuel savings during each future year that will result from the higher CAFE standard is the difference between each model year's fuel use and the fuel use that would occur under either the manufacturer's plans or if the MY 2007 standard remained in effect. This analysis results in estimated lifetime fuel savings of 555 million, 1,813 million, and 2,023 million gallons for MYs 2008, 2009, and 2010, respectively.

A more detailed explanation of our analysis is provided in Chapter VIII of the FRIA and the final EA (see EA p. 26).

[56] In the FRIA, we also evaluated the final rule using a 3 percent discount rate for discounting benefits.

[57] The agency relied on AEO 2005 projections for the total sales figures. The manufacturers provided us with projected sales for passenger cars and light trucks. However, taken together, the sales projections provided by the individual companies to NHTSA yielded unrealistically high industry-wide sales volumes. Percentage of total sales per manufacturer was based on past sales data. A complete discussion of light truck sales projections is provided in the FRIA (FRIA p. VIII–8).

[58] As described in detail in the FRIA, we use a 20 percent rebound effect based on a thorough review of the literature (FRIA p. VIII–45). We are nonetheless aware that there is ongoing research in this area, and will continue to assess this assumption in future rulemakings in light of new evidence.

4. Uncertainty

The agency recognizes that the data and assumptions relied upon in our analysis have inherent limitations that do not permit precise estimates of benefits and costs. NHTSA performed a probabilistic uncertainty analysis to examine the degree of uncertainty in its costs and benefits estimates. Factors examined included technology costs, technology effectiveness in improving fuel economy, fuel prices, the value of oil import externalities, and the rebound effect. This analysis employed Monte Carlo simulation techniques to examine the range of possible variation in these factors. As a result of this analysis, the agency thinks it very likely that the benefits of the Unreformed CAFE standards will exceed their costs for all three model years. A detailed discussion of the uncertainty analysis is provided in Chapter X of the FRIA.

G. Unreformed Standards for MYs 2008–2010

We believe the standards established today are challenging enough to encourage the further development and implementation of fuel-efficient technologies and are achievable within the applicable timeframe. Accordingly, we have concluded that the standards for the Unreformed CAFE system are technologically feasible and economically practicable for those manufacturers with a substantial share of the light truck market (General Motors, Ford, and DaimlerChrysler), and are capable of being met without substantial product restrictions, and will enhance the ability of the nation to conserve fuel and reduce its dependence on foreign oil. As noted above, we have concluded that the standards set through this final rule represent the best overall balance of the statutory factors, and in addition, are consistent with the protection of motor vehicle safety and American jobs.

The Unreformed CAFE light truck standards for MYs 2008–2010 are as follows:

MY 2008: 22.5 mpg

MY 2009: 23.1 mpg

MY 2010: 23.5 mpg

VI. The Reformed CAFE Standards for MYs 2008–2011

A. Overview of Reformed CAFE

The structure of Reformed CAFE for each model year, as adopted in today's final rule, has two basic elements—

(1) a function that sets the target fuel economy levels for each value of vehicle footprint; [59] and

(2) a Reformed CAFE standard based on each manufacturer's production-weighted harmonic average of the fuel economy targets for footprint value. Unlike the proposed Reformed CAFE system, which relied on a step function and associated categories, the final Reformed CAFE system relies on a continuous mathematical function relating fuel economy targets to vehicle footprint.

The required level of CAFE for a particular manufacturer for a given model year is calculated using the target-setting function for that model year in conjunction with that manufacturer's actual total production and its production at each footprint value for that model year.[60] The manufacturer's required CAFE level is calculated by dividing its total production for the model year by the sum of the values obtained by dividing the manufacturer's production of each vehicle model included in its fleet by the fuel economy target for that model.

B. Authority for Reformed CAFE

In the same manner as we explained the step function proposal to be consistent with EPCA,[61] the continuous function Reformed CAFE standard similarly conforms to the mandate to establish maximum feasible fuel economy standards. The continuous function standard is applicable on a fleet average basis and reflects the agency's balancing of the nation's need to conserve energy, the effect of other standards on fuel economy, technological feasibility, economic practicability and other public policy considerations. Further, like the proposed step function standard, the continuous function achieves the congressional policy objectives embedded in EPCA.

The continuous function standard retains the fleetwide compliance aspect mandated by the CAFE statute. By maintaining reliance on harmonic averaging, the continuous function standard promotes the CAFE statute's overriding goal of conserving energy in a manner that preserves manufacturer flexibility and consumer choice. (H. Rpt. 94–340, p. 87; S. Rpt. 94–179, p. 6.)

The discretion provided to the agency by Congress to determine whether to establish a single fuel economy level applicable to all manufacturers or to set a series of fuel economy levels applicable to individual manufacturers equally supports using a step function or a continuous function to establish fuel economy targets for vehicles of different sizes.[62] Under either type of function, a manufacturer's required fuel economy level is dependent on the manufacturer's fleet mix. Moreover, just as the category targets described in the NPRM are equally applicable to all manufacturers, the fuel economy targets defined by a continuous function are equally applicable to all manufacturers for a given model year.

A continuous function standard is based on similar technological and economic considerations employed in establishing the proposed step function standard, and which we believe ensure the technological feasibility and economic practicability of the proposed MY 2011 standard. Moreover, a continuous function is defined based on the modeled capabilities of the same percentage of the fleet as in the step function proposal (*i.e.*, 97 percent of the light truck fleet). Reliance on 97 percent of the fleet better reflects industry-wide considerations than the primary focus on the ''least capable manufacturer with a substantial share of the market'' in the Unreformed CAFE structure.

In the NPRM we recognized the financial challenges facing the motor vehicle industry and that a substantial number of job losses had been announced by large full-line manufacturers. Since publication of the NPRM, two manufacturers of light trucks, each with a significant share of the market, have continued to report financial difficulties. The financial risks faced by these companies, including their workers and suppliers, underscored the importance to full-line vehicle manufacturers of establishing an equitable CAFE regulatory framework. Compared to Unreformed CAFE, the Reformed CAFE will enhance overall fuel savings while providing manufacturers the flexibility they need to respond to changing market conditions. The reforms adopted today will provide a more equitable regulatory framework by creating a level playing field for manufacturers, regardless of

[59] Footprint is an aspect of vehicle size—the product of multiplying a vehicle's wheelbase by its average track width

[60] Since the calculation of a manufacturer's required level of average fuel economy for a particular model year would require knowing the final production figures for that model year, the final formal calculation of that level would not occur until after those figures are submitted by the manufacturer to EPA. That submission would not, of course, be made until after the end of that model year.

[61] See 70 FR 51415, 51445.

[63] For a discussion of the technology costs and determination of the social benefits of improved fuel economy, refer to the FRIA.

whether they are full-line or limited-line manufacturers.

C. Legal Issues Related to Reformed CAFE

1. Maximum feasible

EPCA requires that the light truck CAFE levels be established at the ''maximum feasible average fuel economy level'' achievable by the manufacturers in that model year (49 U.S.C. 32902(a)). When deciding on the maximum feasible level, the agency must consider technological feasibility, economic practicability, the effect of other motor vehicle standards of the Federal government on fuel economy, and the need of the nation to conserve energy (49 U.S.C. 32902(f)). The agency must balance these considerations, along with other factors such as safety, when determining the level of CAFE standards.

As indicated above, and described in greater detail below, the Reformed CAFE system uses incremental cost-benefit analysis (as implemented within the Volpe model) to establish standards. The technology cost and benefit assumptions employed by the model are based on those presented in the NAS report. However, consideration is given to manufacturers' critiques of the technology assumptions employed by NAS. The agency also relies on the product plans provided by manufacturers when projecting potential technology applications. The standard arrived at through this process is then evaluated to determine potential sales and employment impacts. As explained in the following discussion, the totality of this analysis results in a standard that is both technologically feasible and economically practicable. As discussed elsewhere in this notice, the standard reflects consideration of the impact of other Federal motor vehicle standards on fuel economy, and as evidenced by our estimates that the resulting standard for MY 2011 will save approximately 2.8 billion gallons of fuel, also addresses the nation's need to conserve energy.

Vehicle manufacturers and the Alliance expressed concern that the agency's new methodology for setting CAFE standards (*i.e.*, using cost-benefit analysis to identify the pattern and stringency of fuel economy targets) risked losing the key economic practicability check that was previously provided by assessing a proposed standard's effect on the least capable manufacturer, an approach that had proven reasonable and workable in many prior CAFE rulemakings. In general, these commenters argued that the agency must continue to consider the ''least capable manufacturer'' to ensure that standards set under the Reformed CAFE system do not result in adverse economic impacts on any individual manufacturer. General Motors and Ford argued that NHTSA's proposed methodology does not sufficiently consider the capabilities of the ''least capable manufacturer,'' and thus violates its statutory duty to set standards that are ''economically practicable.''

We noted in the NPRM that the term ''least capable'' manufacturer is something of a misnomer under the Reformed system, since each manufacturer's projected level of CAFE is determined by two factors: (1) The extent to which small or large vehicles predominate in its planned production mix, and (2) the type and amount of fuel-saving technologies the manufacturer is deemed capable of applying. Two manufacturers may apply the same type and amount of fuel-saving technologies to their fleets, yet have differing CAFE levels, if their fleet mixes are not identical. Thus, a full-line manufacturer could have a lower overall CAFE than a manufacturer concentrating its production in the smaller footprint range, even though the former manufacturer has applied as much (or more) technology to the models it produces as has the latter manufacturer. The manufacturer concentrating its production in smaller vehicles would have a higher CAFE level due to the higher fuel economies of smaller vehicles. Thus, ''large manufacturer with the lowest fuel economy average'' might better describe the former than ''least capable manufacturer.''

The Reformed CAFE system establishes standards with regard to the capabilities of a wider range of manufacturers than just the ''least capable manufacturer.'' The fuel economy capabilities of an individual manufacturer are projected based on each of the seven largest manufacturers' specific product plans. Consideration of what specific technologies each manufacturer can apply and at what rate each technology can be applied is also made at the individual manufacturer level. Further, a manufacturer's required fuel economy level reflects that manufacturer's actual fleet mix.

Instead of requiring a uniform level of CAFE—which is inherently more challenging for manufacturers whose fleets have high percentages of larger vehicles to meet than for those whose product lines emphasize smaller models—the Reformed system specifies fuel economy targets that vary according to vehicle footprint; these targets are higher for smaller light trucks and lower for large ones. It uses these targets to determine a required CAFE level for each manufacturer that reflects the size distribution and production volumes of its light truck models. By setting each manufacturer's required fleet-wide CAFE level to reflect its size mix, the Reformed system requires some effort by each manufacturer to improve the fuel efficiency of its individual models, regardless of their size distribution.

As stated above, the Volpe model applies technologies to a manufacturer's fleet until the cost of an additional technology application equals the benefits of the resulting improvement in fuel economy. Because these benefits include the value of reducing economic and environmental externalities from producing fuel, this process results in a ''socially optimal'' level of fuel economy. Before we arrive at the level of optimal economic efficiency, it is important to understand the assumptions relied on by the model when applying technology.

As with the Stage analysis, the Volpe model's assumptions about technology cost and effectiveness are based on estimates provided in the NAS report, and incorporate information provided by manufacturers. The agency continues to rely on the NAS report to determine technology costs and effectiveness because the estimates developed in the NAS study were developed by recognized experts in vehicle technology, and were widely peer reviewed. This study is the most up to date peer reviewed study available. While the agency is working to update the NAS data, in a study conducted through an interagency agreement with the Department of Energy, this update requires additional work. To that end, the agency continues to rely on the NAS report.

Because the alternative estimates submitted by vehicle manufacturers and others as part of their comments on the NPRM have not been subjected to the same review process, the agency continues to view those reported in the NAS study as the most reliable estimates available. Further, because the Volpe model applies these technologies to individual vehicle models described in the product plans provided by manufacturers, this ensures that technologies are not added to vehicles already employing them, and that the model reliably projects potential fuel economy improvements for actual vehicle models that manufacturers plan to produce during each future model year. As such, the standard is based on actual characteristics of specific vehicle models and fleet mixes from manufacturers' product plans.

The agency has also responded to information provided by manufacturers concerning the practicability of applying various technologies. As explained in greater detail below in Section XIII. Comparison of the final and proposed standards, the revised assumptions and constraints include: extending lead times provided for implementing certain technologies, reducing annual phase-in percentages for certain technologies, and reducing instances of mid-product cycle technology applications. The model then relies on these revised assumptions in conjunction with the NAS study's original estimates of technology costs and effectiveness, to determine the ''socially optimal'' fuel economy level.

Ford stated that by focusing on ''optimal economic efficiency,'' NHTSA has adopted a surrogate measure of economic practicability that (as contrasted with its traditional assessment whose starting point is the ''least capable manufacturer'') does not consider many of the effects that the higher standards would have on individual manufacturers. DaimlerChrysler noted that Congress specifically directed NHTSA to consider industry-wide capabilities in setting CAFE standards, not just cost-effectiveness for consumers. As such, DaimlerChrysler argued that retaining a ''least capable manufacturer'' analysis would help ensure that the standard continues to be within the industry's ability to afford in terms of capital costs and annual expenditures.

In response to these comments, the agency notes that determining the socially optimal level of fuel economy targets under the assumptions inputted into the Volpe model provides a benchmark for assessing the economic practicability of the resulting standard. Because these socially optimal targets are determined by equalizing the monetized social benefits of improved fuel economy further to the costs of the technologies that would produce such benefits,[63] this process avoids the application of technologies whose benefits are insufficient to justify their costs when the agency determines a manufacturer's capability. In other words, this approach ensures that each identified private technology investment projected by the model produces marginal benefits at least equal to marginal cost.

The agency did identify and consider a variety of benefits and costs that either could not be monetized or could not be quantified. On the benefit side, for example, there is a significant reduction in carbon dioxide emissions, which can not be monetized. There is no agreement in the literature on values or range of values for monetizing such a benefit to the United States. On the cost side, for example, there is a risk of adverse safety impacts from downweighting, which cannot be quantified. This is because the agency is unable to predict to what extent manufacturers may rely on downweighting, and therefore cannot quantify the number of additional deaths and injuries that may occur as a result. Overall, the agency determined that there is no compelling evidence that these unmonetized benefits and costs would, taken together, alter its assessment of the level of the standard for MY 2011 that would maximize net benefits. Thus, the agency determined the stringency of that standard on the basis of monetized net benefits.

Standards set at a level more stringent than those set at the socially optimal level would not be economically efficient for society. Standards more stringent than those established under the Reformed CAFE system adopted in this document would require the industry to continue applying technology past the point at which doing so increases net social benefits.

Standards set at a level less stringent than those set at the socially optimal level would result in a lost opportunity for applying cost-beneficial technologies. Under less stringent standards, technologies that provide benefits at least equal to their costs would not be projected onto manufacturers' product plans. As such, the standards would not capture fuel savings that are cost-effective to achieve.

In considering manufacturers' costs for applying technology, the agency's analysis accounts for the opportunity costs associated with investing in that technology. When a manufacturer invests its capital in additional technology, those resources are unavailable for other investment opportunities, and the returns the manufacturer could have earned on alternative investments or other uses of its capital resources (such as application to safety or performance attributes of a vehicle, or retiring existing debt) represent an additional cost of improving fuel economy. To ensure that this additional cost of using capital resources is reflected in its assessment of the economic practicability of improving fuel economy, the agency discounts the future fuel savings and other benefits that result from higher fuel economy using a 7 percent discount rate.

The agency is relying on a 7 percent discount rate partly because this rate reflects the economy-wide opportunity cost of capital. The agency believes that a substantial portion of the cost of this regulation may come at the expense of other investments the auto manufacturers might otherwise make. Several large manufacturers are resource-constrained with respect to their engineering and product-development capabilities. As a result, other uses of these resources will be foregone while they are required to be applied to technologies that improve fuel economy.

If a manufacturer were able to capture all of the benefits to both vehicle buyers and society as a whole that result from improved fuel savings, it would apply technology to the level where the present value of increased future benefits when discounted at 7 percent just equaled the costs of applying additional technology.[64] Applying technology to improve fuel economy beyond this level would entail costs—including the opportunity cost of the additional capital resources devoted to improving fuel economy—that would exceed the resulting benefits. Failing to improve fuel economy to this level would leave opportunities to obtain fuel savings and related benefits that exceeded the associated costs of the technologies necessary to obtain them.

In commenting on the Reformed CAFE system, the Alliance stated that standards should not be set so high as the cost of the added technology outweighs the societal benefits of the improved fuel economy. Because the social optimal level of fuel economy ensures that the marginal benefit (either to the consumer or to society) of an increase in fuel economy is equal to cost of the technology producing the additional benefit, the social optimum level is economically practicable for society.

Ford suggested NHTSA's cost-benefit analysis has not properly considered costs to manufacturers for making

[63] For a discussion of the technology costs and determination of the social benefits of improved fuel economy, refer to the FRIA.

[64] The main benefit of improving fuel economy is the savings in fuel costs experienced by vehicle buyers, since as a light truck's fuel economy increases, the amount and cost of the fuel required to operate it decreases. At the same time, reducing the amount of fuel light trucks consume also generates benefits to society and the economy as a whole, including reduced emissions of some criteria pollutants that occur during fuel refining and reduced economic costs from importing and consuming petroleum. Because these benefits accrue to individuals and firms other than those who purchase new vehicles, they are referred to as external benefits.

necessary investments and for increasing employment levels, or competitive forces that may cause domestic manufacturers to absorb CAFE-related costs rather than passing them on to buyers. Ford argued that the potential inability of producers to recoup such costs from buyers (in the form of higher prices) must be taken into account explicitly, not solely through its effect on sales. DaimlerChrysler also argued that not all of the costs associated with improved fuel economy can be passed on to consumers in the form of higher vehicle prices.

As stated above, a cost-benefit analysis is not the sole factor in the agency's consideration of economic practicability. The agency also performs a sales impact analysis. In determining the sales impact of higher prices from improved fuel economy, the agency assumes that consumers will value improved fuel economy. However, the analysis does not rely on the value of fuel savings realized over the life of the vehicle. Our analysis considers the value of fuel savings realized in the first 4.5 years of the vehicle's life. The 4.5 year period is the average ownership period for new cars. We determined that the fuel savings during this period will be recognized and valued by light truck purchasers. Based on our analysis, which assumes that consumers value fuel savings over 4.5 years, there are net benefits for the average light truck purchasers. Thus, the average consumer will be willing to pay higher prices for improved fuel economy, and manufacturers will be able to raise prices to recoup their investments.

DaimlerChrysler further argued that the agency must explain how it will decide whether a standard set at a ''maximum net benefits'' level would exceed the level that is economically practicable if it does not take into account the capabilities of the ''least capable manufacturer'' with a substantial market share. DaimlerChrysler argued that the agency has not provided sufficient detail as to its methodology, as would permit informed public comment. This commenter stated that in certain situations, economic practicability might require the agency to set a lower standard than the maximum net benefits methodology might otherwise dictate. For example, DaimlerChrysler, along with the Alliance and Ford, stated that if gas prices were to rise high enough, every technology would theoretically be ''cost-beneficial.''

Gas prices are but one factor relied on in the agency's analysis for setting fuel economy targets. As stated, the Volpe model also takes into account other factors closely associated with economic practicability, such as lead time and phase-in rates. While higher fuel prices increase the benefits associated with improved fuel economy, the marginal cost-benefit analysis is still bounded by the technological and economic assumptions employed by the model. The agency has relied on technologies determined by the NAS report to be ''currently in the production, product planning, or continued development stage, or are planned for introduction. * * * The feasibility of production is therefore well known, as are the estimated production costs'' (NAS p. 40).[65]

Additionally, the model relies on assumptions that reflect manufacturers' comments regarding the applicability of technology. Manufacturers provided detailed critiques of the agency's application of technology in the NPRM, most of which were provided confidentially. Manufacturers provided alternative assumptions that they deemed more reasonable. Presumably, in providing comment on what were reasonable assumptions for the agency to apply, the manufacturers' recommendations inherently accounted for their capabilities, both technological and economic.

Many of these assumptions are closely tied to the economic capabilities of the manufacturers. For example, in response to commenters, the agency employed longer lead time and longer phase-ins for various technologies. These adjustments reduce the economic impact of applying technology by providing greater flexibility as to when fuel economy improvements are expected. Additionally, we limited the number of mid-product cycle applications. Mid-product cycle changes typically are more costly than changes at the beginning of a product cycle, as mid-product cycle changes may necessitate changes to an established manufacturing line. By limiting the availability of technologies using these assumptions, the cost-benefit does not assume that manufacturers will make improvements that would be unjustifiably costly.

The socially optimum level of fuel economy, as determined under the Volpe analysis, is thus indicative of the fuel economy level that is economically practical for both individual manufacturers and the light truck industry as a whole, and provides a process for careful balancing of the ''competing factors of EPCA'' (*CEI* v. *NHTSA*, 901 F.2d 107, 121 (DC Cir. 1990)). Further, the agency conducts an analysis of the estimated sales and employment impacts on individual manufacturers from a standard set at the level derived from the analysis applied through the Volpe model to ensure the economic practicability of that standard.

We recognize the financial difficulties facing several light truck manufacturers. It has been widely reported that General Motors and Ford are facing financial difficulties. In 2005, gasoline prices rapidly increased, causing a shift in consumer demand away from larger, more profitable SUVs and toward smaller, more fuel-efficient cars and light trucks, a segment of the market long dominated by Asian automobile manufacturers. Sales of sport utility vehicles have fallen slightly in each of the last few years, with the trend accelerated by a jump in gas prices late in 2005. The increase in gasoline prices particularly curbed sales of the biggest SUVs. In response, U.S. automakers increased sales during the 2005 summer with discounts that let consumers pay what was called the ''employee'' price. While this marketing led to near-record sales, sales again dropped off in October when the incentives ended. By December of 2005, General Motors and Ford sales were down 10.2 percent and 8.7 percent respectively.

Aside from the recent sales losses, General Motors and Ford have experienced erosion in their respective market shares. General Motors, and to a lesser extent Ford, have seen their market share fall drastically over the last several years in the last year, which has resulted in operating losses. General Motors' market share dropped from 28.1 percent in 2003 to 26.9 in 2004, and to 24.7 percent in 2005. This is compared to General Motors' market share of 35 percent in the early 1990's. Ford has experienced a drop from 19.3 percent in 2003 to 17.8 in 2005.[66]

These losses in market share have coupled with operating losses. General Motors had an operating loss of $11.5 billion for its North American operations in calendar year 2005, with automotive cash flows related to operations at a negative $7.9 billion.[67] During that same year, Ford Motor Company experienced an operating loss of $1.5 billion, with negative cash flows

[65] Complete documentation of the Volpe fuel economy model is available in the CAFE docket.

[66] The market share values are from wardssuto.com. The 2005 values are estimates.

[67] Source: SEC FORM 8–K submitted to the SEC on January 26, 2006, and General Motors' March 16, 2006 press release as reported by Automotive Business Review (*http://www.automotive-business-review.com/article_news.asp?guid=FE50808D–4915-4A6F-949F-7532C6F5CE75*).

from operations at $4.1 billion.[68] In November 2005, General Motors announced that it would cut 30,000 jobs and close 12 manufacturing facilities by 2008. In January 2006, Ford announced that it would cut up to 30,000 jobs by closing 14 manufacturing facilities over the next six years. The financial difficulties facing these manufacturers was given due consideration.

In their comments to the NPRM, several commenters, including General Motors and Ford, expressed concern that the marginal cost-benefit analysis would not appropriately consider the capabilities of individual manufacturers and may result in standards that impose harsh economic impacts on an individual manufacturer. Ford specifically noted that if standards increased further then the costs may be too high and unrecoverable, further compounding the current economic hardship facing the industry. According to Ford, when determining the economic practicability of its CAFE standards, the agency must determine whether technologically-feasible levels would lead to adverse economic consequences, such as a significant loss of sales or the unreasonable elimination of consumer choice, a determination that Ford claimed the agency has not made in selecting its proposed Reformed CAFE targets.

The agency recognizes that we must consider the potential economic and financial impacts of the CAFE standards on individual manufacturers. Aside from incorporating manufacturers' comments regarding the feasibility of technology applications, the agency has also performed a sales and employment impact analysis. The sales analysis looks at a purchasing decision from the eyes of a knowledgeable and rational consumer, comparing the estimated cost increases versus the payback in fuel savings over 4.5 years (the average new vehicle loan) for each manufacturer. This relationship depends on the cost effectiveness of technologies available to each manufacturer. Some manufacturers are estimated to increase sales and others to lose sales. Overall, based on a 7 percent discount rate for future fuel savings, the maximum sales loss is less than 11,000 vehicles per year for the industry. We believe this will have a minor impact on employment.

Further, we note that the regulatory philosophy set forth in Executive Order 12866, ''Regulatory Planning and Review,'' is that a rulemaking agency should set its regulatory requirements at the level that maximizes net benefits unless its statute prohibits doing so. EPCA neither requires nor prohibits the consideration of the fuel economy level at which net benefits are maximized. Additionally, EPCA does not require the agency to rely on the ''least capable manufacturer'' analysis as we have traditionally used. Reliance on the ''least capable'' manufacturer analysis was in response to the direction in the conference report on the CAFE statute language to consider industry-wide considerations, but not necessarily base the standards on the manufacturer with the greatest compliance difficulties.

Moreover, the very structure of Reformed CAFE standards makes it unnecessary to continue to use the ''least capable manufacturer'' approach in order to be responsive to guidance contained in the EPCA conference report. Instead of specifying a common level of CAFE, a Reformed CAFE standard specifies a variable level of CAFE that varies based on the production mix of each manufacturer. By basing the level required for an individual manufacturer on that manufacturer's own mix, a Reformed CAFE standard in effect recognizes and accommodates differences in production mix between full- and part-line manufacturers, and between manufacturers that concentrate on small vehicles and those that concentrate on large ones. A Reformed standard is also responsive to changes in fleet-mix that result from changes in the market.

In contrast to comments from the manufacturers, environmental commenters argued that the marginal cost-benefit analysis is contrary to EPCA because it results in a standard that is lower than what they deemed to be ''maximum feasible.'' The Union of Concerned Scientists stated that the social optimum level is below ''maximum feasible'' because of the uncertainty surrounding many of the assumptions relied on in the model. The Union of Concerned Scientists stated that the model undervalues the benefits because not all externalities are monetized (*e.g.*, reduction in CO_2 emissions). The Union of Concerned Scientists recommends the agency rely on a break-even approach, *i.e.*, set fuel economy levels at the point at which total costs equal total benefits. This commenter stated that the break-even approach would result in targets an average of 6 mpg higher than those in the proposed rule.

The agency considered an approach under which technology was applied to the point of total cost equaling total benefit, but determined that such a standard would violate the maximum feasible requirement. The Volpe model was unable to achieve a level of total cost equaling total benefit before running out of technologies to apply. While the Union of Concerned Scientists stated that it performed a ''break-even'' analysis, it did not explain the technologies it relied upon in its analysis. In any event, the ''break even'' approach necessitates adding technologies that cost more than the benefit they provide.

ACEEE commented that NHTSA's approach of setting CAFE standards that maximize net benefits is flawed because it is inconsistent with the requirements of EPCA. ACEEE stated that under the statute, NHTSA must set ''maximum feasible'' fuel economy standards after considering the ''technological feasibility, economic practicability, the effect of other motor vehicle standards of the Government on fuel economy, and the need of the United States to conserve energy.'' [69] According to ACEEE, there is a range of fuel economy values that are technologically feasible and another range of values that are economically practicable, and the statute requires NHTSA to set the CAFE standard at the highest value within the intersection of those ranges. ACEEE stated that NHTSA's proposed maximum benefits approach would not yield the same level of fuel economy, so the agency's current methodology is therefore impermissible. Accordingly, ACEEE urged NHTSA to adopt an approach whereby CAFE standards would be set at the maximum technically-feasible level that has positive net total economic benefits, rather than a level at which the added benefits from improving fuel economy further are offset by the costs for doing so.

NRDC similarly stated that the agency's methodology ''falls short of statutory compliance'' and argued that a cost-benefit analysis is inappropriate because key benefits of the fuel economy standards are ''impossible to reduce to monetized quantities,'' such as ''the national security benefits of reduced oil dependence and environmental and societal benefits of reducing the severity of global warming.'' NRDC stated that the agency's rationale for relying on a cost-benefit methodology was ''arbitrary and insupportable,'' in part because EPCA provides for NHTSA to engage in ''technology-forcing.'' The Union of Concerned Scientists argued that to account for undervaluing of societal benefits, fuel economy targets should be established at the level where total benefits exceed total costs.

[68] Source: Ford's SEC Form 8–K submitted to the SEC January 23, 2006.

[69] 49 U.S.C. 32902.

As suggested by ACEEE, the agency establishes the standard at the maximum feasible fuel economy level that is economically practicable. The agency is not permitted to establish higher standards simply because they might be technologically feasible. When such standards would impose cost burdens on certain manufacturers that are not economically practicable, such standards would violate EPCA. Conversely, our statutory responsibility does not allow us to set lower standards than those it has established using this process, because the standards adopted today are demonstrably technologically feasible, and more lenient standards would not represent the maximum feasible levels that could be attained while remaining economically practicable.

NRDC commented that the marginal cost-benefit analysis is inconsistent with a ''technology forcing standard'' [70] and, further that it is inappropriate for the purposes of CAFE because the benefits are ''impossible to reduce to monetized quantities.'' NRDC stated that the enhancement of national security and the reduction of potential effects from reduced CO_2 emissions may not fully be quantifiable and monetizable.

We disagree with NRDC with regard to the degree of technology forcing permitted under EPCA. The statute permits the imposition of reasonable, ''technology forcing'' challenges on any individual manufacturer, but does not contemplate standards that will result in severe economic hardship by forcing reductions in employment affecting the overall motor vehicle industry.[71] A fuel economy standard ''with harsh economic consequences for the auto industry * * * would represent an unreasonable balancing of EPCA's policies'' (CAS, 793 F.2d at 1340).

In response to arguments by the Union of Concerned Scientists and ACEEE, NHTSA does not agree that the EPCA requires it to set CAFE standards at the highest technically feasible level that would result in positive net economic benefits. Although EPCA does not specify a method for identifying standards that are economically practicable, Executive Order No. 12866 establishes an overall goal of achieving the highest net benefits, which occurs at the point where the additional benefits from further increasing the standards (marginal benefits) just equal the increase in costs for complying with a stricter standard (marginal costs).[72]

NRDC also stated that the agency should use its authority to set standards to be ''technology forcing.'' While NRDC did not define ''technology forcing'' we took their comment to mean that the agency should establish standards that require investment in developing new technologies. However, the agency would not be able to ensure that standards set at such a level would be technologically feasible, as these levels would require the use of technologies not yet proven.

The standards that result from the continuous function CAFE system are technology-forcing in that the standards require manufacturers to employ technologies beyond those in their product plans, to the extent practicable within the lead time available. This is evidenced by the fact that both the Stage and benefit-cost analyses for determining the level of standards envision extensive application of fuel economy technologies that are currently in their early stages of deployment, but are not already included in manufacturers' product plans for the model years to which the adopted standards apply.

Moreover, our cost-benefit analysis carefully considers and weighs all of the benefits of improved fuel savings. The main source of benefits from the standards is the fuel savings experienced by consumers. With regard to the value of increased energy security, the agency has estimated a monetized value of this security associated with improved fuel savings. We have also determined that there is no compelling evidence that the unmonetized benefits would alter our assessment of the level of the standard for MY 2011. A discussion of the benefit assumptions is provided in Chapter VIII of the FRIA. Further, the marginal cost-benefit analysis ensures that we do not set standards beyond what is economically optimal for society.

2. Backstop

Consistent with our proposal, the Reformed CAFE system adopted today does not include a backstop or similar such mechanism. Several commenters, ACEE, NRDC, the Union of Concerned Scientists, and Environmental Defense, argued that EPCA requires the agency to incorporate such measures under the Reformed CAFE system. However, a backstop or similar mechanism as recommended by commenters would not be consistent with the objectives of EPCA, and in some instances could violate the statute.

''Backstop'' refers to a required fuel economy level that would be applicable to an individual manufacturer (or to the industry) if the required fuel economy level calculated under the Reformed CAFE system for a manufacturer (or industry) was below a predetermined minimum. The concept of a backstop is to prevent or minimize the loss of fuel savings from one model year to the next. Such a requirement would essentially be the same as an Unreformed CAFE standard. Stated another way, the Reformed CAFE standard with a backstop would require compliance with the greater of the following fleet-wide requirements: (1) An average fuel economy level calculated under the Reformed CAFE standard, or (2) an equal-cost fuel economy level calculated under the Unreformed CAFE standard.

Under the Reformed CAFE system a manufacturer's required fuel economy is reflective of that manufacturer's product mix. Fuel economy targets are based on vehicle footprint; vehicles with a larger footprint are compared to less stringent targets than vehicles with a smaller footprint. As such, commenters stated that upsizing [73] of manufacturers' fleets through increased sales of larger vehicles would reduce required fuel levels and fuel savings would decrease. It is this potential for reduced fuel savings that these commenters assert necessitates a backstop or fuel economy ratcheting mechanism.[74]

As previously explained, EPCA requires the agency to establish fuel economy standards with consideration given to four statutory criteria, one of which is the Nation's need to conserve

[70] We assume NRDC is using the phrase ''technology forcing'' to indicate a level of a standard that would require manufacturers to apply technologies beyond that assumed technologically feasible under the Volpe model.

[71] In the past, the agency has set CAFE standards above its estimate of the capabilities of a manufacturer with less than a substantial, but more than a de minimus, share of the market. See, e.g., *CAS*, 793 F.2d at 1326 (noting that the agency set the MY 1982 light truck standard at a level that might be above the capabilities of Chrysler, based on the conclusion that the energy benefits associated with the higher standard would outweigh the harm to Chrysler, and further noting that Chrysler had 10–15 percent market share while Ford had 35 percent market share). On other occasions, the agency reduced an established CAFE standard to address unanticipated market conditions that rendered the standard unreasonable and likely to lead to severe economic consequences. 49 FR 41250, 50 FR 40528, 53 FR 39275; see *Public Citizen*, 848 F.2d at 264.

[72] White House Office of Management and Budget, Circular A–4, September 17, 2003, p. 10.

[73] ''Upsizing'' of a fleet refers to the increase in average footprint that occurs through either an increase to the footprint value of individual vehicles, an increase in the production of vehicles with larger footprint values, or a combination of both.

[74] As described by commenters, a ''ratcheting mechanism'' is a regulatory mechanism that would automatically increase the stringency of the required fuel economy level for a manufacturer or the industry if fuel savings dropped below a predetermined level.

energy. However, the agency has in the past reduced established fuel economy standards because the previous balance of the four criteria no longer gave sufficient consideration to the criteria of economic practicability. This course of action was upheld by the U.S. Circuit Court of Appeals for the District of Columbia, once with respect to light trucks, and the other time with respect to passenger cars. See, *CAS*, 793 F.2d 1322; *Public Citizen*, 848 F.2d 256. With regard to the reduction of the light truck standard, the agency determined that manufacturers had made reasonable efforts to comply with the standard, but it was a shift in market demand that was hindering compliance. Consumers were demanding larger vehicles with lower fuel economy performance than manufacturers or the agency had projected. The Court in *CAS* specifically held that EPCA permits the agency to consider consumer demand and the resulting market shifts in setting fuel economy standards. See, CAS at 1323. This precedent is contrary to the commenters' assertion that a backstop or ratcheting mechanism is statutorily required. The Courts have said that none of the four criteria are preeminent. Instead the agency must balance the four criteria in establishing fuel economy standards.

NRDC and the Union of Concerned Scientists stated that historic rates of vehicle upsizing and the potential for fleet upsizing through shifts in production towards vehicles with larger footprints necessitate a backstop or ratcheting mechanism. These commenters stated that historic increases in light truck foot print and a shift in production of nameplates offered with longer wheelbases could result in a 30 percent and one percent reduction in the projected fuel savings, respectively. As such, commenters suggested that the agency adopt a backstop or ratcheting mechanism that would apply if the light truck fleet increased in size beyond some threshold, but did not identify what such a threshold should be.

The regulatory mechanisms suggested by commenters would essentially limit the ability of manufacturers to respond to market shifts arising from changes in consumer demand. If consumer demand shifted towards larger vehicles, a manufacturer potentially could be faced with a situation in which it must choose between limiting its production of the demanded vehicles, and failing to comply with the CAFE light truck standard. Forcing such a choice would be contrary to the congressional intent for establishing EPCA.

Congress directed that:

> [A]ny regulatory program must be carefully drafted so as to require of the industry what is attainable without either imposing impossible burdens on it or unduly limiting consumer choice as to the capacity and performance of motor vehicles.

H. Rep. 94–340 (p. 87). The Court's determination in *CAS* reflects this congressional directive. These comments, on the other hand, seem unaware of it. Consideration of consumer demand is a permissible one under EPCA.

A backstop could also have the unintended consequence of resulting in downsizing by manufacturers, which could have negative safety implications. A manufacturer facing the potential of failing to comply with a backstop might shift its production to smaller, lighter vehicles.

Furthermore, a ratcheting mechanism could result in a manufacturer required to comply with a fuel economy level that violates EPCA. Under the Reformed CAFE system, a manufacturer's required fuel economy level is based on targets that represent the fuel savings capabilities of vehicles with a given footprint value. Targets are set with consideration of the technological feasibility of improving the fuel economy of vehicles given their footprint. As such, the Reformed CAFE system encourages manufacturers to undertake reasonable efforts to improve the fuel economy of all its light trucks. If the stringency of targets were automatically increased due to a predetermined trigger, the resulting changes to required fuel economy levels would be beyond what was established after careful consideration of the statutory criteria, including the technological and economic capabilities of the industry. This result would violate EPCA.

Commenters also presented additional scenarios (i.e., upsizing at category boundaries and upweighting to remove vehicles from the light truck CAFE program) that they argued would likely result in some loss of fuel savings. These additional scenarios are addressed below. As discussed further below, concerns raised by these additional scenarios are addressed through the Reformed CAFE system adopted today.

3. Transition Period

The agency is providing a transition period during MYs 2008–2010, during which manufacturers may choose to comply with the Unreformed CAFE standard or the Reformed CAFE standard. This transition period will minimize the potential for unintended compliance burdens that may be experienced by a manufacturer as the result of shifting to a new regulatory structure. The transition period is critical given that this is the first comprehensive reform of the light truck CAFE program since its inception.

The transition period is consistent with the recommendation of the NAS report. The NAS report stated that a restructuring of the CAFE system should include a phase-in period in order to provide manufacturers an opportunity to analyze the implications of the new standards and to redo their product plans (see NAS Report at 108). The Reformed CAFE standard will require certain manufacturers to improve their fleets, when in the past these manufacturers did not need to be concerned with the light truck CAFE program. These manufacturers are those that produce fleets predominately comprised of small light trucks, which by virtue of their small size have high fuel economies. These manufacturers traditionally had high fleet wide fuel economies that were above the standard. However, the Reformed CAFE system, by comparing vehicles to footprint specific targets will require more manufacturers to improve their fleets' fuel economy performance beyond the baseline of the manufacturers' product plans.

Furthermore, the structure of the Reformed CAFE might require some manufacturers to revise their compliance strategies. For example and as explained below, the Reformed CAFE system minimizes the ability of manufacturers to offset the low fuel economy performance of larger vehicles by increasing the production of smaller vehicles with higher fuel economies. Manufacturers that relied on such a compliance strategy in the past might need to revise their product plans in order to comply with the Reformed CAFE standard. The transition period is an opportunity for manufacturers to gain experience with how the Reformed CAFE system impact their fleets and compliance strategies, while still providing manufacturers the option to comply under the more familiar Unreformed CAFE system.

Several commenters questioned whether the agency had authority to establish a transition period during which manufacturers could choose to comply with one of two standards. The Union of Concerned Scientists stated that the transition period would lead to a ''worst of both worlds'' scenario; each manufacturer would comply with the CAFE system that provided the lower of the two required fuel economy levels. The Union of Concerned Scientists estimated that under this scenario, the actual light truck fuel economy in the transition years would be as much as 0.4 mpg lower than it would be under either the Reformed CAFE system or the Unreformed CAFE system.

First, we are unable to predict how manufacturers will choose to comply during the transition period. Some manufacturers might choose to continue to comply under the Unreformed CAFE system, given that it is a regulatory structure with which they are familiar. Some manufacturers might plan to comply with the Unreformed CAFE program, but determine that they comply with the Reformed CAFE, and therefore to gain experience with the new system switch to the Reformed system. Other manufacturers may choose to gain early experience with the Reformed CAFE system and choose to comply with the Reformed CAFE system for all 3 years of the transition. We have concluded that it is prudent to provide manufacturers this flexibility in order to provide for a more orderly transition to Reformed CAFE.

Second, this is not the first time that the CAFE program provided manufacturers a choice of standards under which to comply. In 1979, manufacturers were given the option of complying with the 4x4 and 4x2 standards separately or combining all their trucks into one fleet and complying with the 4x2 numerical level. In 1983–1991, manufacturers were provided the option of complying with standards applicable to their 4x4 light truck fleet and 4x2 light truck fleet separately, or complying with a single combined standard applicable to their entire fleet. In establishing the later option, we stated that it provides manufacturers additional flexibility in complying (45 FR 81593, 81594 (December 11, 1980)). We also noted that such a compliance mechanism provides a degree of stability in the standard setting structure of CAFE (*see,* id.). Although the substance of the compliance options adopted in this document differs from those that gave rise to compliance options in previous model years, the rationale is the same.

Manufacturers commented that the flexibility of a transition period is necessary for manufacturers to understand the new system and avoid unintended consequences when revising compliance strategies and product plans. Toyota noted that the current system has been in place for over 25 years, and therefore, a 3-year transition is appropriate for manufacturers to better understand how to plan for and implement the Reformed CAFE system. The Alliance, General Motors, and Mitsubishi stated that 3 years of lead-time is the minimum necessary to comply with the required fuel economy levels under the Reformed CAFE structure. Nissan stated that the stringency of the required fuel economy levels that results from the Reformed CAFE system will be extremely challenging, given the significant changes to the CAFE system that must be incorporated into a manufacturer's product planning process. Nissan suggested that because the proposed regulatory changes are so much more extensive than merely setting new CAFE levels, which Nissan claims the agency has stated requires at least 30–36 months lead time, an even longer phase-in may be appropriate.

General Motors stated that the availability of the traditional standards during MY 2008–2010 would provide a safety net against unintended consequences from the reform process. However, General Motors stated that the agency need not establish the MY 2011 Reformed CAFE standards in the current rulemaking. Instead, General Motors urged, NHTSA should await the experience and data that the transition period will produce. General Motors expressed concern that if the Reformed CAFE targets begin to increase significantly because of new analytical methodologies, time to fully address all of the relevant issues may not be available due to statutory deadlines. In such an instance, General Motors commented that a standard grounded in the ''least capable manufacturer'' might be preferable.

Manufacturers develop product plans for their fleets at least 5 years in advance, plans which incorporate consideration of CAFE compliance. As such, manufacturers have already begun investing in their fleets for some of the model years that are subject to today's final rule. Some manufacturers may determine that it will be necessary to adjust their product plans based on the new CAFE structure. Given the uncertainty associated with how a manufacturer will perform under Reformed CAFE, we are providing a transition period.

In addition to providing manufacturers the option of complying under either CAFE system during the transition period, we adjusted the Reformed CAFE standard such that the industry wide compliance costs are approximately equal between the two systems. Cost equalization has an important advantage. Since the Unreformed CAFE standards were judged to be economically practicable and since the Reformed CAFE standards spread the cost burden across the industry to a greater extent, equalizing the costs between the two systems provides the agency with confidence that the Reformed CAFE standards are also economically practicable.[75] Further, this approach promotes an orderly and effective transition to the Reformed CAFE system since experience with the new system will be gained prior to full implementation in MY 2011.

Several commenters questioned whether the agency had the authority to equalize compliance costs during the transition period. The Union of Concerned Scientists and ACEEE stated that equalizing costs during the transition years and not setting them at a level at which marginal costs equaled marginal benefits, resulted in Reformed CAFE standards are not set at the ''maximum feasible'' level. Therefore, these commenters concluded that the Reformed CAFE standards during the transition period would not comply with EPCA.[76]

With regard to the agency's authority for establishing standards under EPCA, the agency is not limited to the considerations provided for in the statute when determining what fuel economy levels will be maximum feasible. For example, the agency also considers the effect that the CAFE standards will have on safety.[77] Just as safety is an appropriate consideration in determining maximum feasible fuel economy levels, so is the need for an orderly transition to a CAFE system that provides greater fuel savings than the current system.

Because we equalized aggregate industry costs between Reformed and Unreformed CAFE, the costs are not borne by manufacturers in the same way and costs for individual manufacturers may differ between the two systems. Therefore, some manufacturers may have a cost incentive to comply under the Reformed CAFE system beginning in MY 2008. This will provide both the industry and the agency with

[75] We equalized aggregate industry costs between Reformed and Unreformed CAFE. The costs are not borne by manufacturers in the same way and costs for individual manufacturers may differ between the two systems.

[76] Additionally, the ACEEE recommended that the transition period be structured so that all manufacturers pay compliance costs equal to the least capable manufacturer, but did not provide details as to how the standards would be set, or whether such standards would be technologically feasible.

[77] The United States Court of Appeals pointed out in upholding NHTSA's exercise of judgment in setting the 1987–1989 passenger car standards, ''NHTSA has always examined the safety consequences of the CAFE standards in its overall consideration of relevant factors since its earliest rulemaking under the CAFE program.'' *Competitive Enterprise Institute* v. *NHTSA (CEI I*), 901 F.2d 107, 120 at n.11 (D.C. Cir. 1990).

experience in compliance with and the administration of the new system. Further, some manufacturers may chose to comply under the Reformed CAFE in order to gain a familiarity with the new system. As such, the cost equalization will promote an orderly and effective transition to the Reformed system.

The equalization of costs provides the industry greater flexibility in adjusting to the Reformed CAFE system. The three-year transition period as adopted encourages experimentation by manufacturers, which we conclude will effect a quicker transition than would result by either implementing an abrupt change after providing appropriate lead time or maintaining the status quo. The Reformed CAFE program provides for greater fuel savings. By effecting a quicker transition period, greater fuel savings will be realized over time, thereby furthering EPCA's goal of improving fuel savings.

D. Structure of Reformed CAFE

1. Footprint Based Function

The proposed Reformed CAFE system was premised on using vehicle footprint to establish fuel economy targets for light trucks of different sizes. We noted that vehicle weight and shadow [78] were discussed in the ANPRM, but along with commenters to the ANPRM, we had concerns that weight and shadow could more easily be tailored for the sole purpose of subjecting a vehicle to a less stringent target (70 FR 51440). As a result, both of those attributes, if used as the foundation of our program, could fail to achieve our goal of enhancing fuel economy with a Reformed CAFE program, and use of weight could fail to achieve our goal of improving the safety of the program.

Vehicle footprint is more integral to a vehicle's design than either vehicle weight or shadow and cannot easily be altered between model years in order to move a vehicle into a different category with a lower fuel economy target. Footprint is dictated by the vehicle platform, which is typically used for a multi-year model lifecycle. Short-term changes to a vehicle's platform would be expensive and difficult to accomplish without disrupting multi-year product planning. In some cases, several models share a common platform, thus adding to the cost, difficulty, and, therefore, unlikelihood of short-term changes.

Vehicle footprint is the area defined by vehicle wheelbase multiplied by vehicle track width. The proposal defined wheelbase as the longitudinal distance between front- and rear-wheel centerlines. The proposed track width definition was based on the Society of Automotive Engineers (SAE) definition in W101 of SAE J1100, Surface Vehicle Recommended Practice, revised July 2002, which reads as follows:

The lateral distance between the centerlines of the base tires at ground, including the camber angle.[79] However, the agency was concerned that a vehicle's track width could be increased by off-setting its wheels,[80] at minimal expense, and thus subjecting the vehicle to a less stringent target. Therefore, the agency modified the W101 definition for the proposal to read as follows:

> [T]rack width is the lateral distance between the centerlines of the tires at ground when the tires are mounted on rims with zero offset.

Commenters generally supported the use of footprint as a metric to categorize light trucks. However, manufacturers raised a variety of concerns with the proposed definition of track width. The Alliance disagreed with the agency's concern regarding the potential for changes made to wheel offset. The Alliance stated that manufacturers determine wheel offsets based on suspension geometry, ride, and handling characteristics, weight and vehicle drivability. As such, the Alliance asserted that it would be unlikely for a manufacturer would alter a vehicle's wheel offset in response to the light truck CAFE program.

The Alliance, Ford, General Motors, and BMW suggested that the agency should define track width in accordance with W113 in SAE J1100, which defines track width as:

> [T]he lateral distance between the wheel mounting faces,[81] measured along the spindle axis.[82]

Conversely, Honda opposed use of W113, stating that W113 and wheel offset are related to packaging issues inside the wheel area, but not relevant to issues such as wear and dynamic performance. Honda stated that the W113 measurement could be increased without any change to vehicle size or dynamic performance by using wheels with a larger positive offset.

Nissan recommended using SAE J1100 W101, which is based on the centerline of a vehicle's tires at the ground. Nissan stated that it relies on the W101 measurement for handling performance design considerations as well as safety performance design. Nissan stated that there is little incentive to manipulate the W101 measurement because even minor adjustments affect handling. Honda added that use of the tire centerline has more relevance to rollover risk.

The definition of footprint adopted in today's final rule incorporates the definition of track width as defined in W101. The agency has reviewed the three different definitions of track width and has determined that there is the potential to affect the measurements under each definition. The definition proposed by the agency can be affected through changes to a wheel's camber angle and the thickness of the wheel mounting face (*e.g.*, through the addition of washers). The measurement under W113 could be affected by the thickness of the wheel mounting face. The measurement under W101 can be affected by changes to wheel offset (positive or negative offset), camber angle, and the thickness of the wheel mounting face.

However, W101 is most directly linked to safety in terms of rollover risk, as stated by Honda. The W101 measurement is taken where a vehicle's tires touch the ground and is used by NHTSA in calculating a vehicle's Static Stability Factor. If a manufacturer were to increase a vehicle's footprint through increasing its track width, there likely would be a positive safety effect.

We also believe that use of the vehicle footprint attribute helps us achieve greater fuel economy without having a potential negative impact on safety. While past analytic work [83] focused on the relationship between vehicle weight and safety, weight was understood to encompass a constellation of size-related factors, not just weight. More recent studies [84] have begun to consider

[78] ''Shadow'' is the area defined as the vehicle's length multiplied by the vehicle's width.

[79] Camber angle is the angle between the vertical axis of the wheel of an automobile and the vertical axis of the vehicle when viewed from the front or rear. It is used in the design of steering and suspension.

[80] Wheel offset is the distance from where a wheel is mounted to an axis to the centerline of the wheel. The offset can be one of three types.

Zero Offset—The hub mounting surface is even with the centerline of the wheel.

Positive—The hub mounting surface is toward the front or wheel side of the wheel. Positive offset wheels are generally found on front wheel drive cars and newer rear drive cars.

Negative—The hub mounting surface is toward the back or brake side of the wheels centerline. ''Deep dish'' wheels are typically a negative offset.

[81] A spindle axis is the rotating arm, or axis, unto which the wheels are attached.

[82] W113 was added to SAE J1100 in September of 2005, after the agency published the NPRM. (A spindle axis is the rotating arm, or axis, unto which the wheels are attached.)

[83] See, Kahane (2003) and Van Auken, R.M. and J.W. Zellner, An Assessment of the Effects of Vehicle Weight on Fatality Risk in Model Year 1985–98 Passenger Cars and 1985–97 Light Trucks, Dynamic Research, Inc. February 2002. Docket No. NHTSA 2003–16318–2.

[84] See, Van Auken, R.M. and J.W. Zellner, *Supplemental Results on the Independent Effects of*

Continued

whether the relationship between vehicle size and safety differs. To the extent that mass reduction has historically been associated with reductions in many other size attributes and given the construct of the current fleet, we believe that the relationship between size or weight (on the one hand) and safety (on the other) has been similar, except for rollover risks.

Developing CAFE standards based on vehicle footprint encourages compliance strategies that decrease rollover risk. Manufacturers are encouraged to maintain track width because reducing it would subject the vehicle to a more stringent fuel economy target. Maintaining track width potentially would allow some degree of weight reduction without a decrease in overall safety. Moreover, by setting fuel economy targets for light trucks with the smallest footprints that approach (or exceed) 27.5 mpg, the agency is providing little incentive, or even a disincentive, to design vehicles to be classified as light trucks in order to comply or offset the fuel economy of larger light trucks.

The influence of Reformed CAFE on track width is reinforced by our New Car Assessment Program (NCAP) rollover ratings. As stated above, track width as defined by SAE J100 W101 is one of the elements of our Static Stability Factor, which constitutes a significant part of our NCAP rollover ratings and which correlates closely with real world rollover risk. The rollover NCAP program (as well as real world rollover risk) reinforces Reformed CAFE by a separate disincentive to decrease track width.

Overall, use of vehicle footprint is ''weight-neutral'' and thus does not exacerbate the vehicle compatibility problem. A footprint-based system does not encourage manufacturers to add weight to move vehicles to a higher footprint category. Nor would the system penalize manufacturers for making limited weight reductions. By using vehicle footprint in lieu of a weight-based metric, we are facilitating the use of promising lightweight materials that, although perhaps not cost-effective in mass production today, may ultimately achieve wider use in the fleet, become less expensive, and enhance both vehicle safety and fuel economy.[85] In Reformed CAFE, lightweight materials can be incorporated into vehicle design without moving a vehicle into a footprint category with a more stringent average fuel economy target.

2. Continuous Function

In the NPRM, we proposed a Reformed CAFE structure utilizing a step function that established fuel economy targets for vehicles within specified ranges of footprint values. We also discussed and sought comments on an alternative structure that would use a continuous function to establish a different fuel economy target for each discrete footprint value. In today's final rule, we are adopting a Reformed CAFE structure that employs such a continuous function.

The process for establishing a continuous function is similar to that for establishing a step function, which was described in detail in the NPRM. Moreover, a CAFE system based on a continuous function will provide fuel-saving benefits equivalent to those of the proposed step function. By varying a vehicle's fuel economy target continuously but gradually as its footprint changes, a continuous function will reduce the incentive created by a step function to upsize a vehicle whose footprint is near a category boundary. By comparison, the proposed step function would have relaxed fuel economy targets significantly for any vehicle that could be upsized so that it moves from one category up to the next. At the same time, the continuous function will also minimize the incentive to downsize a vehicle to improve its fuel economy since, unlike under the proposed category system, any reduction of footprint will raise a vehicle's fuel economy target. A continuous function also provides manufacturers with greater regulatory certainty because there are no category boundaries that could be redefined in future rulemaking. These points are discussed in greater detail below.

a. Overview of Establishing the Continuous Function Standard

The continuous function standard is developed using a three-phrase process substantially similar to that used to develop the step function standard described in the NPRM. In ''phase one,'' the agency adds fuel saving technologies to each manufacturer's fleet until the incremental cost of improving its fuel economy further just equals the incremental value of fuel savings and other benefits from doing so. This is done for each of the seven largest manufacturers. Data points representing each vehicle's size and ''optimized'' fuel economy from the light truck fleets of those manufacturers are then plotted on a graph.

In ''phase two,'' a preliminary continuous function is statistically fitted through these data points, subject to constraints at the upper and lower ends of the footprint range. This contrasts with the proposed step function standard, in which the vehicle models of the improved fleets were placed in the pre-defined footprint categories and the harmonic average fuel economy of the models assigned to each category was used to determine the preliminary target for that category. With a continuous function, the agency sets different fuel economy targets for each increment or value of vehicle footprint, rather than setting targets, that would each apply to a range of footprint values.

However, establishing fuel economy targets that vary gradually by vehicle footprint does not differ fundamentally from the proposal to set different targets for specific footprint ranges. If the number of footprint categories in a step function were steadily increased, the relationship of fuel economy targets to vehicle footprint would increasingly resemble that under a continuous function. In fact, as the number of footprint categories in a step function increased, the fuel economy targets it established would apply to progressively smaller footprint ranges, until each category consisted of a single value of footprint just as under the continuous function.

Once a preliminary continuous function has been statistically fitted to the data for a model year, the level of the function is then adjusted just as the step function is adjusted in ''phase three'' of the proposed rule. That is, the preliminary continuous function is then raised or lowered until industry-wide net benefits are maximized. Maximization occurs when the incremental change in industry-wide compliance costs from adjusting it further would be exactly offset by the resulting incremental change in benefits.

Under a continuous function, the level of CAFE required for each manufacturer (and its compliance with that level) is determined in exactly the same fashion as under the proposed step function. Each manufacturer's required CAFE level is the sales-weighted harmonic average of the fuel economy

Curb Weight, Wheelbase, and Track on Fatality Risk in 1985–1997 Model Year LTVs, Dynamic Research, Inc. May 2005. Docket No. NHTSA 2003–16318–17.

[85] The Aluminum Association commented that using aluminum to decrease a vehicle's weight by 10 percent could improve its fuel economy by 5–8 percent. The commenter noted that the Honda Insight, an all aluminum vehicle, is 40 percent lighter than a comparable steel vehicle. It also provided data to demonstrate that all aluminum vehicles have comparable performance in frontal barrier crash tests as comparable steel vehicles. See comments provided by the Aluminum Association, Inc. (Docket No. 2003–16128–1120, pp. 5 and 12).

targets corresponding to the footprint of each of its light truck models. Its compliance with that CAFE level is assessed by comparing the sales-weighted harmonic average of each of its model's actual fuel economy to this required level. The key difference is that under the continuous function, any change in a vehicle's footprint subjects it to a slightly different fuel economy target, thus changing a manufacturer's required CAFE level slightly. Conversely, under the step function, changing a vehicle's footprint would subject it to a new target—and thus change a manufacturer's required CAFE level—only if that change moved it to a smaller or larger footprint category.

B. Industry-Wide Considerations in Defining the Stringency of the Standard

In setting standards under the proposed Reformed CAFE system, we focused on the seven largest manufacturers of light trucks in selecting the targets. This differs from the traditional focus on the manufacturer with the lowest projected level of CAFE that also has a significant share of the market (*i.e.*, the ''least capable'' manufacturer). We have traditionally set the Unreformed CAFE standards with particular regard to the ''least capable'' manufacturer with a significant market share in response to language in the conference report on the CAFE statute directing the agency to consider industry-wide factors, but not necessarily to base the standards on the manufacturer with the greatest compliance difficulties. As the NPRM indicated, this ''least capable'' manufacturer approach was simply a way of implementing the guidance in the conference report in the specific context of Unreformed CAFE. While this approach has ensured that the standards are technologically feasible and economically practicable for all manufacturers with significant market shares, it limits the amount of fuel saving possible under Unreformed CAFE.

As previously explained, by basing a manufacturer's required fuel economy level on that manufacturer's individual product mix, the Reformed CAFE system provides for a more individualized assessment of the capabilities of each of the manufacturers. Thus, Reformed CAFE permits the agency to carefully assess the capabilities of the ''least capable manufacturer,'' as well as the capabilities of the other manufacturers that comprise nearly all of the light truck market. Instead of requiring a uniform level of CAFE—which is inherently more challenging for manufacturers whose fleets have relatively high percentages of larger vehicles to meet than for those whose product lines emphasize smaller models—the Reformed system specifies fuel economy targets that vary according to vehicle footprint. These targets are higher for smaller light trucks and lower for large ones. By setting each manufacturer's required fleet-wide CAFE level to reflect its size mix, the Reformed system requires each manufacturer to ensure the fuel efficiency of its individual models, regardless of their size distribution.

Porsche expressed disagreement with NHTSA's decision to consider only the performance and capabilities of the seven largest manufacturers, while not considering the other four manufacturers of light trucks (Volkswagen, BMW, Porsche, and Subaru). Porsche stated that the Reformed CAFE standards do not truly represent industry-wide considerations if they do not consider this remaining several percent of the light truck market, particularly where many of these manufacturers serve niche markets not served by the seven largest manufacturers.

With regard to Porsche's suggestion that the agency consider all manufacturers in setting the targets, we previously have addressed the degree to which we consider manufacturers with small shares of the light truck market. In our 1996 rulemaking setting light truck CAFE standard for MY 1998, NHTSA faced a substantially similar argument from Mercedes-Benz asserting that there is a need to set the CAFE standards at a level achievable by all light truck manufacturers (*i.e.*, even those manufacturers with a very small market share). In rejecting that suggestion, we cited the language from the Conference Report accompanying EPCA that directs us to consider industry-wide considerations and to not base the standards on the manufacturer with the greatest difficulties. Even under Reformed CAFE, this aspect of CAFE standard-setting has not changed since that time.

The target setting process in this rulemaking focuses on roughly 97 percent of the light truck market, a figure that reflects industry-wide considerations. Inclusion of all manufacturers, even those with a very small market share, has the potential to skew the resulting CAFE targets so as to decrease the overall stringency of the standards. Such an approach would depress the CAFE levels below the maximum feasible capability of the rest of the industry and reduce overall fuel savings. We recognize that under the Reformed CAFE system, the degree to which the standard would be depressed by including the remaining very small manufacturers likely would not be more than 0.1 mpg on any given target. However, this reduction would result in a reduction in fuel savings. Balancing the need of the Nation to conserve energy, we have concluded to rely on the largest seven manufacturers as discussed.

c. Improving the Light Truck Fleet

The first phase in determining the footprint targets was to determine separately for *each* of the seven largest manufacturers the overall level of CAFE that would maximize the net benefits for that manufacturer's vehicles.

To find the socially optimal point for each of these seven manufacturers (*i.e.*, the point at which the incremental or marginal change in costs equals the incremental or marginal change in benefits for that manufacturer), we used the Volpe model to compute the total costs and total benefits of exceeding the baseline [86] CAFE by progressively larger increments. We began by exceeding the baseline by 0.1 mpg. We then used the model to calculate the total costs and total benefits of exceeding the baseline by 0.2 mpg. The marginal costs and benefits were then computed as the difference between the total costs and total benefits resulting from exceeding the baseline by 0.1 mpg and the total costs and benefits resulting from exceeding the baseline by 0.2 mpg. We then used the Volpe model to calculate the total costs and total benefits of exceeding the baseline by 0.3 mpg and computed the difference between the total costs and benefits between 0.2 mpg and 0.3 mpg to determine the marginal costs and benefits.

We continued making similar iterations until marginal costs equaled marginal benefits for that manufacturer. Performing this iterative process individually for each manufacturer pushed each of the seven largest

[86] An important distinction needs to be made between the baseline and the manufacturer's product plan mpg. As discussed earlier, ''baseline'' is defined as the fuel economy that would exist absent of the rulemaking (*i.e.*, the model year 2007 standard of 22.2 mpg). The 22.2 mpg baseline differs from the mpg level reported in a manufacturer's product plan. Some manufacturers report fuel economy levels that are below 22.2 mpg. In that case, the cost and benefits of going from the product plan mpg to the baseline (22.2) mpg are not counted as costs and benefits of the rulemaking, as they were already counted in the MY 2005–2007 final rule. Only costs and benefits associated with going from baseline mpg to a higher standard are counted. It is important to note that since technology is applied on a cost effective basis, the most cost effective technologies will be used to get a manufacturer from the product plan mpg to the baseline mpg.

manufacturers to a point at which net benefits are maximized for each manufacturer's vehicles.

As a general concept, Toyota expressed support for the agency's use of cost-benefit analysis in establishing proposed CAFE standards, although it asserted that NHTSA may have underestimated costs and overestimated potential benefits in developing its proposal. Toyota also suggested that the agency had relied too heavily on its approach of using cost-benefit analysis to determine a maximum feasible standard, and in doing so had not considered other relevant factors. Thus, Toyota recommended that NHTSA carefully review the assumptions in its model in order to ensure that the economically efficient fuel economy targets it identifies nevertheless fall within the practical constraints and limitations of technology deployment. Finally, Toyota also urged caution in assessing any potential changes to the CAFE targets resulting from increased fuel prices.

As discussed previously, DaimlerChrysler argued that in order to ensure the economic practicability of CAFE standards, NHTSA's procedure of establishing standards that maximize net benefits must always be tempered by considering the industry's ability to afford the required technologies. DaimlerChrysler also argued that the agency's methodology for determining ''maximum feasible'' fuel economy levels overestimates the potential of technology to improve fuel economy, while underestimating its costs. The commenter suggested that setting standards based upon ''maximum feasible'' and ''maximum net benefits'' approaches will not necessarily yield identical results in all cases.

As discussed above, the marginal cost-benefit analysis is part of the agency's consideration of economic practicability. Our analysis also considered the financial condition of the industry in determining technology applications. The marginal cost-benefit analysis, taken in conjunction with these technology considerations, provided fuel economy requirements that were then subject to a sales and job impact analysis. The totality of this process, in conjunction with consideration of the nation's need to conserve energy, the impacts of other Federal standards, and societal impacts such as safety, provides us with a determination of ''maximum feasible.''

The Alliance cautioned that while it is probably permissible for NHTSA to use cost-benefit analysis in setting CAFE standards, the agency should not rely solely on this tool in determining their economic practicability. However, the Alliance provided no ''tool'' to determine economic practicability or an individual manufacturer's capability. The Alliance argued that the proposed CAFE standards pose significant technical challenges and may be beyond manufacturers' capabilities, and thus that NHTSA should not finalize standards any higher than those proposed in the NPRM, because higher targets would be unlikely to comply with the statutory criteria of technological feasibility and economic practicability.[87] The Alliance also noted that the fuel economy improvements required by the proposed standard would come at a time when vehicles are already significantly more fuel-efficient than in recent years, thereby making such fuel economy improvement much more difficult and costly to achieve. Finally, the Alliance also commented that use of cost-benefit analysis makes the agency's estimates of the costs, benefits, and applicability of certain technologies more important than in setting previous rules, and these assumptions should therefore be fully explained and documented.

Similarly, NADA commented that the success of NHTSA's CAFE reform hinges upon the application of appropriate information and assumptions. For example, NADA stated that because the cost-benefit analysis is so critical to the establishment of CAFE targets under the agency's proposal, there must be an accurate assessment of real costs and real benefits. NADA argued that applying cost-benefit analysis to determine the level of CAFE standards should be only one step in a rigorous examination of their economic practicability.

Honda requested confirmation that once CAFE standards are set using NHTSA's proposed benefit-cost approach, they will not be revised simply because updated information affecting the benefit or cost estimates becomes available (*e.g.*, new fuel prices estimates), unless overwhelming need can be demonstrated. According to Honda, such changes would be extremely disruptive to manufacturers' product planning. Thus, Honda argued that updated data should be considered only for setting CAFE requirements that would apply to model years beyond those covered by the current rule.

Environmental Defense raised specific objections to some of the assumptions relied upon in the agency's analysis, but stated that the Reformed CAFE standard-setting methodology itself is reasonable. Environmental Defense stated that the Reformed CAFE approach provides greater transparency than the Stage analysis relied upon in the Unreformed CAFE system.

In response to the manufacturers' reservations about equating ''maximum feasible'' fuel economy standards with those that produce maximum net benefits, the agency is aware of its continuing statutory responsibility to establish maximum feasible fuel economy standards at levels that simultaneously reflect consideration of technological feasibility, economic practicability, the effects of other Federal vehicle standards, and the need of the nation to conserve energy. The approach for determining the continuous function sets the fuel economy targets just below the level where the increased cost of technologies that could be adopted by manufacturers to improve fuel economy would first outweigh the added benefits that would result from such technology.

These targets translate into required levels of average fuel economy that are technologically feasible because manufacturers can achieve them using available technologies. Those levels also reflect the need of the nation to conserve energy because they reflect the economic value of the savings in resources, as well as of the reductions in economic and environmental externalities that result from producing and using less fuel. We note that our assumptions for each technology, its cost, and its effectiveness are in the FRIA (see FRIA Table VI–4). (However, the application to each manufacturer is confidential and therefore not included in the docketed FRIA.)

In answer to comments from various commenters that NHTSA's process for establishing fuel economy targets overstates the fuel economy improvements likely to result from specific technologies and underestimates manufacturers' costs for adopting those fuel economy technologies, the agency again notes that we have relied on the technology cost and effectiveness estimates from the NAS report. The estimates of fuel economy technology effectiveness and costs developed by NAS represent the most reliable estimates that are available. The alternative estimates of technology costs and effectiveness recommended by some commenters

[87] According to the Alliance, once finalized, the CAFE rule would mark seven consecutive years of light truck fuel economy increases. The Alliance argued that combined with previous increases for MY 2005–2007, the current proposal would match the highest seven-year rate of increase (2.2 percent per year, the average from 1982–1989) in the history of the light truck CAFE program, and it would be more than 1.5 times the historical trend of fuel efficiency improvements.

have not been subjected to the same level of expert review and public scrutiny as those developed by NAS, and are thus not suitable for use by NHTSA in establishing fuel economy standards.

In response to Honda's request for clarification regarding our position on updating the standards when new data become available, new data will be relied upon for consideration of standards beyond MY 2011. If the agency were to consider increasing the established standards for MY 2008-2011, we would need to be mindful of lead time constraints and the need for regulatory certainty (i.e., the need for manufacturers to be able to rely on today's final rule to adjust their product plans).

d. Defining the Function and the Preliminary Shape of the Curve

In the second phase, we plotted the results of phase one (i.e., the light truck fleets of the seven largest manufacturers, each separately ''socially optimized''). Then, we calculated a statistical relationship through the plotted data points (using production-weighted nonlinear least squares regression). This relationship defines a preliminary continuous function (a ''curve'') that, upon being adjusted, determines the fuel economy targets for light trucks based on vehicle footprint. Although adjusted, the shape of the curve remains unchanged throughout the equal-increment adjustments in phase three below, because the absolute differences (on a gallon-per-mile basis) between the targets are unaffected by those adjustments.

In its report, NAS illustrated a function that set fuel economy targets for vehicle based on weight. See Figure 2 below. Under the NAS function, fuel consumption increased in a linear manner as vehicle weight increased up to 4,000 lbs. At 4,000 lbs, the function leveled-off. The leveling of the function at 4,000 lbs represented a ''safety threshold,'' i.e., the NAS report determined that there was a safety benefit in minimizing the incentive to up-weight vehicles beyond 4,000 lbs. Under the NAS function, increasing a vehicles weight beyond 4,000 lbs did not subject a vehicle to a less stringent fuel consumption value.

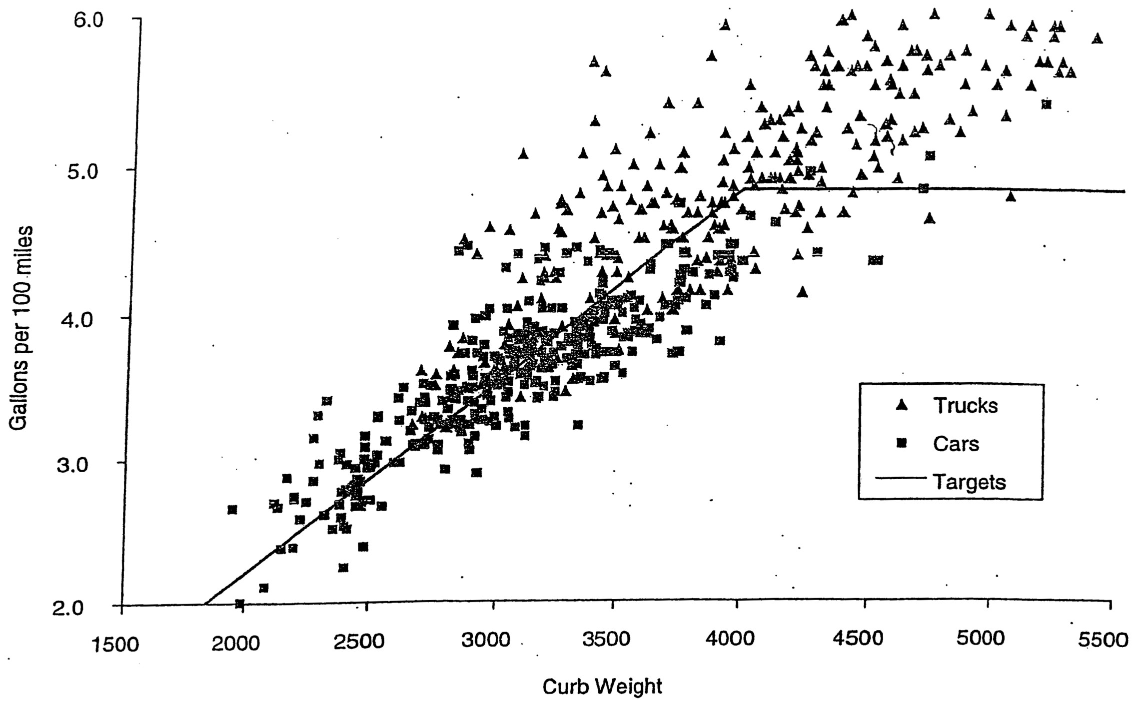

Figure 2: Illustration of the fuel economy function under the NAS alternative attribute system example (NAS report, p. 109).

The agency considered relying on a function as illustrated by NAS, but determined that the NAS function presented several problems. First, the flattening of the function would be expected to produce a milder form of the ''edge effects'' that are of concern under the step function. At the ''safety threshold'' there would be an abrupt change in the rate at which size increases are rewarded. This abrupt change could distort the production of vehicles located near the threshold and encourage manufacturers to potentially downsize some vehicles to the threshold point. Second, it is not clear whether and, if so, where, in terms of footprint, a true ''safety threshold'' occurs. Without a ''safety threshold'' the NAS function would be a simple linear function, which as discussed below introduces several potential problems. Finally, there is a possibility that a function based on the NAS illustration could extrapolate to unreasonably high levels for small vehicles.

As discussed below, the agency has decided to use a constrained logistic function to set the targets. We have determined that a constrained logistic function provides a good fit to the optimized light truck fleet data, while not resulting in potentially impracticable high targets for very small vehicles, or unreasonably low targets for very large vehicles.

The agency evaluated a variety of mathematical forms to estimate the relationship between vehicle footprint and fuel economy. The agency considered a simple linear function, a quadratic function, an exponential function, and an unconstrained logistic function. Each of these relationships was estimated in gallons per mile (gpm) rather than miles per gallon (mpg). As explained in the NPRM, the relationship between fuel economy measured in mpg and fuel savings is not linear. An increase in one mpg in a vehicle with low fuel economy (e.g., 20 mpg to 21 mpg) results in higher fuel savings than if the change occurs in a vehicle with high fuel economy (e.g., 30 mpg to 31 mpg). Increasing fuel economy by equal increments of gallons per mile provides equal fuel savings regardless of the fuel economy of a vehicle. Increasing the fuel economy of a vehicle from 0.06 gpm to 0.05 gpm saves exactly the same amount of fuel as increasing the fuel economy of a vehicle from 0.03 gpm to 0.02 gpm.[88]

Given that the agency is concerned with fuel savings, gpm is a more appropriate metric for evaluating the functions. Therefore, we plotted the ''socially optimized'' fleets in terms of footprint versus gpm. Once a shape of a function was determined in terms of ''gallons per mile,'' the agency then converted the function to mpg for the purpose of evaluating the potential target values. Figures 3A through 6B below illustrate each of the functions as sales weighted estimates of the relationship between fuel economy of the ''socially optimized'' fleets and foot print, which were considered by the agency.

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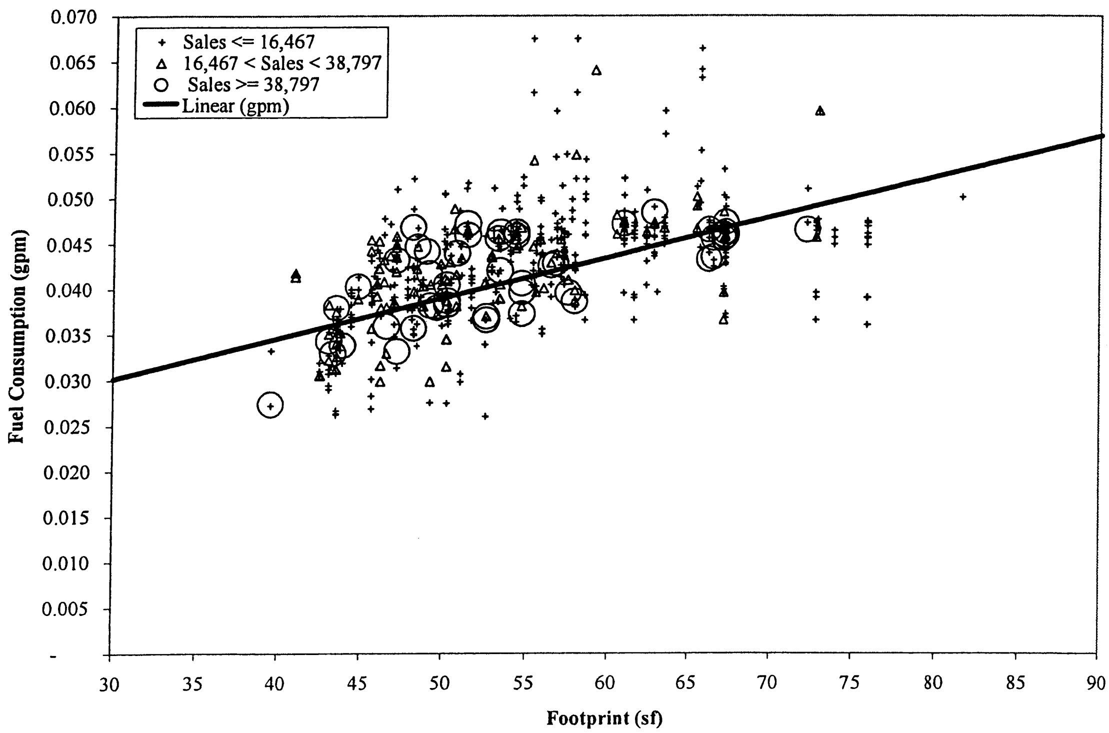

Figure 3A: Linear function fit through sales weighted "socially optimized" light truck fleet (gpm as a function of footprint)

[88] Lower fuel consumption represents a more stringent value (i.e., a low gpm value equates to a high mpg value)

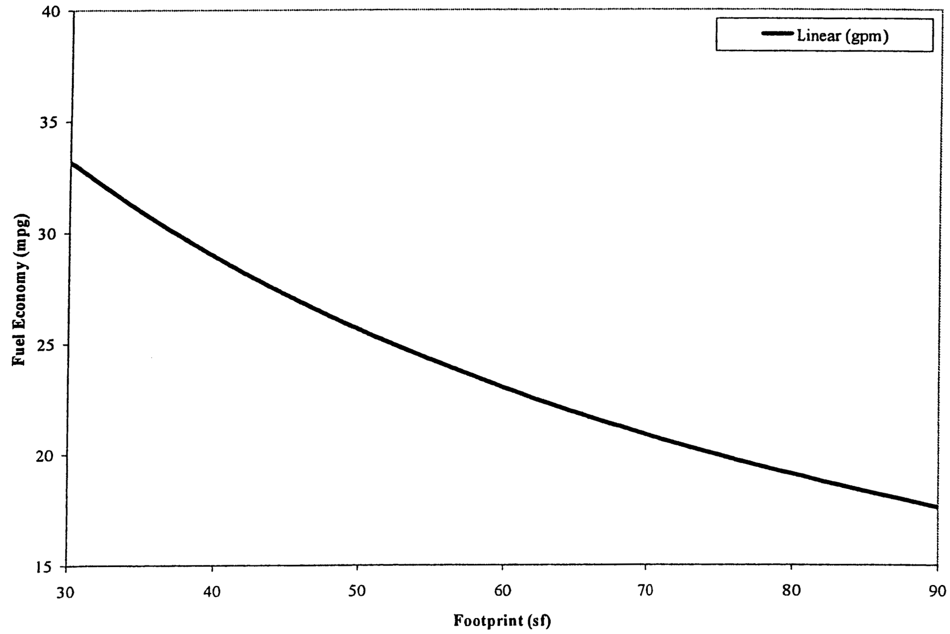

Figure 3B: Linear function fit through sales weighted "socially optimized" light truck fleet (mpg as a function of footprint)

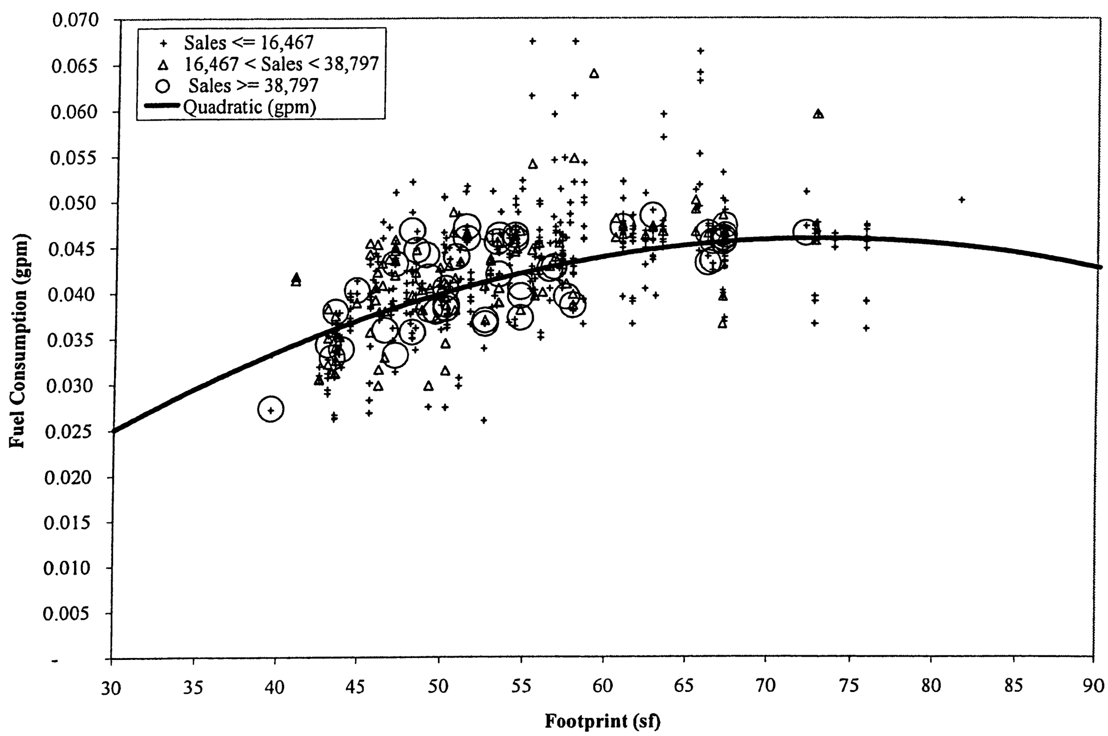

Figure 4A: Quadratic function fit through sales weighted "socially optimized" light truck fleet (gpm as a function of footprint)

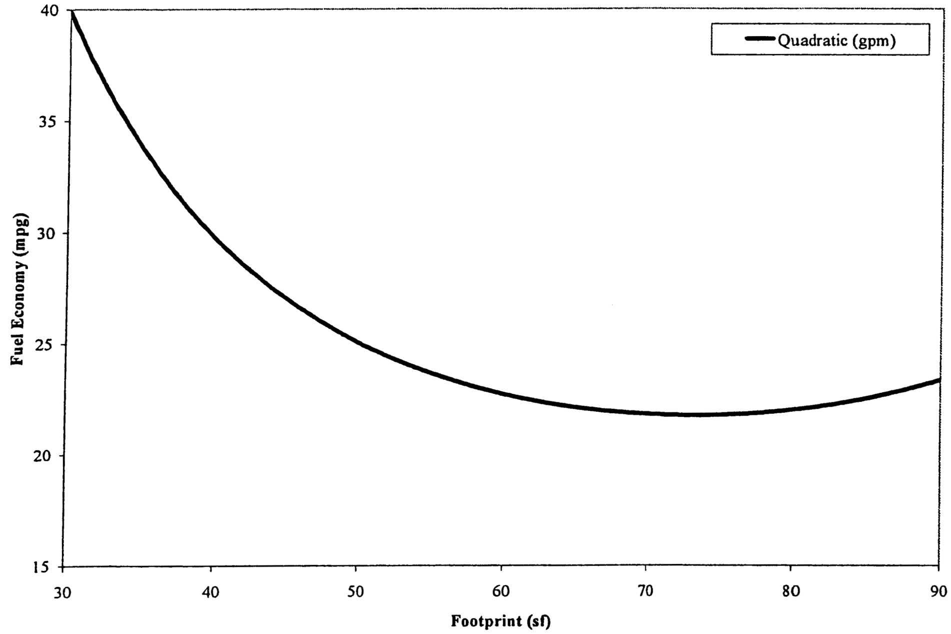

Figure 4B: Quadratic function fit through sales weighted "socially optimized" light truck fleet (mpg as a function of footprint)

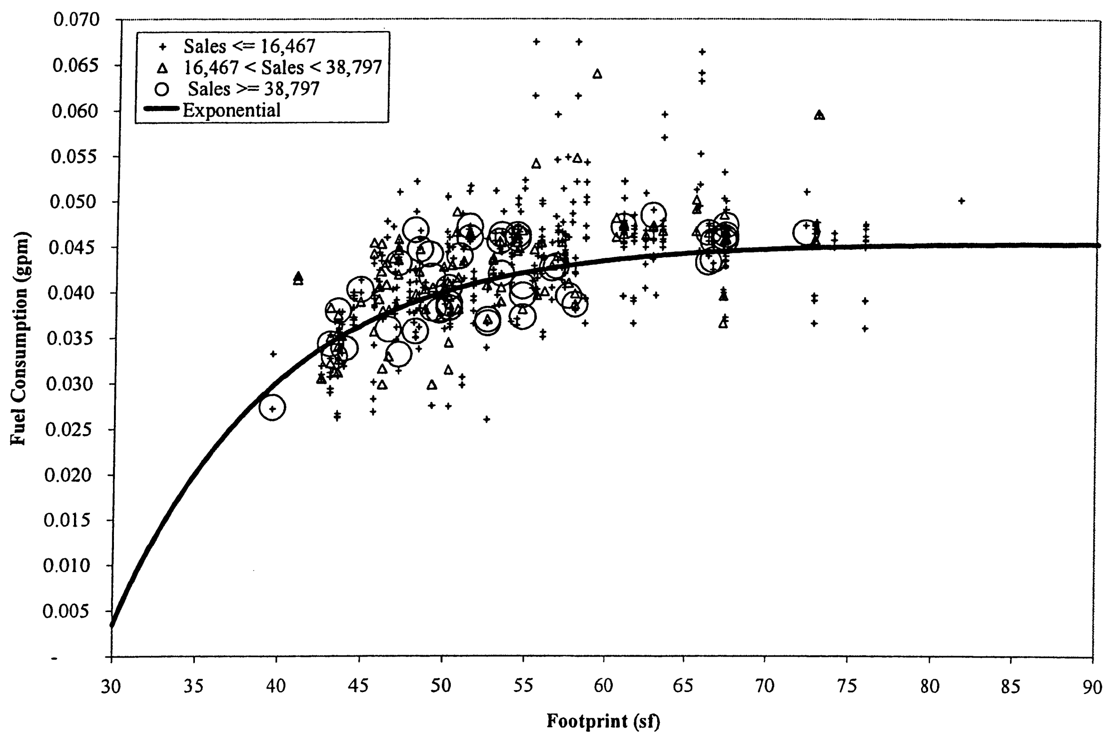

Figure 5A: Exponential function fit through sales weighted "socially optimized" light truck fleet (gpm as a function of footprint)

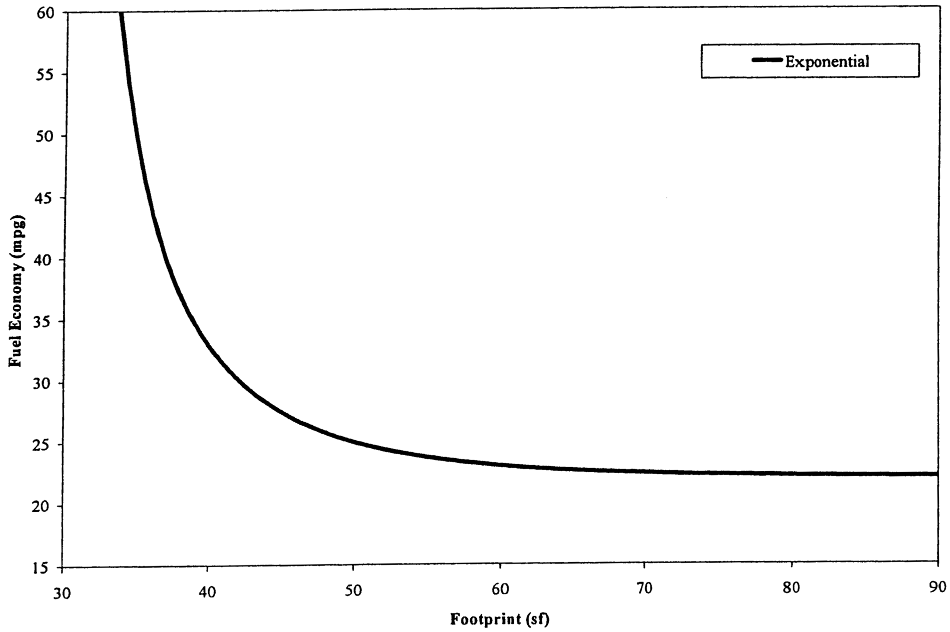

Figure 5B: Exponential function fit through sales weighted "socially optimized" light truck fleet (mpg as a function of footprint)

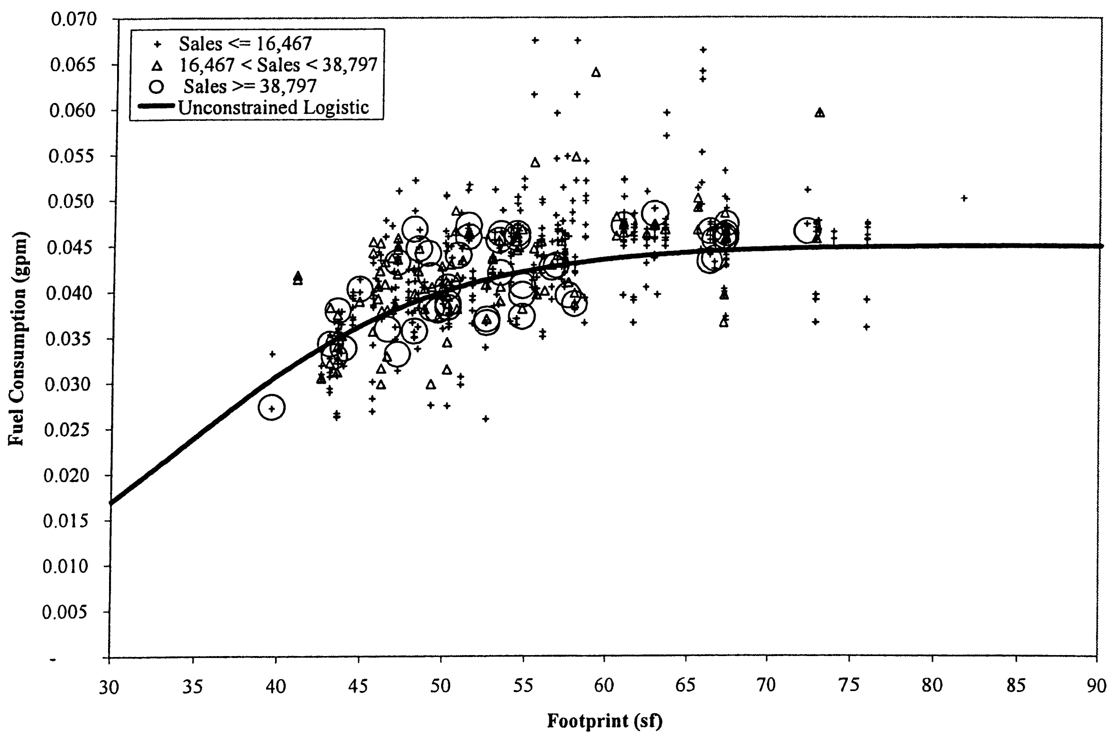

Figure 6A: Logistic function fit through sales weighted "socially optimized" light truck fleet (gpm as a function of footprint)

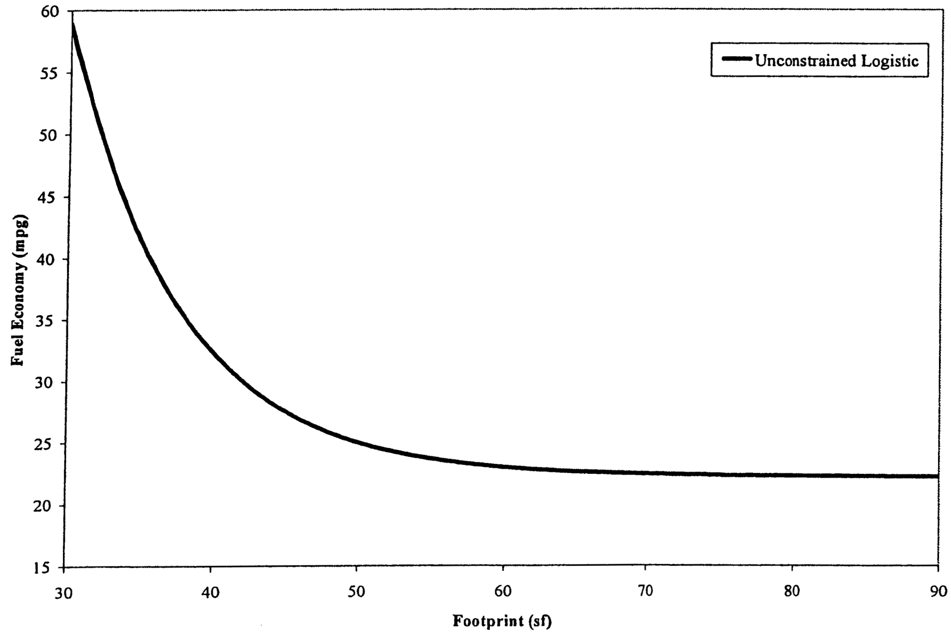

Figure 6B: Logistic function fit through sales weighted "socially optimized" light truck fleet (mpg as a function of footprint)

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After evaluating the functions above, we determined that none of the functions as presented would be appropriate for the CAFE program. Each of the four forms fit the data relatively well within the footprint range observed in the manufacturers' product plans (from about 40 square feet to about 85 square feet). However, at slightly beyond the endpoints of the observed range, the functional forms tended towards excessively high stringency levels at the smaller end of the footprint range, excessively low stringency levels at the higher end of the footprint end, or both. Excessively high stringency levels at the smaller end of the footprint range potentially could result in target values beyond the technological capabilities of manufacturers. Excessively low stringency levels at the higher end of the footprint range standards would reduce fuel savings below that of the socially optimized fleet.

As Figure 3A shows, a simple linear functional form provides a reasonably good fit for small vehicles, but results in very low stringency for vehicles above 80 square feet would correspond to fuel consumption values for very large vehicles greater than the fuel consumption for those vehicles under the optimized fleet. Reliance on a linear function would result in targets for large light trucks that are well below the optimized fuel economy, in terms of mpg, for those vehicles. These low target values would reduce fuel savings and provide a fuel economy incentive for upsizing. Additionally, depending on the distribution of the fleet, a simple linear relationship could also produce targets for very small vehicles well above the corresponding data points.

Polynomial relationships between footprint and fuel economy, such as a quadratic function, result in fuel consumption values that deviate substantially from the data points at either end of the footprint range. Further, because of their inherent curvature, polynomial functions often result in less stringent mpg targets for the smallest models than for slightly larger vehicles, or mpg targets for the largest models that are more stringent than those for slightly smaller models. As illustrated in Figure 4B, the convex curvature of the function results in increases in stringency for vehicles with a footprint larger than about 70 square feet. This increase is contrary to the data points of the socially optimized fleet.

Under an exponential relationship, the fuel economy targets tend towards very high levels of stringency as footprint declines below 40 square feet (see Figure 5B). Under the exponential function for footprint values smaller than the smallest vehicle in the planned fleet are more a characteristic of the function, as opposed to representing the technological capabilities of such vehicles. A similar increase in targets occurs under a logistic function, although not to the extent as with an exponential function (see Figure 6B).

Under either an unconstrained exponential or an unconstrained logistic function, if a manufacturer were to introduce a vehicle with a footprint smaller than that considered in the optimized fleet, that vehicle would be compared to a fuel economy target potentially beyond the level that would be achieved had the agency "optimized" that vehicle. Such a target likely would be difficult to achieve using available technology. If a market demand were to develop for light trucks smaller than the smallest light truck currently planned by manufacturers, targets based on an exponential relationship or a logistic relationship could be technologically infeasible and limit consumer choice.

To address this issue the agency determined that it is necessary to constrain the chosen function at the end points of the footprint range. However, imposing a constraint on an exponential function prevents the curve from closely fitting the actual relationship between vehicle footprint and fuel economy across much of the size spectrum. In addition, exponential functions constrained to reach a maximum mpg value tended to have inconsistent shapes when fitted to light truck data for different model years.[89] Therefore, the agency decided to use a constrained logistic function to fit the target curve to the data points. The constrained logistic function is illustrated below in gallons per mile and inverted in miles per gallon:

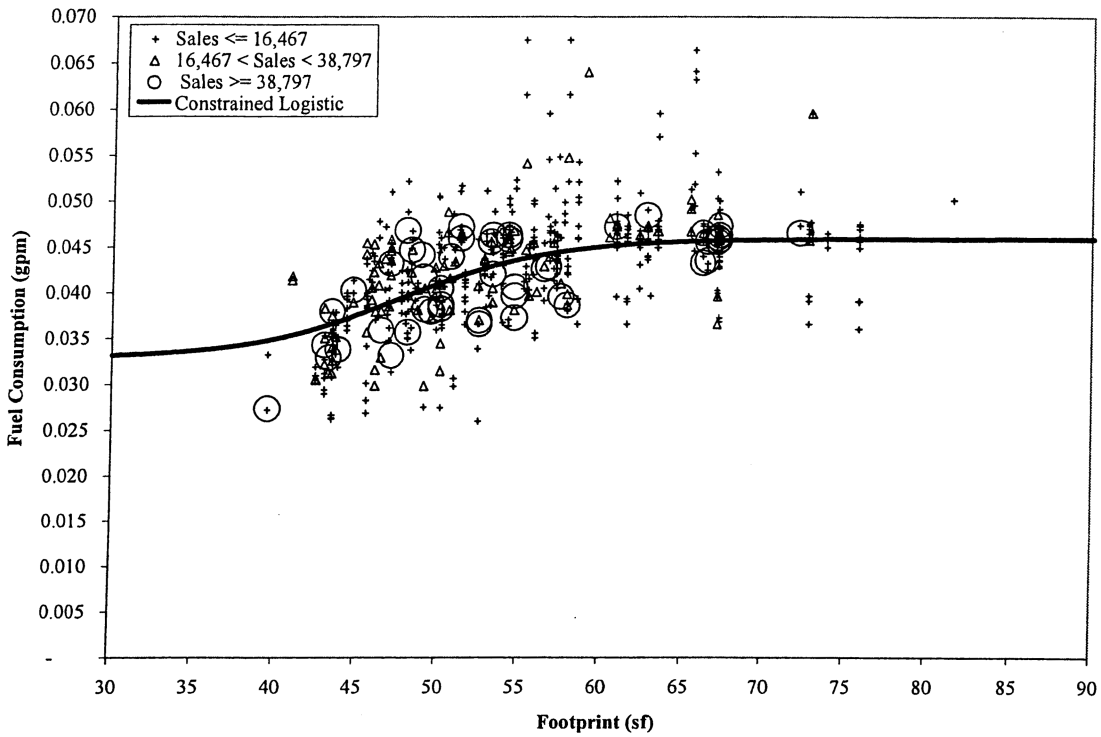

Figure 7: Constrained logistic function fit through sales weighted "socially optimized" light truck fleet (gpm as a function of footprint)

[89] That is, the targets they established for models for some footprint values declined rather than increased between successive model years.

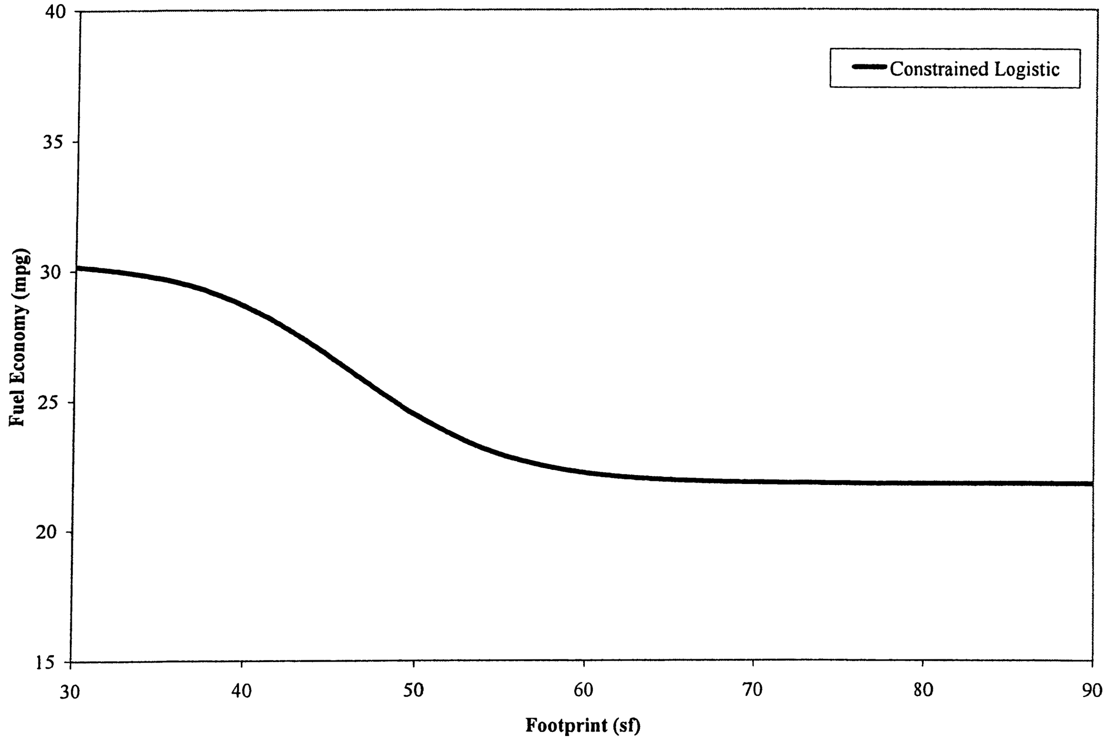

Figure 8: Constrained logistic function

The constrained logistic function provides a relatively good fit to the data points without creating excessively high targets for small vehicles, excessively low targets for large vehicles, or regions in which targets for large vehicles exceed those for small vehicles. The constrained logistic function also produces a curve that provides an acceptable fit to the light truck data across all four model years.

Further, by constraining the function at the ends of the footprint range, we limit the potential for the curve to be disproportionately influenced by a single vehicle model located at either end of the range. The vehicle population decreases as the curve moves away from the middle of the footprint range. The low vehicle population levels provide for a single vehicle model located at either end of the range to have a greater influence on its target, than a vehicle with comparable production numbers located in the middle of the range. This greater influence translates to greater influence on the shape of the curve. As demonstrated in the unconstrained logistic function, at a footprint value of 40 square feet a single model produced in larger numbers than other vehicles at or near this footprint value causes associated fuel consumption values to sharply decrease. This translates to rapidly increasing targets as footprint decreases below 40 square feet. Constraining the function also minimizes the potential for a disproportionate influence from a single vehicle model on the curve, the agency has constrained the target values at the ends of the range.

Constraining the upper and lower bounds in this manner has the additional benefit of generating a curve that closely tracks the shape of the proposed step-function. We have constrained this function so that the smallest/largest vehicles face similar stringency that was found in the smallest/largest categories in the step function.

The constrained logistic function selected by the agency is defined by four parameters. Two parameters establish the function's upper and lower bounds (i.e., asymptotes), respectively. A third parameter specifies the footprint at which the function is halfway between the upper and lower bounds. The last parameter establishes the rate or "steepness" of the function's transition between the upper (at low footprint) and lower (at high footprint) boundaries.

The agency determined the values of the parameters establishing the function's upper and lower bounds by calculating the sales-weighted harmonic average values of optimized fuel economy levels for light trucks with footprints below 43 square feet and above 65 square feet, respectively. Because these ranges respectively include the smallest and largest models represented in the current light truck fleet, the agency determined that these two segments of the light truck fleet are appropriate for establishing the upper and lower fuel economy bounds of a continuous function.

The remaining two parameters (i.e., the "midpoint" and "curvature" parameters) were estimated using production-weighted nonlinear least-squares regression to achieve the closest fit to data on footprint and optimized fuel economy for all light truck models expected to be produced during each of model years 2008–2011.[90] Described mathematically, the logistic function is as follows:

[90] More precisely, these two parameters determine the range between the vehicle footprints where the upper and lower limits of fuel economy are reached, and the value of footprint for which the value of fuel economy is midway between its upper and lower bounds.

$$T = \frac{1}{\frac{1}{a} + \left(\frac{1}{b} - \frac{1}{a}\right)\frac{e^{(x-c)/d}}{1+e^{(x-c)/d}}}$$

Where,

T = the fuel economy target (in mpg)
a = the maximum fuel economy target (in mpg)
b = the minimum fuel economy target (in mpg)
c = the footprint value (in square feet) at which the fuel economy target is midway between a and b
d = the parameter (in square feet) defining the rate at which the value of targets decline from the largest to smallest values
e = 2.718 [91]
x = footprint (in square feet, rounded to the nearest tenth) of the vehicle model

The resulting curve is an elongated ''S''-shape, with fuel economy targets decreasing as footprint increases.

e. Final Level of the Curve (and Targets)

The final step in the target setting process is to adjust the level of the preliminary curve defined in step two to a level ''optimized'' for the entire fleet produced by the seven largest manufacturers. The preliminary curve is gradually adjusted, by changing the values of parameters (a) and (b) by equal increments of fuel savings [92] until the incremental change in total costs incurred by all manufacturers for complying with their respective CAFE requirements (the sales-weighted harmonic averages of the mpg targets for their individual models specified by the function) from a further adjustment equals (within precision limits of the analysis) the incremental change in the benefits. Each light truck model's final fuel economy target can be determined by entering its footprint (in square feet) into the function with these revised parameter values appropriate for its model year, and calculating the resulting value of fuel economy in miles per gallon.

Once targets are calculated for each vehicle in a manufacturer's fleet under the continuous function, the corporate average fuel economy level required of the manufacturer is calculated using a harmonic average, as under the proposed step function. A manufacturer's actual fuel economy is calculated according to the procedure used in the current CAFE system, and compared to its required CAFE level in order to assess whether it has complied with the standard. Penalties and credits are also determined and applied as under the current and proposed CAFE systems.

MYs 2008–2010. In each of the transition years, we did not adjust the curve to the optimal level. Instead, we adjusted the curve until the total industry costs under the Reformed CAFE program approximately equaled the total industry costs under the Unreformed CAFE program. Cost equalization has several important advantages, as explained above in the discussion of the transition period. Since the Unreformed CAFE standards were judged to be economically practicable and since the Reformed CAFE standards spread the cost burden across the industry to a greater extent, equalizing the costs between the two systems ensures that the Reformed CAFE standards are within the realm of economic practicability.[93] Also, cost equalization promotes an orderly and effective transition to the Reformed CAFE system by minimizing the cost differences between the two choices.

MY 2011. The Reformed CAFE standard for MY 2011 is set at the social optimal level as described above, and is not constrained by the costs of an Unreformed standard. As previously stated, all manufacturers are required to comply with the Reformed CAFE standard in MY 2011.

The parameter values for MYs 2008–2011 are as follows:

TABLE 4.—PARAMETER VALUES FOR LOGISTIC FUNCTION

Parameter	Model year			
	2008	2009	2010	2011
a	28.56	30.07	29.96	30.42
b	19.99	20.87	21.20	21.79
c	49.30	48.00	48.49	47.74
d	5.58	5.81	5.50	4.65

3. Application of the Continuous Function Based Standard

The Reformed CAFE standard establishes a relationship between vehicle footprint and the fuel economy target for light trucks with different footprint values. In effect, today's final rule establishes a category system like that proposed in the NPRM, in which each footprint value is its own category, and has an associated fuel economy target.

The required level of CAFE for each manufacturer during a model year is the production-weighted harmonic average of the fuel economy targets for each model in its product line for that model year. While individual manufacturers may face different requirements for their overall CAFE levels depending on the distribution of footprint values for the models making up their respective product lines, each manufacturer is subject to identical fuel economy target for light truck models with the same footprint value. Moreover, the same

[91] For the purpose of the Reformed CAFE standard, we are carrying e out to only three decimal places.

[92] Equal increments of mpg have differing energy values. A 0.1 mpg increment added to a vehicle with a higher mpg performance will have a lower fuel savings value than an equal mpg increment added to a vehicle with a lower mpg performance. As such, we adjust the curve by equal increments of fuel savings as opposed to mpg.

[93] We equalized aggregate industry costs between Reformed and Unreformed CAFE. The costs are not borne by manufacturers in the same way and costs for individual manufacturers may differ between the two systems.

formula is used to determine each manufacturer's required level of CAFE using the fuel economy targets for different footprint values, footprint values for its individual models, and the production levels of each of its models. Individual manufacturers face different required CAFE levels only to the extent that they produce different size mixes of vehicle models.

To determine whether it has achieved its required overall CAFE level, each manufacturer's production-weighted harmonic average of the actual fuel economy levels for each model in its entire product line is compared to this required CAFE level. If the weighted average of its models' actual fuel economy levels is at least equal to the manufacturer's required level of average fuel economy, then it has complied with the Reformed CAFE standard. If its actual fleet-wide average fuel economy level is greater than its required CAFE level, the manufacturer earns credits equal to that difference that can be used in any of the three preceding or following model years.

More specifically, the manner in which a manufacturer's required overall CAFE for a model year under the Reformed system is computed is similar to the way in which its actual CAFE for a model year has always been calculated. Its required CAFE level is computed on the basis of the production and the footprint target as follows:

$$\frac{\text{Manufacturer X's Total Production of Light Trucks}}{\dfrac{\text{X's production at footprint m}}{\text{Target for footprint m}} + \dfrac{\text{X's production at footprint n}}{\text{Target for footprint n}} + \text{etc}} = \text{X's required level of CAFE}$$

This formula can be restated as follows:

$$Required\_Fuel\_Economy\_Level = \frac{N}{\sum_i \frac{N_i}{T_i}}$$

Where:

N is the total number (sum) of light trucks produced by a manufacturer,

N_i is the number (sum) of the i^{th} model light truck produced by the manufacturer, and

T_i is fuel economy target of the i^{th} model light truck.

The required level is then compared to the CAFE that the manufacturer actually achieves in the model year in question:

$$CAFE = \frac{N}{\sum_i \frac{N_i}{mpg_i}}$$

Where,

N is the total number (sum) of light trucks produced by the manufacturer,

N_i is the number (sum) of the i^{th} model light trucks produced by the manufacturer,

mpg_j is the fuel economy of the i^{th} model light truck.

A manufacturer is in compliance if the actual CAFE meets or exceeds the required CAFE.

The method of assessing compliance under Reformed CAFE can be further explained using an illustrative example of a manufacturer that produces four models in two footprint categories with fuel economy targets assumed for the purposes of the example shown in Table 3:

TABLE 5.—ILLUSTRATIVE EXAMPLE OF METHOD OF ASSESSING COMPLIANCE UNDER A CONTINUOUS FUNCTION APPROACH

Model	Fuel economy (mpg)	Production (units)	Footprint (sq. ft.)	Footprint (mpg)
A	27.0	100,000	43.00	27.5
B	24.0	100,000	42.00	27.8
C	22.0	100,000	52.00	23.7
D	19.0	100,000	54.00	23.2

Under Reformed CAFE, the manufacturer would be required to achieve an average fuel economy level of:

$$\text{Required CAFE Level} = \frac{400{,}000}{\frac{100{,}000}{27.5mpg}+\frac{100{,}000}{27.8mpg}+\frac{100{,}000}{23.7mpg}+\frac{100{,}000}{23.2mpg}} = 25.4 \text{ mpg}$$

This fuel economy figure would be compared with the manufacturer's actual CAFE for its entire fleet (*i.e.*, the production-weighted harmonic mean fuel economy level for four models in its fleet):

$$\text{Actual CAFE} = \frac{400{,}000}{\frac{100{,}000}{27.0mpg}+\frac{100{,}000}{24.0mpg}+\frac{100{,}000}{22.0mpg}+\frac{100{,}000}{19.0mpg}} = 22.6 \text{ mpg}$$

In the illustrative example, the manufacturer's actual CAFE (22.6 mpg) is less than the required level (25.4 mpg), indicating that the manufacturer is not in compliance.

4. Why This Approach To Reform and Not Another?

a. Continuous Function vs. the Proposed Step-Function (Categories)

The NPRM proposed a Reformed CAFE system that would establish a system of six size categories based on vehicle footprint, and specify a target fuel economy level for the vehicles in each category. The categories and their respective targets were incorporated into a step function (see Figure 1, above). The CAFE level required of each manufacturer then would be determined by computing the sales-weighted harmonic average of the fuel economy targets for each light truck category in which it produces light trucks.

The NPRM also discussed and sought comment upon the alternative of incorporating the fuel economy targets into a continuous function based on vehicle footprint, which could have some important advantages over a stepwise function. However, we did not propose a specific mathematical form for a continuous function.

As explained above, the agency has elected to adopt a Reformed CAFE system that employs a continuous function to set fuel economy targets. Use of a continuous function addresses three major concerns raised by commenters with regard to the proposed Reformed CAFE structure. Reliance on a continuous function (1) eliminates potential problems associated with the need to redefine category boundaries in future rulemakings; (2) substantially reduces the incentive for manufacturers to "upsize" vehicles; and (3) substantially reduces the incentive for manufacturers to respond to the CAFE requirements through downsizing, a compliance option that can reduce a vehicle's safety. The following explains these three benefits in detail.

First, reliance on a continuous function eliminates the footprint based categories. By eliminating categories, we eliminate the need to redefine categories as the light truck distribution changes.

In the NPRM, we prescribed a method for determining category boundaries. The method was intended to reduce the potential for "edge effects." We noted that when the distribution of light trucks was graphed such that footprint increased from left to right, vehicles just to the left of a boundary faced the greatest incentive for upsizing. These vehicles could be moved into a less stringent category with relatively minor increases in size.

In order to minimize this potential, we defined the proposed boundaries generally at points on the graph where there was relatively low vehicle volume immediately to the left and high vehicle volume immediately to the right. Identification of points between low and high volume was based on the distribution of vehicles from the product plans provided to the agency in response to the 2003 ANPRM. Based on this distribution, the agency was able to readily identify appropriate boundary locations, as illustrated in Figure 9 below.

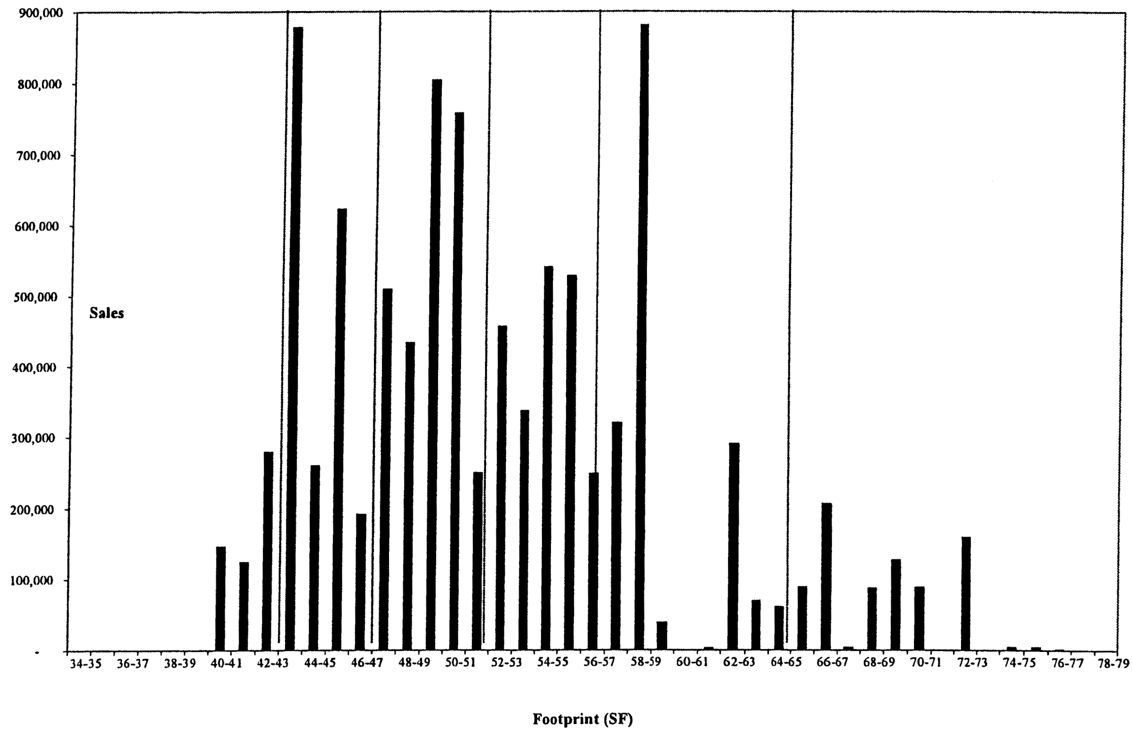

Figure 9: MY 2011 Sales distribution of light truck fleet by footprint used in the NPRM

A variety of commenters also recognized the potential for "edge effects." The Alliance asserted that the agency's selection of boundaries under the step function effectively addressed this potential problem, noting that it "agrees with the agency's assessment that both the number and the location of the boundaries for the footprint categories would likely minimize any such edge effects."

As previously indicated, manufacturers provided updated product plans in response to the NPRM and RFC. The new product plans reflected a new distribution of vehicles. When the proposed boundaries were applied to the updated manufacturer plans, the boundaries did not align with low and high volume points, as in the NPRM.

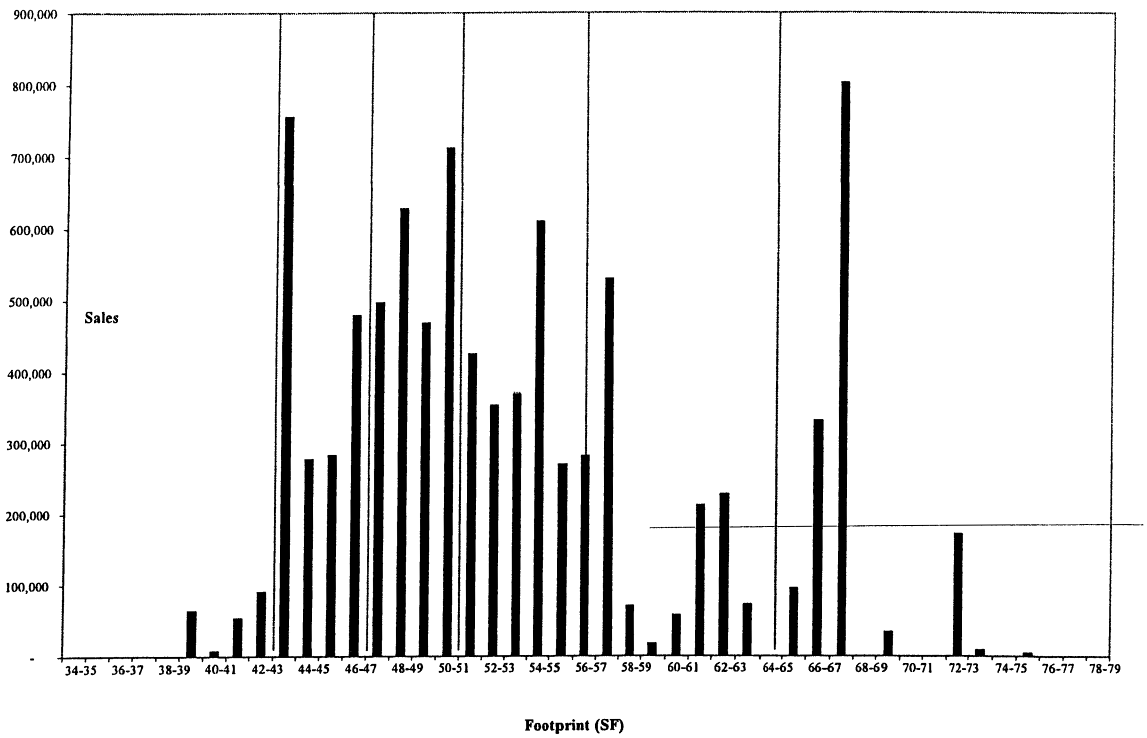

Figure 10: Proposed category boundaries and updated MY 2011 light truck fleet distribution

As illustrated in Figure 10 above, the distribution of the updated light truck fleet does not provide clear points of low volume adjacent to high volume as was the case with the older fleet that was the basis for the NPRM. Because the updated fleet has a more uniform distribution of vehicles across the footprint range, there are multiple potential boundary assignments that would segment the light truck fleet into six categories, and there is less opportunity to find boundaries that would minimize ''edge effects'' to the same extent as in the NPRM. Figures 11 and 12 illustrate potential ways by which the agency might have attempted to redefine the boundaries.

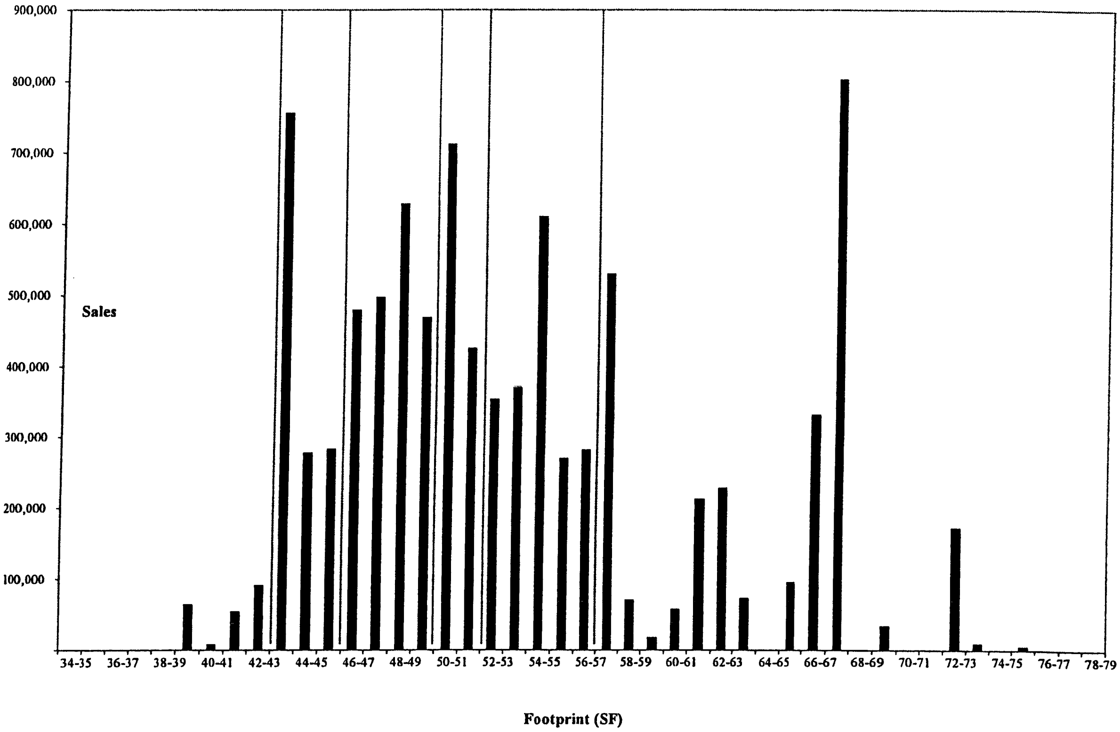

Figure 11: Potential boundary locations

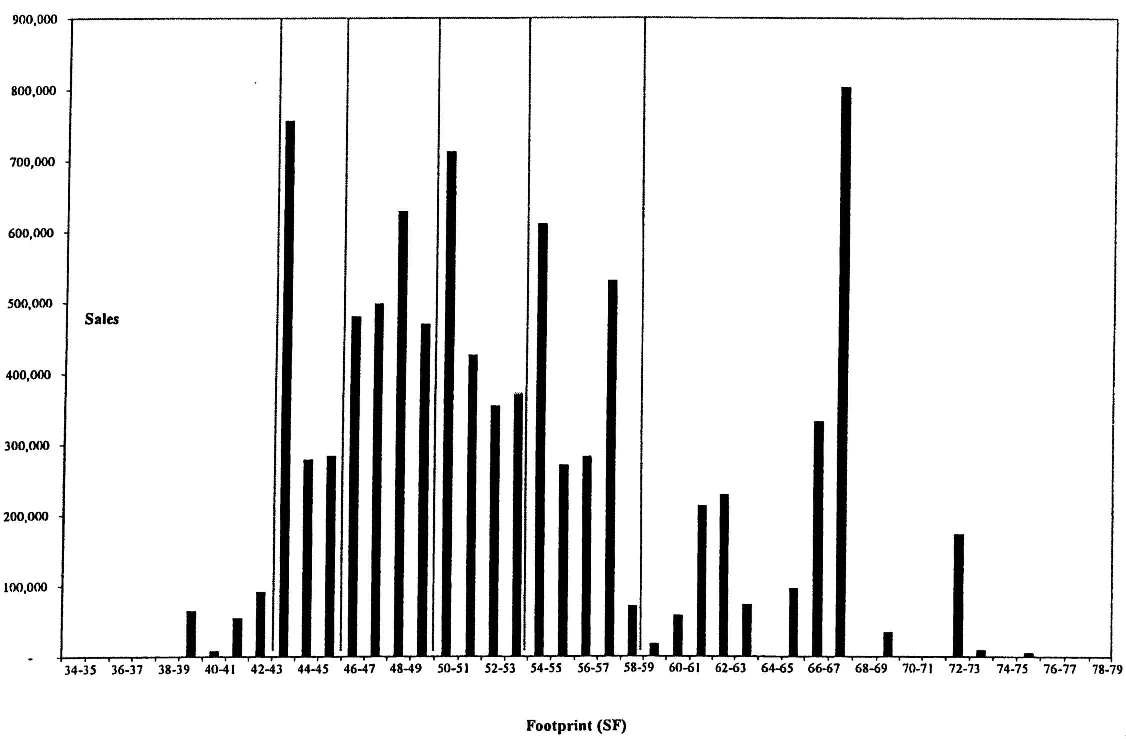

Figure 12: Potential boundary locations

However, it was clear that because of the distribution of the light truck fleet in the revised product plans, there was not the opportunity to provide category divisions that similarly minimize ''edge effects'' to the same degree as in the NPRM. Moreover, Toyota was concerned that changes to boundaries could significantly alter a manufacturer's compliance responsibility, and urged the agency to rely on the proposed boundaries for the final rule.

As recognized by Toyota, the required fuel economy level of individual manufacturers is highly influenced by boundary location. Table 6 below illustrates the required fuel economy for a sampling of manufacturers if boundaries were set according to the figures above.

TABLE 6.—REQUIRED FUEL ECONOMY LEVELS UNDER VARIOUS BOUNDARY LOCATIONS

Manufacturer	Required fuel economy (mpg)—boundaries set according to figure 11	Required fuel economy (mpg)—boundaries set according to figure 12
General Motors	23.3	23.2
Toyota	23.8	23.8
Nissan	24.2	23.7

The potential need to redefine category boundaries from one model year to the next and one rulemaking to the next would create uncertainty for manufacturers. Manufacturers would face not only the potential of a vehicle facing a higher target resulting from shifts in the function, but would also face the potential of a vehicle being compared to a much more stringent target as the result of a boundary shift. By utilizing a continuous function, the agency eliminates boundaries and thus the potential difficulties associated with defining and redefining category boundaries.

Second, reliance on a continuous function substantially reduces the incentive for manufacturers to respond to Reformed CAFE by ''upsizing'' vehicles. IIHS said that although the boundaries in the proposed categorical system were carefully chosen to minimize the number of models that were just below them, the differences between fuel economy targets for some adjacent categories were nevertheless large enough to make upsizing an important potential concern. For vehicles just below boundaries, small increases in footprint could produce a significant reduction in fuel economy target. As an example, IIHS stated that based on the proposed categories, General Motors could reduce the fuel economy target applicable to the 2005 Chevrolet Trailblazer EXT by 1.5 mpg by increasing that model's track width by 1.5 inches. The Mercatus Center echoed this concern, citing calculations showing that 14 of 55 light truck models could be moved to the next larger footprint category with an increase in footprint of less than 2 percent.

Conversely, under a continuous function, significant reductions in fuel economy targets cannot be achieved through small increases in footprint. Fuel economy targets decrease gradually as vehicle size increases, as compared to the punctuated changes under a step-function. Again, using the Chevrolet Trailblazer as an example, IIHS noted that in order to gain a 1.5 mpg difference in its fuel economy target, ''the Trailblazer's footprint would have to change by about the entire range of one of the proposed footprint categories.'' Natural Resources Canada stated that although any erosion of fuel savings resulting from upsizing is unlikely to be significant under a stepwise function, ''it is our opinion that setting fuel economy targets using a continuous function, based on footprint, would eliminate any concern in this regard.''

In contrast to IIHS's assertions, Toyota argued that because a continuous function relaxes a vehicle's fuel economy target for any increase in size, a continuous function provides a greater incentive for vehicle ''upsizing.'' Toyota stated that under a continuous function, manufacturers have a small incentive to increase the size of every vehicle model they produce, instead of a stronger incentive to upsize only a few models.

The agency disagrees with Toyota. While the agency acknowledges Toyota's argument that a continuous function reduces a model's fuel economy target in response to any increase in its size, this feature need not provide an incentive for manufacturers to upsize their vehicles if the form of the function reflects the underlying engineering relationship between size and fuel economy.

Under the continuous function, as a vehicle's footprint increases, its applicable target decreases. However, the rate at which target levels decrease is gradual. Further, an increase in a vehicle's footprint is not without cost. Generally, as vehicle size increases, its fuel economy performance decreases. The decrease in fuel economy performance can result from additional weight added to achieve increased size or result from design implications of upsizing the vehicle (*e.g.*, an increase drag resistance from increased frontal area). As such, increasing footprint can decrease a vehicle's fuel economy, further reducing the incentive to upsize.

Under the step function approach, some vehicles were located near the upper boundaries of the categories despite agency efforts to minimize the number. Under the step function approach, a small change to the footprint of these vehicles would result in a substantial decrease in their targets, as much as 1.2 mpg. The continuous function approach does not provide an opportunity for substantial decreases in a vehicle's target based on slight increases to footprint.

This point can be illustrated by comparing the proposed boundaries and the adopted continuous function. When the agency plotted the revised product plans against the proposed boundaries, we found that there were approximately 1.25 million vehicles that could move to a less stringent category with changes in footprint of less than one square foot. These minor changes would reduce applicable target values by 1.0–3.3 mpg. Under a continuous function, footprint increases of similar magnitude would reduce applicable targets by no more than 0.2 mpg.

Third, reliance on a continuous function substantially reduces an incentive present in the proposed step-function standard for manufacturers to ''downsize'' vehicles. IIHS raised concern that under the proposed step function system, manufacturers might reduce the sizes of models within the limits of the footprint range for a category to make it easier to comply with their required fuel economy levels. The IIHS commented that there ''is room within NHTSA's proposed system of footprint categories to retain the same fuel economy target but reduce size * * *'' and that ''the safety of the resulting vehicle would be compromised.'' General Motors also acknowledged this possibility, stating that the category structure of the Reformed CAFE system:

[S]till may incentivize manufacturers to use reductions in track width and/or wheelbase (to create a smaller and/or lighter vehicle) to meet CAFE targets within a category or overall. While changes in vehicle dimensions may not be the first choice for manufacturers, they remain an option-one that can adversely affect safety.

In contrast, IIHS stated that any downsizing under a continuous function would subject a vehicle to a more stringent target. As such, IIHS stated that a continuous function would better minimize the potential for manufacturers to respond to the CAFE program through unsafe downsizing.

With respect to minimizing the incentive to downsize, the agency agrees with IIHS. We concur with IIHS's concern over the potential to downsize within a step function category, particularly within the smallest size categories, where reducing vehicles' size or weight likely would have the largest impact on occupant safety.

Commenters raised a variety of other procedural and administrative concerns that the agency should take into account in choosing between stepwise and continuous functions. General Motors and Nissan expressed concern that setting fuel economy targets using a continuous function could present an even greater challenge to public understanding of the Reformed CAFE program than relying on a category system to set vehicles' fuel economy targets. Neither commenter explained why they believed a stepwise function would be more readily understood. Honda commented that it would be easier for manufacturers of high fuel economy vehicles to demonstrate the ''superiority of their products'' to potential buyers under a stepwise function than under a continuous function.

We do not believe that a standard based on a continuous function is harder to understand than one based on a step function. The main difference is that instead of identifying an appropriate category to determine a vehicle's target, a target under a continuous function standard is located along a curve. Calculating a manufacturer's required fuel economy is done in a similar manner under both systems and calculating a manufacturer's compliance is performed in exactly the same manner.

While manufacturers may not be able to advertise ''best in CAFE category'' under a continuous function, the Reformed CAFE does not prevent such comparisons from being made under non-CAFE classifications. Manufacturers currently promote ''best in class'' claims based on industry and marketing classifications. For example, Honda advertises that its Ridgeline is the ''only 4-door pickup to achieve the highest government crash test rating (5 stars) for both frontal and side-impact tests.''[94] Under the current CAFE program, light trucks are all within a single fleet, yet manufacturers still advertise ''best in class.'' Presumably, such claims could continue to be made under Reformed CAFE.

Nissan asserted that compliance calculations would be ''unduly cumbersome'' under a continuous function. Nissan also stated that the agency's administration and enforcement process would be more burdensome under a continuous function than under a stepwise function because NHTSA would need to review complex compliance calculations submitted by each manufacturer.

In the NPRM, we proposed requiring manufacturers to submit a vehicle's footprint along with the CAFE data currently collected. Manufacturers and the agency would rely on this data to determine required fuel economy levels and compliance. An additional calculation would be required to determine a vehicle's target, as opposed to determining the appropriate category and corresponding target. However, we do not believe that the additional calculation—one easily performed using a programmable hand calculator or spreadsheet program—will be overly cumbersome.

Ford indicated that the use of a harmonic average to calculate a manufacturer's compliance obligation, combined with the use of categories, would provide manufacturers the greater flexibility to make improvements in an appropriate manner as opposed to use of a harmonic average with a continuous function.

The standard adopted in this document retains the flexibility provided by use of a harmonic average to determine a manufacturer's compliance requirement and a manufacturer's actual fuel economy level. Additional flexibility is provided by the fact that fuel economy targets are more specific to a vehicle. As opposed to being compared to a target representative of the capabilities of vehicles within a range of footprint values, the final rule compares a vehicle to the potential fuel economy achievable by vehicles of equal size. A manufacturer still has the ability to compensate for a vehicle that performs below its set fuel economy target by exceeding the target for one or more of its other models.

Toyota argued that because the NPRM did not propose a specific continuous function for review, ''additional notice and comment would be necessary should NHTSA wish to pursue a continuous line function in place of size-based targets, since it is simply not possible for manufacturers or the public to determine the implications of such a system in the context of new standards for model years 2008 through 2011.'' In contrast, Nissan asserted that switching to a continuous function would ''result in little to no difference in fuel economy compliance levels,'' suggesting that the NPRM's discussion of a continuous function was sufficiently detailed to allow a manufacturer to assess the costs and other challenges of complying with a Reformed CAFE standard that uses a continuous function.

Although the agency is not adopting the category system as proposed, the targets under today's final rule are consistent with the category targets proposed in the NPRM. Figure 13 below shows the resulting relationship between vehicle footprint and target fuel economy level for 2011 described by the logistic function with parameter values statistically calibrated for that model year and subsequently optimized. The figure also compares its curved shape to that stair step shape of the fuel economy targets established in the previously proposed category system for that model year.

[94] *http://automobiles.honda.com/models/model_overview.asp?ModelName=Ridgeline* (last visited January 15, 2006).

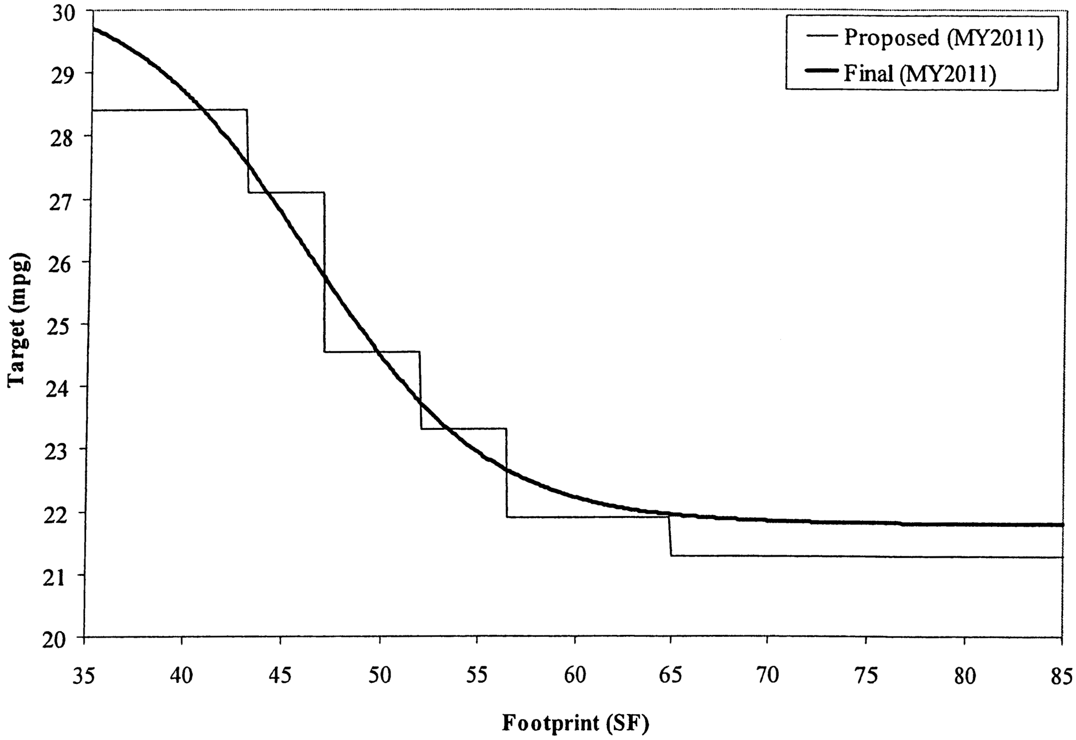

Figure 13: Final "optimized" curve compared to the proposed step function

RMI favored a step-function, because its ''size neutrality'' provides a better foundation for replacing fuel economy standards with a ''feebate'' system. In context of fuel economy, ''feebate'' refers to a transportation initiative in which consumers of low-fuel economy vehicles would pay into a fund from which payments would be made to purchasers of high-fuel economy vehicles. In response to RMI's comment, we note that EPCA does not provide for a feebate system, but instead requires the agency to establish average fuel economy standards. However, as discussed above, the continuous function adopted today provides greater ''size neutrality'' than a step function (i.e., a continuous function reduces incentives to downsize or upsize a vehicle).

Although the continuous function standard adopted in today's final rule eliminates the abrupt changes in fuel economy targets present in a step-function standard, it is important to recognize that the function does not ''smooth'' the targets as requested by some commenters. Toyota, Porsche, BMW, and the Alliance questioned why the stringency in Category 3 increased at a higher rate than the stringency levels of other categories. Toyota stated that vehicles in this size category tend to be fairly fuel-efficient unibody SUVs and minivans. Toyota also noted that the proposed Category 3 target experienced a 5.4 percent increase between 2008 and 2009, while the target for Category 6 actually went down from 2009 to 2010. Toyota suggested that the agency consider ''smoothing'' the target levels for the interim model years by linearly increasing the target levels between 2008 and 2011. Similarly, Honda questioned the increases in stringency proposed for the smaller footprint vehicles. Honda stated that, at least in theory, the agency's methodology (i.e., adding technology to each vehicle until the marginal cost exceeds the marginal benefits) should result in more stringent standards for larger vehicles, since the higher baseline fuel consumption would justify the addition of more technology. Honda observed that under the proposed step function light trucks in the smallest footprint category were projected to achieve an increase in fuel economy of 22 percent, while the increase for light trucks in the largest footprint category was only 16 percent. Honda questioned whether technologies have been applied uniformly and fairly to all vehicles.

As explained above, the stringency of the targets is based on the opportunity to apply fuel savings technology to vehicles within the light truck fleet. Differences in increases in stringency between vehicles of different sizes reflect differences in the potential improvements for those vehicles, and the costs and benefits of those improvements. While larger vehicles typically have low fuel economy performance, that does not mean that such vehicles are not equipped with fuel saving technologies. Conversely, the higher fuel economy performance of smaller vehicles is not necessarily reflective of fuel savings technologies, but may be more indicative of the vehicles small size. The reformed CAFE system recognizes variations in the baseline fuel economy levels between vehicles, in the costs of improving fuel economy, and in the resulting fuel savings and related benefits. Manufacturers' efforts to improve fuel economy are reflected in the degree of projected improvement across the range of footprint values. Increases in stringency above a manufacturer's baseline are consequences of the agency's improving the overall fuel efficiency of the light truck fleet to a maximum feasible level.[95]

[95] Additionally with regard to Honda's comment, it is also important to distinguish between improvements in fuel economy (which is measured

Continued

b. Continuous Function and Targets vs. Classes and Standards

As explained in the NPRM, we considered an approach under which we would establish separate classes based on footprint and establish a standard for each class. However, there were two primary shortcomings that led us to evaluate other approaches for our Reformed CAFE. Nothing provided by the commenters caused us to re-evaluate our decision not to establish a multi-class system based on footprint.

First, transfers of credits earned in a footprint class in a model year to a different footprint class in a different model year would have required a complicated process of adjustments to ensure that fuel savings are maintained.[96] This is because credits (denominated in mpg) earned under the multiple classes and standards approach would have differing energy value. Credits earned for exceeding the higher fuel economy standard for the smaller footprint vehicles would have less energy value than exceeding the lower fuel economy standard for the larger footprint vehicles by an equal increment. In fact, if credits were generated in a class with relatively high CAFE standards and transferred to another class with relatively low CAFE standards, total fuel use by all vehicles in the two classes might increase. That result would undermine the entire reform effort by producing lessened energy security.

One can calculate the appropriate adjustments for such a credit transfer system to ensure no loss of fuel savings. This would ensure equivalent energy savings. However, instituting a complicated new process of credit adjustments would detract from the benefits of reforming the CAFE program by making it more difficult to plan for and determine compliance. Further, taking this step would not cure another problem associated with credits. Credits earned by exceeding a standard in a model year may be used in any of the three model years preceding that model year and, to the extent not so used, in any of the three model years following that model year (49 U.S.C. 32903(a)). They may not, however, be used within the model year in which they were earned (Id.).

Second, establishing separate standards for each class would needlessly restrict manufacturer flexibility in complying with the CAFE program. A requirement for manufacturers to comply with separate standards, combined with the inability either to apply credits within the same model year or to average performance across the classes during a model year, could increase costs without saving fuel. This would happen by forcing the use of technologies that might not be cost-effective. Further, Congressional dialogue when considering the enactment of the EPCA and amendments to it has repeatedly expressed the view that manufacturers should have flexibility in complying with a CAFE program so that they can ensure fuel savings, while still responding to other external factors.

Reliance on a continuous function avoids these shortcomings just as the proposed step function would have avoided these shortcomings. Instead of establishing distinct standards for multiple classes, our proposal establishes targets across the range of footprint values and applies them through a harmonically weighted formula to derive regulatory obligations. Credits are earned and applied under today's final rule in the same way as they are earned and applied under Unreformed CAFE and in a manner fully consistent with the statute. Thus, no complicated new provisions for credits are needed. Further, the use of targets instead of standards allows us to retain the benefits of a harmonically weighted fleet average for compliance. This ensures that manufacturers must provide the requisite fuel economy in their light truck fleet, while giving the manufacturers the ability to average performance across their entire fleet and thus the flexibility to provide that level of fuel economy in the most appropriate manner.

c. Consideration of Additional Attributes

In the NPRM, the agency sought comment on whether Reformed CAFE should be based on vehicle size (footprint) alone, or whether other attributes, such as towing capability and/or cargo-hauling capability, should be considered. The comments received in response to our request were either strongly supportive or strongly opposed to including additional attributes. Commenters supporting consideration of additional attributes (General Motors, Nissan, DaimlerChrysler, Ford, Alliance, Sierra Research, NADA, and SUVOA) stated that such consideration is necessary to account for the varying degrees of utility among vehicles with similar footprint values. Commenters opposed to including additional attributes (NRDC, Environmental Defense, ACEEE, NESCAUM, and Rocky Mountain Institute) stressed the potential of using these attributes to manipulate vehicles into categories with less stringent targets.

The most frequently mentioned attribute was towing capability. However, Nissan stated that NHTSA should incorporate a mechanism providing fuel economy credits for all optional safety and utility features. The Alliance suggested 4WD/AWD capability in addition to towing.

Among the commenters supporting a modification for towing ability, the criteria for that classification differed. General Motors defined ''heavy-tow capable'' vehicles as a vehicle with a maximum towing capacity that is equal to or greater than 8,000 pounds. The Alliance suggested that the definition should be based on towing capacity equal to or greater than a set percentage of the vehicle's curb weight. That association argued that extra towing capacity means different things for different size vehicles.

Among those supporting consideration of additional attributes, the means suggested for providing credit for those attributes also differed. Nissan presented a method for calculating credits based on weight differences between a vehicle's base model and versions with optional safety and utility enhancing equipment, such that each additional 3 pounds of weight would provide a 0.01 mpg credit. Some commenters suggested a set percentage reduction; 5 percent with respect to towing capacity or 10 percent for 4WD/AWD. DaimlerChrysler suggested a provision which essentially created a second category for any MY 2005 product that is at least 25 percent below the 2008 MY target for its size class, rather than considering specific attributes. Under DaimlerChrysler's provision, the fuel economy target for such a vehicle would be set at its 2005 level plus 5 percent and would then increase 1.5 percent per year.

NRDC, Environmental Defense, ACEEE, NESCAUM, and Rocky Mountain Institute opposed consideration of additional attributes in determining a vehicle's target fuel economy. These commenters, along with Honda and Toyota, were concerned with the potential for

in miles per gallon) and reductions in fuel consumption (which is measured in gallons per mile). Because of differences between their initial fuel economy levels, the improvements in fuel economy that would be required by the proposed targets for the smallest and largest categories of light trucks cited by Honda (22 and 16 percent, respectively) actually correspond to reductions in fuel consumption of 18% and 14% percent, respectively.

[96] The 2003 ANPRM on reforming CAFE noted that the agency had previously concluded that the credits earned in one class could not be transferred to another class, but re-examined the legislative history of the CAFE statute and called that interpretation into question.

manufacturers to ''game'' such considerations. These commenters argued that manufacturers might find it more cost-effective to include whatever attribute was relied upon for adjustment, even if not requested or required by customers, rather than redesigning the vehicle for increase fuel efficiency.

Toyota raised specific concern with the attribute of tow rating, stating that there is not an objective method for quantifying this metric. Toyota also opposed adjustments for attributes, arguing that the targets already reflect the presence of such designs in the vehicles. Toyota stated that if these vehicles were permitted adjustments, the agency would essentially be ''double counting'' the effect of the attribute considered. Toyota further stated that depending on the attribute relied upon for adjustment, some manufacturers might be provided a competitive advantage based on their current fleet mix.

After reviewing these comments, NHTSA has decided not to consider any additional attributes for MYs 2008–2011. First, NHTSA notes that even some manufacturers noted the potential for abuse of a system that provided credits or lower targets for vehicles with certain attributes. Second, NHTSA believes the ''list of eligible features'' suggested by Nissan would be very confusing for both manufacturers and the agency.

With regard to the suggestion that the agency consider 4WD/AWD capability, the agency notes that it discontinued the option of a separate standard for 2WD vs. 4WD light trucks beginning with the standard for the 1992 model year.[97] The agency noted that separate standards were originally intended to provide an alternative means of compliance for manufacturers that manufactured primarily 4WD vehicles, and that these intended beneficiaries had disappeared. The agency noted that most manufacturers were choosing to comply with the combined standard. The agency also expressed concerns that separate standards could decrease fuel economy by encouraging the production of less fuel-efficient 4WD vehicles. Since there are no specialized manufacturers that need relief to comply with the standard, NHTSA is not reversing this decision.

With regard to towing capacity, in addition to the above concerns the agency notes that manufacturers suggested different approaches on how to define vehicles which would qualify for consideration. The agency is aware that the SAE is working on a uniform metric to rate towing capacity, and this may provide at least some of the information NHTSA would need to reconsider this issue with regard to towing capacity in the future.

d. Backstop and ''Fuel Saving'' Mechanisms

The agency is not establishing a backstop or fuel economy ''ratcheting'' mechanism under the Reformed CAFE system. As explained above, incorporating a backstop or fuel economy ratcheting system would be contrary to the intent of EPCA. The intent of the CAFE program is not to preclude future mix shifts and design changes in response to consumer demand. A backstop would likely have this influence. As discussed, a backstop or a ratcheting mechanism would limit the ability of a manufacturer to respond to market shifts arising from changes consumer demand. Such a system would be in opposition to congressional intent to establish a regulatory system that does not unduly limit consumer choice.

Additionally, supplementing the Reformed CAFE standards with a backstop would negate the value of establishing the attribute-based standards for some manufacturers and perpetuate the shortcomings of Unreformed CAFE. A backstop would essentially be a required fuel economy level akin to the Unreformed CAFE standard that would apply to a manufacturer if the required fuel economy for that manufacturer as determined under the Reformed CAFE system was below some determined threshold. For example, if consumer demand shifted to larger light trucks such that a manufacturer's required fuel economy level under the Reformed CAFE system was below the backstop fuel economy level, that manufacturer would be required to comply with the backstop. By requiring such a manufacturer to comply with the backstop, there would be a risk that the backstop would not be economically practicable given the change in the market, as occurred under the Unreformed CAFE standards in the mid-1980s. With regard to a ''ratcheting'' mechanism, an ''automatic'' increase in the stringency of targets or requirements could potentially subject manufacturers to required levels of average fuel economy level that are not technologically feasible.

Furthermore, the structure of the Reformed CAFE system addresses concerns commenters cited as the rationale for establishing a backstop, *i.e.*, concerns with manufacturers' upsizing vehicles and their fleets for the sole purpose of reducing the stringency of their light truck CAFE requirement.

First, the structure of the Reformed CAFE system minimizes the incentive for manufacturers to upsize vehicles, more so under the continuous function approach. Second, manufacturers are limited in their ability to increase the size of their vehicles beyond that extent demanded by consumers. Finally, making vehicles larger for CAFE compliance purposes is not cost-free. Market forces or fuel price increases will restrain consumer demand for large light trucks with low fuel economy. These reasons lead us to the conclusion, more so given the structure of the adopted reform, not to establish a backstop. These points apply equally to determination not to adopt a fuel economy ''ratcheting'' mechanism as recommended by several commenters.

With regard to the first point, reliance on a continuous function minimizes the incentive for manufacturers to increase vehicle size solely for the purpose of subjecting that vehicle to a less stringent target. As explained in the discussion of continuous function versus step function above, we explained that increases in vehicle size will more likely be accompanied by a decrease in fuel economy performance that offsets the reduction in target stringency. This is a result of targets decreasing gradually as vehicle size increases across the footprint continuum. This offset reduces the incentive for manufacturers to increase vehicle size solely in response to the CAFE program. The decrease in a vehicle's fuel economy performance from increasing its footprint will offset, to a degree, the advantage of the lower target.

With regard to the second point, manufacturers are limited in what changes they can make based on what will be accepted by the market. Changes in footprint result in perceptible changes in performance and design (*e.g.*, a longer and/or wider vehicle). As noted above, the track-width component of footprint, as defined in today's final rule, directly affects vehicle handling and stability. The connection between footprint and vehicle performance limits the ability of manufacturers to increase footprint in a manner not perceptible to the consumer. As stated by IIHS, under a continuous based function, customers would be more likely to notice any design changes that achieved a substantial CAFE benefit, as opposed to small changes that would move a vehicle into a less stringent category under the step-function approach.

Finally, making vehicles larger for CAFE compliance purposes is not cost-

[97] 55 FR 12487, April 4, 1990.

free. All else being equal, larger vehicles are more costly to build and operate. Market forces or fuel price increases will restrain consumer demand for large light trucks with low fuel economy, unless the need for utility justifies the expense to the manufacturers of producing and to the consumers of operating large trucks.

The agency did a preliminary evaluation of the cost associated with increasing a vehicle's footprint. We relied on the databases provided by manufacturers in which the manufacturers included a vehicle's manufacturer's suggested retail price (MSRP). We identified 22 nameplate vehicles that had data indicating more than one footprint value, either from a manufacturer offering different configurations of a nameplate or as a result of changes between model years.

We then separated out the 22 nameplates into 44 pairs and compared MSRP. Some of the price differences within the pairs appeared to represent differences in levels of options as well as footprint. The costs per square foot for these changes were in excess of $1000. These data point pairs were excluded.

The remaining pairs were evaluated. The average cost per square foot increase of the remaining 25 pairs was $119; the median cost was $46. Deleting the 5 percent highest and lowest costs resulted in a mean cost per square foot increase of $85. We note that this is a preliminary evaluation and that these costs represent those associated with increases in footprint that occur as part of a planned model redesign. We expect that the costs associated outside a planned redesign would be substantially higher.

We believe that the costs associated with increasing a vehicle's wheelbase would be even greater than those associated with an increase in track width. Based on a review of confidential information provided by a manufacturer, we estimate that the cost of redesigning a vehicle mid-product cycle such that the vehicle has a longer wheelbase would be at least equal to 50 percent of the costs associated with introducing the original vehicle design. Given this high estimate, it would be unlikely that a manufacturer would extend a vehicle's wheelbase solely in response to the CAFE program. The agency intends to further explore the costs associated with changes in footprint.

Comments from the environmental organizations raised a number of concerns, which they stated necessitated a back stop or ratcheting mechanism. These concerns can be categorized into three areas: (1) Increases in fleet size based on historic trends and potential market shift, (2) increases in a vehicle's footprint to take advantage of a less stringent category, and (3) upweighting of a vehicle to remove it form the light truck CAFE program.

With regard to the environmental organizations' first concern, we explained above that the light truck CAFE program is not intended to constrain consumer choice. Any historic upsizing of manufacturers' fleets occurred under Unreformed CAFE in response to market demands, and market demands will continue to influence the size of the light truck fleet. Moreover, the agency established the MYs 2008–2011 standards after evaluating the product plans provided by manufacturers. Planned shifts in fleet mix have been taken into consideration in establishing the final rule. Future standards will also rely, in part, on product plans provided by manufacturers. As such, projected trends in fleet mix and fleet size will continue to be a consideration in establishing future CAFE standards.

With regard to the second concern, both NRDC and Union of Concerned Scientists stated that a number of vehicles would need only changes ranging from one-tenth of an inch to 1.5 inches in wheelbase and track width to become subject to a less stringent category. The Union of Concerned Scientists stated that an increase in vehicle size of 1–10 percent would be equivalent to a 0.05 to 1.18 mpg decrease in the fleet wide average fuel economy, respectively. This concern was also echoed by IIHS.

Again, as explained above, the agency is adopting a standard based on a continuous function as opposed to the step function. Under the continuous function small changes in vehicle footprint are not rewarded with large decreases in target values. Target values decrease gradually, as opposed the larger decreases that occur as a vehicle moves between categories under the proposed system. As such, the incentive for upsizing has been further minimized by adopting a continuous function approach.

Environmental groups' third major concern was that of uprating, *i.e.*, manufacturers increasing the GVWR of vehicles beyond the 8,500 lbs GVWR boundary for the light truck CAFE program. As explained in greater detail below, the agency is extending the definition of light truck to MDPVs. By including MDPVs, we are capturing essentially all SUVs with a GVWR less than 10,000 lbs.[98]

Aside from our concerns with the legality of a backstop, the agency has concluded that the potential for fuel loss from manufacturers increasing the footprint values of vehicles or through shifting their fleet mix has been substantially reduced by the structure of the final rule. By gradually decreasing the value of targets as footprint increase, minor increases to footprint do not result in significant decreases in applicable target values. Further, increases to footprint come at a cost in terms of fuel economy performance, vehicle handling, and consumer acceptance.

5. Benefits of reform

a. Increased Energy Savings

The Reformed CAFE system increases the energy savings of the CAFE program over the longer term because fuel saving technologies will be required to be applied to light trucks throughout the entire industry, not just by a limited number of manufacturers. The energy-saving potential of Unreformed CAFE is limited because it requires only a few full-line manufacturers to make improvements. In effect, the capabilities of these full-line manufacturers, whose offerings include larger and heavier light trucks, constrain the stringency of the uniform, industry-wide standard. The Unreformed CAFE standard is generally set below the capabilities of limited-line manufacturers, who sell predominantly lighter and smaller light trucks. Under Reformed CAFE, which accounts for fuel economy potential of the fleets of individual manufacturers, virtually all light-truck manufacturers will be required to improve the fuel economy of their vehicles. Thus, Reformed CAFE continues to require full-line manufacturers to improve the overall fuel economy of their fleets, while also requiring limited-line manufacturers to enhance the fuel economy of the vehicles they sell.

Our estimates indicate that the Reformed CAFE system will result in greater fuel savings than the Unreformed CAFE system during the transition period, even though the industry-wide compliance costs were equalized for those model years:

[98] With MDPVs included in the definition of light truck, only approximately 50,000 vehicles could be removed from the light truck CAFE program with an uprating of 1,000 lbs or less.

TABLE 7.—ESTIMATED FUEL SAVINGS FROM REFORMED AND UNREFORMED CAFE SYSTEMS FOR MYS 2008–2010

[in billions of gallons]

	MY 2008	MY 2009	MY 2010
Reformed CAFE system	0.7	1.9	2.2
Unreformed CAFE system	0.6	1.8	2.0

The improvement in fuel savings made possible by the switch to the Reformed CAFE system will be even greater beginning MY 2011. By requiring improvements across the entire industry, the Reformed CAFE system produces greater fuel savings at levels that remain economically practicable. For comparison, the agency performed a cursory Stage analysis for MY 2011. On the basis of that cursory analysis, the agency determined that, under the Unreformed CAFE system, the fleet wide (including MDPVs) fuel economy standard would be 23.3 mpg. We note that the Stage Analysis for MY 2011 results in a lower Unreformed standard for that year than the Unreformed standard for MY 2010. This is due to the inclusion of MDPVs in MY 2011. MDPVs, which have low fuel economies, are produced primarily by General Motors. Under the Unreformed CAFE system, General Motors would be the least capable manufacturer. Because of this, and because including the MDPVs lowers the CAFE level projected for General Motors, the inclusion of MDPVs would depress the Unreformed CAFE standard. Table 8 below illustrates the difference in fuel savings between the Unreformed CAFE system and the fully implemented Reformed CAFE system in MY 2011.

TABLE 8.—COMPARISON OF THE ESTIMATED FUEL SAVINGS FROM REFORMED IN MY 2011 AND AN UNREFORMED STANDARD OF 23.3 MPG IN MY 2011

[in billions of gallons]

	MY 2011
Reformed CAFE system	2.8
Unreformed CAFE system	2.1

As illustrated above, the Reformed CAFE system saves an additional 700 million gallons of fuel over the Unreformed CAFE system over the lifetime of the vehicles in the MY 2011 fleet. Further, we estimate that the fuel savings under a 23.3 mpg Unreformed standard in MY 2011 would have come at a cost of approximately $ 1.9 billion. While the cost of the Reformed fuel savings in MY 2011 is approximately $2.5 billion, this cost is distributed across a greater number of manufacturers. Additional discussion of the Reformed CAFE costs is provided below.

b. Reduced Incentive To Respond to the CAFE Program in Ways Harmful to Safety

In the NPRM, we noted the key trends in the light vehicle population and in the crashes that produce serious and fatal injuries to highlight the safety impacts of reforming CAFE. Specifically, we identified rollovers and crash compatibility. Both are related to reforming CAFE.

Pickups and SUVs have a higher center of gravity than passenger cars and thus are more susceptible to rolling over, if all other variables are identical. Their rate of involvement in fatal rollovers is higher than that for passenger cars—the rate of fatal rollovers for pickups and SUVs is twice that for passenger cars. Rollovers are a particularly dangerous type of crash. Overall, rollover affects about three percent of light vehicles involved in crashes, but accounts for 33 percent of light vehicle occupant fatalities. Single vehicle rollover crashes account for nearly 8,500 fatalities annually. Rollover crashes involving more than one vehicle account for another 1,900 fatalities, bringing the total annual rollover fatality count to more than 10,000.

Crash compatibility is the other prominent issue. Light trucks are involved in about half of all fatal two-vehicle crashes involving passenger cars. In the crashes between light trucks and passenger cars, over 80 percent of the fatally injured people are occupants of the passenger cars.

In regard to reducing regulatory incentives for design changes adversely affecting safety, commenters generally supported the proposed reliance on footprint, recognizing the safety concerns that led the agency to base the Reformed CAFE system on a size metric. Both General Motors and Nissan stated that weight provides the best correlation to fuel economy, but given the safety concerns about downsizing and the concerns about creating a potential for upsizing, these commenters support the use of footprint. RVIA stated that vehicle weight does have a direct impact on overall fuel economy, but the proposed reliance on footprint is reasonable.

The Alliance also supported the size-safety correlation and stated that use of footprint and the structure of Reformed CAFE would reduce the incentive to produce small vehicles in order to offset larger light trucks. However, the Alliance stated that the agency did not acknowledge improvements made by manufacturers in the static stability factor and industry's commitment to address the compatibility issue.

The Rocky Mountain Institute supported the use of footprint, stating that the proposal would create an incentive for decoupling size from weight by adopting lighter-but-stronger materials and would encourage manufacturers to make vehicles that are ''big, hence protective and comfortable, without also making them heavy, hence hostile and inefficient.'' The Aluminum Association stated that use of footprint would provide opportunities to increase safety while saving fuel by substituting aluminum for steel.

The agency continues to believe that the manner in which fuel economy is regulated can have substantial effects on vehicle design and the composition of the light vehicle fleet. Reforming CAFE is important for vehicle safety because the current structure of the CAFE system provides an incentive to manufacturers to reduce the weight and size of vehicles, and to increase the production of vehicle types (particularly pickup trucks and SUVs) that are more susceptible to rollover crashes and are less compatible with other light vehicles. For these reasons, reforming CAFE is a critical part of the agency's effort to address the vehicle rollover and compatibility problems.

The final rule based on footprint substantially reduces the incentive to introduce smaller vehicles or to reduce vehicle size to offset the lower fuel economy of larger vehicles. Adding the continuous function concept to footprint eliminates the opportunity that existed under the proposal to downweight by reducing vehicle size to the lower edge of a category (which would have increased vehicle fuel economy without subjecting the vehicle to a higher target). It does this by eliminating the categories that covered a range of footprint sizes. Thus, under the final rule, each change in footprint results in a different target.

i. Reduces Incentive To Reduce Vehicle Size and To Offer Smaller Vehicles

Without CAFE reform, significant increases in Unreformed light truck CAFE standards, especially if accompanied by high fuel prices, would likely induce a wave of shifting production mix toward smaller light trucks and reducing the size and/or weight of light trucks. Such a shift occurred in the 1970's and early 1980's when fuel price increases and competitive pressures induced vehicle manufacturers to shift their production mix toward their smaller and lighter vehicles to offset the lower fuel economy of larger and heavier vehicles and to redesign their vehicles by reducing their size and/or weight.[99] The need for manufacturers to make rapid and substantial increases in passenger car and light truck CAFE in response to the CAFE standards in late 1970's and early 1980's provided an added incentive for them to take those actions.

The shift in production mix and reduction in vehicle size/weight that occurred in the 1970's and early 1980's contributed to many additional deaths and injuries.[100] While the adoption of additional safety performance requirements for those vehicles has saved lives, even more lives would have been saved if the shifting of production mix toward smaller vehicles and the reduction in size and/or weight had not occurred.

By relying on vehicle size to determine required fuel economy levels, the agency will minimize the incentive for manufacturers to comply through downsizing vehicles or by increasing the production of smaller vehicles solely to offset the sales of larger vehicles. These compliance strategies reduce safety by reducing the crashworthiness of individual vehicles, and compound the problem of fleet compatibility.

Reforming CAFE such that required fuel levels are determined through the use of footprint-based fuel economy targets discourages reductions in vehicle size. As a vehicle decreases in size, the fuel economy target against which that vehicle is compared increases.

[99] Shifting production mix down toward smaller vehicles involves decreasing the production volumes of vehicles that are heavier or larger and thus have relatively low fuel economy and increasing the production volumes of lighter or smaller vehicles.

[100] NAS Report, p. 3.

Several commenters raised concern that the structure as proposed (i.e., a category-based system) would still reward downsizing. IIHS stated that a manufacturer could rely on limited reduction in size as a method to reduce weight, without moving a vehicle into a different category.

The agency recognizes the potential for limited downsizing being rewarded in a category based system. However, this potential reward is substantially reduced and possibly eliminated under the continuous function adopted today. Under the continuous function, any reduction in size will result in a vehicle becoming subject to higher target. Where a step-function would permit limited reduction in footprint within a category, under a continuous function any reduction in footprint will subject a vehicle to a more stringent target.

IIHS further stated that even if a manufacturer maintained a vehicle's size, the manufacturer still could reduce a vehicle's weight in order to improve the vehicle's fuel economy. IIHS cautioned that such weight reduction would likely reduce a vehicle's crashworthiness because decreased size and weight have separate effects on a vehicle's ability to protect its occupants. IIHS, citing the NAS report and Kahane study, stated that although the potential safety cost is greater when both decrease, a decrease in mass alone will, on average, reduce the crashworthiness of the light truck fleet.

The potential for downweighting through limited reductions in footprint is minimized under the Reformed CAFE structure adopted in this document. Reliance on a continuous function further discourages footprint reduction because as a vehicle model's footprint is reduced, the vehicle is subject to a higher target. Reformed CAFE, as adopted today, links the level of the average fuel economy targets to the size of footprint so that there is an incentive to reduce weight only to the extent one can do so while also preserving size. Thus, we have minimized the incentive for a compliance strategy that could increase rollover propensity and cause further divergence in the size of the light truck fleet.

By basing Reformed CAFE on a measure of vehicle size (footprint) instead of weight, the agency is aware that the CAFE program will continue to permit and to some extent reward weight reduction as a compliance strategy. The safety ramifications of downweighting—especially downweighting that is not achieved through downsizing—will need to be examined on a case-by-case basis in future rulemakings. Historically, the size and weight of light-duty vehicles have been so highly correlated that it has not been technically feasible to fully disentangle their independent effects on safety.[101] The agency remains concerned about compliance strategies that might have adverse safety consequences.

As explained in more detail below in Section VIII, Technology issues, in determining the fuel saving potential of a manufacturer's fleet, the agency employed weight reduction as a compliance strategy only in limited instances. The agency only considered weight reduction for vehicles with a curb weight greater than 5,000 lbs. This limitation was based on the Kahane study, which indicated that weight reduction of the heaviest vehicles would not negatively impact safety. If downweighting were concentrated among the heaviest of the light trucks, any extra risk to the occupants of those vehicles might be more than offset by lessened risk in multi-vehicle crashes to occupants of smaller light trucks and cars. IIHS agreed with the agency that downweighting of the heaviest vehicles would likely not harm safety.

Additionally, it is possible that some of the lightweight materials used in a downweighting strategy may have the strength and flexibility to retain or even improve the crashworthiness of vehicles and the safety of occupants. General Motors expressed some concern with the practicality of using lightweight materials, stating that it does not intentionally reduce mass by replacing it with advanced materials. However, General Motors did state that it seeks to use advanced materials and technologies in new generation vehicles. As stated above, the agency used limited weight reduction in our modeling;

[101] Kahane, C.J., Response to Docket Comments on NHTSA Technical Report, Vehicle Weight, Fatality Risk and Crash Compatibility of Model Year 1991–99 Passenger Cars and Light Trucks, Docket No. NHTSA–2003–16318–16, 2004 discusses the historic correlation and difficulty of disaggregating weight and ''size.'' Except for a strong correlation of track width with rollover risk, it shows weak and inconsistent relationships between fatality risk and two specific ''size'' measures, track width and wheelbase, when these are included with weight in the analyses. See also Kahane, C.J., Vehicle Weight, Fatality Risk and Crash Compatibility of Model Year 1991–99 Passenger Cars and Light Trucks, NHTSA Technical Report No. DOT HS 809 662, Washington, 2003, pp. 2–6. Evans, L. and Frick, M.C., Car Size or Car Mass—Which Has Greater Influence on Fatality Risk? American Journal of Public Health 82:1009–1112, 1992, discusses the intense historical correlation of mass and wheelbase and finds that relative mass, not relative wheelbase is the principal determinant of relative fatality risk in two-car collisions. See also, Evans, L. ''Causal Influence of Car Mass and Size on Driver Fatality Risk,'' American Journal of Public Health, 91:1076–81, 2001.

however, we cannot dictate which technologies a manufacturer must employ in order to comply with the standards. The stringency of today's standards should not make it necessary for any manufacturers to rely on unsafe or unproven compliance strategies.

Reformed CAFE also reduces the incentive for manufacturers to comply through increasing the number of smaller vehicles, with higher fuel economies, to offset larger vehicles, with lower fuel economies. The way in which Reformed CAFE dilutes the effect of this action as compliance strategy can be seen by looking at a Reformed CAFE standard. The fuel economy targets, as determined by the continuous function, are constants. Regardless of what compliance strategy is chosen by a manufacturer, nothing that the manufacturer does will change those values.

The distribution of vehicle models along the continuous function and the production volume of each model, however, are variables under the control of the manufacturers. Further, they are variables not only in the formula for calculating a manufacturer's actual level of CAFE for a model year, but also in the formula for calculating a manufacturer's required level of CAFE for that model year.

Thus, by changing the distribution of its production across the footprint based-function, a manufacturer will change not only its actual level of CAFE, but also its required level of CAFE. For example, all other things being equal, if a manufacturer were to increase the production of one of its higher fuel economy models and decrease the production of one of its lower fuel economy models, both its actual level of CAFE and its required level of CAFE would increase.

Likewise, again all other things being equal, if a manufacturer were to redesign a model so as to decrease its footprint (thereby presumably also decreasing its weight), the model will become subject to a higher target. Again, as a result, both the manufacturer's actual CAFE and required CAFE would increase. Thus, we have substantially reduced the incentive for a compliance strategy that could cause further divergence in the size of the light truck fleet and increase rollover propensity.

The reduced effectiveness of those actions as compliance strategies under Reformed CAFE increase the likelihood that manufacturers will choose two other actions as the primary means of closing the gap between those two levels: (1) Reducing vehicle weight while keeping footprint constant, and (2) adding fuel-saving technologies. Both of those actions would increase a manufacturer's actual CAFE without changing its required CAFE. Nevertheless, since a change in a vehicle's footprint will result in a change in both actual and required CAFE, manufacturers will have more flexibility to respond to consumer demand for vehicles with different footprint values without harming their ability to comply with CAFE standards or adversely affecting safety.

ii. Reduces the Difference Between Car and Light Truck CAFE Standards

In discussing the proposed step-function CAFE standard, we stated that the Reformed CAFE system would reduce the disparity between car and light truck standards—the so called ''SUV loophole''—which in turn would promote increased safety because the disparity has created an incentive (beyond that provided by the market by itself) to design vehicles to be classified as light trucks instead of cars.[102] The continuous function standard adopted today will operate in the same manner. The fuel economy targets along the continuous function for the smaller footprint categories of light trucks would, by MY 2011, be at or near (and for the smallest light trucks above) the level of the current 27.5 mpg CAFE standard for cars.

One way to design vehicles so that they are classified as light trucks instead of passenger cars is to design them so that they have higher ground clearance and higher approach angles.[103] Designing vehicles so that they have higher ground clearance results in their also having a higher center of gravity. Generally speaking, light trucks have a higher center of gravity than cars, and thus are more likely than cars to rollover. Moreover, in order to create a higher approach angle, it is necessary to raise or minimize the front structure below the front bumper, which increases the likelihood that a light truck will override a car's body in a front or rear end crash. It also increases the likelihood that when a light truck crashes into the side of a car, its front end will pass over the car's door sill and intrude farther into the car's occupant compartment. In addition to not being structurally aligned with cars, light trucks are generally heavier than passenger cars, which add to their compatibility problems with cars.

Both NRDC and the Union of Concerned Scientists questioned the effectiveness of the proposed Reformed CAFE system in limiting the incentive to produce light trucks as opposed to passenger cars. The Union of Concerned Scientists stated that not all passenger car-like light trucks would be in the first two of the proposed categories. The Union of Concerned Scientists listed the Ford Freestyle and the Dodge Magnum as examples of passenger car-like light trucks that have footprint values larger than proposed categories one and two, and thus would be subject to fuel economy targets lower that the passenger car standard. NRDC cited a forecast from The Planning Edge forecast which suggested that 27 new models of small and crossover vehicles would be added to the light truck fleet between MY 2005 and MY 2010, some of which would not be in the first category of the proposed CAFE structure. NRDC stated that the Reformed CAFE structure would still provide an incentive for automakers to classify vehicles as light trucks.

As stated above, the Reformed CAFE system will compare smaller light trucks to fuel economy levels more comparable to the passenger car standard. A vehicle such as the Ford Escape, with a footprint of 43.5 square feet, will be compared to a fuel economy target of 27.3 mpg in MY 2011. This significantly minimizes the incentive to manufacturer a vehicle as a light truck as opposed to a passenger car, solely for CAFE purposes.

c. More Equitable Regulatory Framework

The Reformed CAFE system adopted today provides a more equitable regulatory framework for full-line vehicle manufacturers and creates a level playing field for all manufacturers.

The Unreformed CAFE system cannot match the Reformed CAFE system in terms of providing an equitable regulatory framework for different vehicle manufacturers. Under Unreformed CAFE, all vehicle manufacturers are required to comply with the same fleet-wide average CAFE requirement, regardless of their product mix. For full-line manufacturers, this creates an especially burdensome task. We note that these manufacturers often offer vehicles that have high fuel economy performance relative to others in the same size class, yet because they sell many vehicles in the larger end of the light truck market, their overall CAFE is low relative to those

[102] NAS Report (p. 88) noted that that gap created an incentive to design vehicles as light trucks instead of cars.

[103] The term ''approach angle'' is defined by NHTSA in 49 CFR 523.2 as meaning ''the smallest angle, in a plane side view of an automobile, formed by the level surface on which the automobile is standing and a line tangent to the front tire static loaded radius arc and touching the underside of the automobile forward of the front tire.''

manufacturers that concentrate in offering smaller light trucks. As a result, Unreformed CAFE is binding for such full-line manufacturers, but not for limited-line manufacturers who sell predominantly smaller light trucks. The full-line vehicle manufacturers have expressed a legitimate competitive concern that the part-line vehicle manufacturers are entering the larger end of the light-truck market with an accumulation of CAFE credits. While this concern has merit, it is also the case that some part-line manufacturers (e.g., Toyota and Honda) have been industry innovators in certain technological aspects of fuel-economy improvement.

As with the proposed step-function, the Reformed CAFE program adopted today requires manufacturers to comply with a fuel economy level that is representative of that manufacturer's actual production mix. Under both functions, vehicles are compared to fuel economy targets more representative of a vehicle's fuel saving capabilities than comparison to a single flat standard. In fact, a required fuel economy level under the continuous function is more representative of a manufacturer's capabilities, because a target is established for each specific vehicle footprint, as opposed to the proposed step function for which a target would have been established for a range of footprint values.

d. More Responsive to Market Changes

Reformed CAFE is more market-oriented because it respects economic conditions and consumer choice. Reformed CAFE does not force vehicle manufacturers to adjust fleet mix toward smaller vehicles unless that is what consumers are demanding. As the industry's sales volume and product mix changes in response to economic conditions (e.g., gasoline prices and household income) and consumer preferences (e.g., desire for seating capacity or hauling capability), the expectations of manufacturers under Reformed CAFE will, at least partially, adjust automatically to these changes. Accordingly, Reformed CAFE may reduce the need for the agency to revisit previously established standards in light of changed market conditions, a difficult process that undermines regulatory certainty for the industry. In the mid-1980's, for example, the agency relaxed several Unreformed CAFE standards because fuel prices fell more than expected when those standards were established and, as a result, consumer demand for small vehicles with high fuel economy did not materialize as expected. By moving to a market-oriented system, the agency may also be able to pursue more multi-year rulemakings that span larger time frames than the agency has attempted in the past.

E. Comparison of Estimated Costs To Estimated Benefits

1. Costs

In order to comply with the Reformed CAFE standards, we estimate the average incremental cost per vehicle to be $66 for MY 2008, $201 for MY 2009, $213 for MY 2010, and $271 for MY 2011. Under the Reformed CAFE system, a greater number of manufacturers will be required to improve their fleets and make additional expenditures than under the Unreformed CAFE system. The level of additional expenditure that would be necessary beyond already planned investment varies for each individual manufacturer. These individual expenditures are discussed in more detail in Chapter VII of the FRIA. As stated above, these costs are distributed across a greater share of the industry.

The total incremental costs (the costs necessary to bring industry from 22.2 mpg, the level required by the standard for MY 2007, to the final rule levels) are estimated to be $553 million for MY 2008, $1,724 million for MY 2009, $1,903 million for MY 2010, and $2,531 million for MY 2011. A comparison between the Reformed and Unreformed CAFE system costs is shown in Table 9. By policy design, the mpg levels under Reformed CAFE were 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.

TABLE 9.—ESTIMATED COST FROM REFORMED AND UNREFORMED CAFE SYSTEMS FOR MYs 2008–2010

[in millions of year 2003 dollars]

	MY 2008	MY 2009	MY 2010
Reformed CAFE system	553	1,724	1,903
Unreformed CAFE system	536	1,621	1,752

2. Benefits

The benefits analysis applied to the final standards under the Unreformed CAFE system was also applied to the standards under the final Reformed CAFE system. Benefit estimates include both the benefits from fuel savings and other economic benefits from reduced petroleum use. A more detailed discussion of the application of this analysis to the required fuel economy levels under the Reformed CAFE system can be located in Chapter VIII of the FRIA.

Adding benefits from fuel savings to other economic benefits from reduced petroleum use as a result of the Reformed CAFE standards produced an estimated incremental benefit to society. The total value of these benefits is estimated to be $782 million for MY 2008, $2,015 million for MY 2009, $2,336 million for MY 2010, and $2,992 million for MY 2011, based on fuel prices ranging from $1.96 to $2.39 per gallon. These estimates are provided as present values determined by applying a 7 percent discount rate to the future impacts. We translated impacts other than fuel savings into dollar values, where possible, and then factored them into our total benefit estimates. The benefits analysis for Reformed CAFE is based on the same assumptions as the benefits analysis for Unreformed CAFE.

Based on the forecasted light truck sales from AEO 2005 and an assumed baseline fuel economy (i.e., the industry wide fuel economy level if the MY 2007 standard were to remain in effect), we estimated the fuel savings from the Reformed CAFE program. This analysis resulted in estimated lifetime fuel savings of 746 million, 1,940 million, 2,230 million, and 2,834 million gallons under the Reformed CAFE standards for MY 2008, 2009, 2010, and 2011 respectively.

NHTSA estimates that the direct fuel-savings to consumers account for the majority of the total benefits, and by themselves exceed the estimated costs of adopting more fuel-efficient technologies. In sum, the total incremental costs by model year compared to the incremental societal benefits by model year are as follows:

TABLE 10.—COMPARISON OF INCREMENTAL COSTS AND BENEFITS FOR THE REFORMED CAFE STANDARDS

[In millions]

	MY 2008	MY 2009	MY 2010	MY 2011
Total Incremental Costs*	$553	$1,724	$1,903	$2,531
Total Incremental Benefits*	782	2,015	2,336	2,992

* Relative to the 22.2 mpg standard for MY 2007

These estimates are provided as present values determined by applying a 7 percent discount rate to the future impacts.

In light of these figures, we have concluded that the standards established under the Reformed CAFE system serve the overall interests of the American people and are consistent with the balancing that Congress has directed us to do when establishing CAFE standards. For all the reasons stated above, we believe the Reformed CAFE standards represent fuel economy levels that are economically practicable and, independently, that are a cost beneficial advancement for American society. A more detailed explanation of our analysis is provided in Chapter IX of the FRIA.

3. Uncertainty

As with the Unreformed CAFE standards, the agency recognizes that the data and assumptions relied upon in our analysis have inherent limitations that do not permit precise estimates of benefits and costs. NHTSA performed a probabilistic uncertainty analysis on the Reformed CAFE standards to examine the degree of uncertainty in its costs and benefits estimates. Factors examined included technology costs, technology effectiveness in improving fuel economy, fuel prices, the value of oil import externalities, and the rebound effect. This analysis employed Monte Carlo simulation techniques to examine the range of possible variation in these factors. As a result of this analysis, the agency thinks it very likely that the benefits of the Reformed CAFE standards will exceed their costs for all four model years. A detailed discussion of the uncertainty analysis is provided in Chapter X of the FRIA.

F. MY 2008–2011 Reformed CAFE standards

The manner in which a manufacturer's required overall CAFE for a model year under the Reformed system is computed is similar to the way in which its actual CAFE for a model year has always been calculated. Its required CAFE level is computed on the basis of the production and the footprint target as follows.

$$Required\_Fuel\_Economy\_Level = \frac{N}{\sum_i \frac{N_i}{T_i}}$$

Where:

N is the total number (sum) of light trucks produced by a manufacturer,

N_i is the number (sum) of the ith model light truck produced by the manufacturer, and

T_i is fuel economy target of the ith model light truck, which is determined according to the following formula, rounded to the nearest hundredth: where,

$$T = \frac{1}{\frac{1}{a} + \left(\frac{1}{b} - \frac{1}{a}\right)\frac{e^{(x-c)/d}}{1+e^{(x-c)/d}}}$$

a = the maximum fuel economy target (in mpg)

b = the minimum fuel economy target (in mpg)

c = the footprint value (in square feet) at which the fuel economy target is midway between a and b

d = the parameter (in square feet) defining the rate at which the value of targets decline from the largest to smallest values

e = 2.718

x = footprint (in square feet, rounded to the nearest tenth) of the vehicle model

TABLE 11.—CALIBRATED PARAMETER VALUES FOR TARGET

Parameter	Model year			
	2008	2009	2010	2011
a	28.56	30.07	29.96	30.42
b	19.99	20.87	21.20	21.79

TABLE 11.—CALIBRATED PARAMETER VALUES FOR TARGET—Continued

Parameter	Model year			
	2008	2009	2010	2011
c	49.30	48.00	48.49	47.74
d	5.58	5.81	5.50	4.65

The following is a representative sample of footprint values for MY 2005 light trucks and their associated targets for MY 2011:

TABLE 12.—REPRESENTATIVE VEHICLES AND THEIR APPLICABLE FUEL ECONOMY TARGETS FOR MY 2011

Representative vehicle(s)	Footprint (square feet)	Target (mpg)
Ford F–150 Super Cab	75.8	21.81
GM Silverado Extended Cab	65.3	21.93
Lincoln Navigator	55.4	22.84
Honda Odyssey	54.7	22.98
Hummer H3	50.7	24.16
GM Equinox	48.2	25.19
Saturn Vue	45.2	26.56
Ford Escape	43.5	27.32

Based on the product plans provided by the manufacturers, we project that manufacturers will be required to comply with fuel economy levels in MYs 2008–2011 under the Reformed CAFE system as follows:

TABLE 13.—PROJECTED REQUIRED FUEL ECONOMY LEVELS BY MANUFACTURER

Manufacturer	MY 2008 (mpg)	MY 2009 (mpg)	MY 2010 (mpg)	MY 2011 (mpg)
General Motors	21.9	22.6	22.9	23.2
Ford	22.7	23.2	23.8	23.9
DaimlerChrysler	23.2	23.7	24.1	24.3
Nissan	22.3	23.3	23.7	23.9
Mitsubishi	25.1	25.8	26.3	27.0
Subaru	25.4	26.4	26.3	26.8
Toyota	22.6	23.0	23.2	23.8
Hyundai	23.9	25.0	25.0	25.4
BMW	24.5	25.1	25.5	25.8
Porsche	23.0	23.7	24.0	24.2
VW	23.1	23.7	24.1	24.2
Isuzu	22.2	22.9	23.2	23.4
Honda	23.3	24.0	24.4	24.6
Suzuki	25.5	26.3	26.6	27.1

The projected required industry wide fleet fuel economy levels for MY 2008–2010 are 22.7 mpg, 23.4 mpg, and 23.7 mpg, respectively. These levels are more stringent than those in the NPRM. The projected required fleet wide required fuel economy levels in the NPRM for MYs 2008–2010 were 22.6 mpg, 23.1 mpg, and 23.4 mpg, respectively. The increase in stringency is a result of higher compliance costs associated with the Unreformed CAFE standards. Even though the Unreformed CAFE standards are the same as those proposed in the NPRM, the associated compliance costs have increased because the updated product plans reflect the fact that manufacturers have already planned to apply several of the lower cost fuel improvement technologies. As a result, the Stage analysis applies technologies with higher costs in order to achieve the same fuel economy level under the proposed Unreformed CAFE system. Because the Reformed CAFE system is constrained by costs of the Unreformed CAFE system in the transition period, the Volpe model has more to ''spend'' (and spend more efficiently than under an Unreformed standard) when applying technologies in the Reformed CAFE system. The result is Reformed CAFE standards with higher stringency than in the NPRM.

We estimate that the industry wide fleet fuel economy average in MY 2011 will be 24.0 mpg. Based on the product plans submitted in response to the ANPRM, we estimated that manufacturers intended to achieve an industry wide fuel economy level of approximately 22.0 mpg. In the NPRM the proposed Reformed standard for MY 2011 would have been 23.9 mpg, with MDPVs remaining unregulated. As a result of today's final rule, we project a required industry wide fuel economy of 24.0 in MY 2011, with MDPVs included in the light truck fleet.

While the reformed standards adopted today are more stringent than those proposed, and we are regulating a larger fleet in MY 2011, we have determined that the Reformed CAFE system and associated target levels for MYs 2008–2011 will result in required fuel economy levels that are both technologically feasible and economically practicable for manufacturers.

VII. Technology issues

A. Reliance on the NAS Report

The agency affirms our reliance on the cost and fuel saving estimates provided in the NAS report for the technologies relied upon in our analysis. The NAS cost and effectiveness numbers are the best available estimates at this time. They were determined by a panel of experts formed by the National Academy of Sciences. The report has been reviewed by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the Report Review Committee of the National Research Council. The purpose of the independent review was to provide candid and critical comments that assisted the authors and the NAS in making the published report as sound as possible and to ensure that the report met institutional standards for objectivity, evidence and responsiveness to the study charge. The agency has reviewed other studies of technologies available to improve fuel economy and have concluded that the estimates of fuel economy technology effectiveness and costs developed by the NAS are the most reliable available. Alternative estimates recommended by some commenters have not been subject to the same level of expert and public review, and thus are not suitable for use by NHTSA in establishing fuel economy standards.

B. Technologies Included in the Manufacturers' Product Plans

The Alliance, DaimlerChrysler, Ford, General Motors, Nissan, Toyota, and Sierra Research argued that the agency's analyses incorrectly projected the use of certain technologies that were either already featured on vehicles or were included in the manufacturer's product plans. Because the benefits of these technologies are already incorporated into the manufacturer's baseline capabilities, any further projected fuel economy improvements were incorrectly attributed. The commenters urged the agency to revise our analyses to account for technologies that were already on vehicles or in the product plans submitted to the agency.

In performing the Stage Analysis and the Reformed CAFE analysis to determine the final CAFE standards, the agency relied on manufacturers' comments and confidential product plan information to adjust our calculations. Accordingly, the technologies that were already featured on certain vehicles or already incorporated into the manufacturers' baseline product plans were removed from the Stage Analysis. We note that the detailed description of the adjustments made to the Stage Analysis contains confidential information and is discussed in general terms in the FRIA. However, this final rule provides a description of the steps taken in order to address comments and discrepancies between the product plan information available to NHTSA in preparing the August 2005 NPRM and this final rule.

C. Lead Time

In developing the proposal, the agency relied on lead time assumptions for the introduction of technologies based on technology availability and its fuel saving benefits. The Alliance, Sierra Research, and most vehicle manufacturers argued that our application rates and timing did not adequately consider technology readiness and the typical automotive product lifecycle in proposing the Unreformed CAFE standards. Honda and Toyota cited the NAS report, which stated that "the widespread penetration of even existing technologies will probably require 4 to 8 years." [104] Honda and Toyota supported the NAS findings with regard to lead time assumptions.

Underscoring the importance of lead time, Toyota asked NHTSA to propose CAFE standards for model years beyond 2011 as soon as possible in order to afford the manufacturers an opportunity for timely product development and planning. Toyota argued that in Japan and Europe, fuel economy targets for the 2008 to 2010 model years have been in place since 1999 and 2000 respectively.

Manufacturers offered the following specific arguments in favor of reduced phase-in rates and extending lead time.

Product cycles and finite engineering resources. The commenters argued that technologies cannot be incorporated in every vehicle at the same time due to capital costs, differing vehicle and powertrain planning cycles, and engineering resource constraints, both at the manufacturer level as well as at the supplier level. As DaimlerChrysler explained, resource constraints dictate that a new technology is first integrated into a single product and later deployed fleet-wide. Similarly, Ford argued that there are not enough resources available to develop and implement multiple technologies simultaneously across the entire product lineup within a short period of time. Toyota stressed that the lead time is not how long it takes to develop a given technology, but how long it takes to incorporate this technology into different vehicle configurations. The manufacturers stated that product cycles are typically staggered so that not all light trucks undergo changes in the same timeframe. These commenters argued that in order to realistically reflect the manufacturers' capabilities, the Stage Analysis should stagger technology application and avoid projecting fleet-wide application of any one technology within a single model year.

With respect to the actual duration of product cycles, different manufacturers argued that for light trucks, they last from at least 5 to more that 8 years. Further, they argued that the product and technology plans for each model are usually finalized several years prior to their introduction. Manufacturers stated that after design decisions affecting the powertrain are "frozen," it is nearly impossible to implement any major changes to address fuel economy.

Incorporating "off-the-shelf" technologies. The Alliance and vehicle manufacturers argued that even readily available "off-the-shelf" technology cannot be simply bolted onto an existing vehicle because integrating any technology into the vehicle is a complex task requiring advance preparations, not just with respect to vehicle integration, but also with respect to the automated assembly lines. They also argued that the manufacturers need time to ensure that the new technology is optimized not just for vehicle integration and assembly, but also for serviceability and customer satisfaction in-use. The manufacturers also argued that NHTSA should not assume that manufacturers can readily adopt "off-the-shelf" technologies from one vehicle application to another.

Customer acceptance. The Alliance and vehicle manufacturers argued that incorporation of specific technologies is also dependent upon customer acceptance. For example, DaimlerChrysler argued that a premature fleet-wide application of new technology could result in widespread customer rejection, which can be avoided if a given technology is slowly phased in and allowed to mature. Many commenters also argued that simultaneous fleet-wide incorporation of new technology raises product quality and durability concerns that could affect customer acceptance. For example, Honda argued that new technologies need to be "piloted" on a limited number of vehicles, to ensure

[104] Honda comment p. 6, and Toyota comment p. 3, quoting the NAS report.

adequate quality before being spread to a wider number of sales.

The agency recognizes that vehicle manufacturers must have sufficient lead time to incorporate changes and new features into their vehicles. In making its lead time determinations, the agency considered the fact that vehicle manufacturers follow design cycles when introducing or significantly modifying a product. For the final rule, the agency based our lead time assumptions more closely on the findings of the NAS report, typically relying on the mid-point of the NAS range for full market penetration, *i.e.*, 6 years or approximately a 17 percent phase-in rate. As illustrated in Appendix B of this document, and as discussed further below, the agency made numerous adjustments to timing when applying technologies in order to address lead time concerns.

D. Technology Effectiveness and Practical Limitations

The Alliance, General Motors, DaimlerChrysler, Ford, Toyota, and Sierra Research argued that the agency overstated potential fuel economy benefits of certain technologies in its analyses. The manufacturers argued that benefits assigned to a given technology are not the same for every vehicle. Instead, these commenters asserted, actual fuel economy benefits depend on vehicle characteristics. Additionally, the Alliance, Toyota, DaimlerChrysler, Ford, and General Motors argued that the agency's analyses incorporate a number of technologies that have not yet been fully developed or have implementation issues that limit their wide-spread availability. Manufacturers provided the following examples of instances in which they believe the agency overestimated fuel saving potentials or applied technologies in an overly aggressive manner:

• Aerodynamic Drag Reduction—Manufacturers stated that some aerodynamic changes could impact vehicle compatibility and result in styling constraints that could affect consumer demand;

• Improved Rolling Resistance—These commenters stated that recently improved Federal tire safety standards are so stringent they limit the availability of low rolling resistance tires. Further, these commenters stated that consumers demand all-season tires that perform well in winter weather conditions but sacrifice rolling resistance.

• Variable Valve Lift and Timing—Manufacturers stated that benefits of this technology must be offset by friction due to the increased number of sliding components required for a 2-step lift system, and by increased oil pump losses due to the need for more oil pump capacity. Further, these commenters stated that application of this technology to a multi-valve base engine will not result in sufficient incremental performance improvement to allow downsizing the engine;

• Hybrids and Diesels—Manufacturers asserted that the fuel economy benefit of hybrids varies depending on the type of hybrid, the application, and the driving cycle. With respect to diesels, manufacturers stated that widespread customer acceptance is still to be determined due to higher costs, past experience with older diesel technology, and challenges faced by manufacturers regarding Tier 2 and LEV II emissions compliance.

The manufacturers also argued that some estimates did not account for synergy or ''system effects.'' That is, when multiple technologies that address the same opportunity for improvement (*e.g.*, pumping losses) are combined, their effectiveness is diminished because they address the same type of loss. Thus, the manufacturers argued that the lack of a full examination of ''system effects'' has resulted in a set of projected fuel economy improvements that overestimate the technologies' combined capabilities. With respect to hybrid engines, several manufacturers argued that the fuel economy benefit of hybrid vehicles varies depending on the type of hybrid, the application, and the driving cycle.

In contrast, environmental organizations generally stated that the agency underestimated the availability of fuel saving technologies. These commenters generally held that existing technologies could be applied to manufacturers' fleets and result in fuel economy performances in excess of 26 mpg. The Union of Concerned Scientists stated that the agency underestimated the availability of hybrids, and noted that Toyota has stated that it plans for hybrids to account for 25 percent of its sales by early next decade. The Union of Concerned Scientists also cited Ford's goal of having the capacity to produce 250,000 hybrids by 2010. The comment provided by Sierra Club, U.S. PIRG, and NET described a study in which ''existing fuel saving and safety technology'' applied to a Ford Explorer would result in a 71 percent improvement in fuel economy.[105]

We note that the hybrid numbers cited by the Union of Concerned Scientists refer to Ford's goal for introducing hybrids in both its light truck fleet and its passenger car fleet. With respect to the study cited by Sierra Club *et al.*, the technology applications applied to the Ford Explorer have not all been proven to be feasible through application in a production vehicle.

With respect to ''systems effects,'' NHTSA's analysis used fuel economy benefit values that account for the diminished effectiveness that one technology may have when used in concert with other similar technologies. For instance, a number of technologies reduce an engine's pumping losses. For these technologies, NAS offers two fuel economy benefit values—a higher value for a ''baseline'' engine, with no such technologies applied, and a lower value for a ''reference'' engine with pumping loss partially reduced. The difference between the ''reference'' and ''baseline'' values is an estimate of the synergistic effect that results from applying similar technologies to the same vehicle. Whenever an additional technology is selected for a vehicle that already has one or more similar technologies, NHTSA always chooses the lower value to account for these synergies.

E. Technology Incompatibility

The Alliance, DaimlerChrysler, Ford, General Motors, Nissan, and Toyota argued that certain technologies projected in the agency analyses are incompatible with their vehicle or engine architecture. While their specific comments regarding NHTSA's technology projections are confidential, we are able to provide some generic examples.

Manufacturers argued that not all engines are readily compatible with cylinder deactivation. For some, incorporation of this technology would require substantial investment and engineering resources. Similarly, manufacturers argued that switching from a single overhead cam design to a dual overhead cam design would, in some instances, require a complete engine redesign. Manufacturers also argued that because of greater torque, CVTs are not compatible with heavier vehicles equipped with large V8 engines. Instead, they work best on lighter light trucks based on passenger car platforms. Similarly, manufacturers argued that electrical power steering is compatible with only smaller light trucks, unless the heavier vehicles were also switched to 42-volt electrical systems. At least one manufacturer asserted that low friction oil might be incompatible with some engine designs

[105] Friedman *et al.*, Building a Better SUV: A Blueprint for Saving Lives, Money and Gasoline. Union of Concerned Scientists and the Center for Auto Safety. September 2003.

and expressed concerns about the availability of low friction oil in some markets. Finally, the manufacturers argued that because of the consumer demand and expectations for off-road capabilities, all-season traction, and greater stopping performance, low rolling resistance tires are incompatible with some light truck models.

In applying technology in the Stage Analysis and the Reformed CAFE analysis to determine the final standards, the agency carefully considered the manufacturers' comments and confidential product plan information to adjust our calculations. In some instances, the manufacturers' comments reflected strategies already employed in the agency's analysis. For example, the NPRM analysis did not apply CVTs to larger light trucks equipped with V8 engines. Further, the technologies that turned out to be incompatible with certain vehicles were removed from the Stage Analysis. When it was practicable to do so, the agency substituted different technology applications that were compatible with those vehicles. As explained above, the detailed description of the adjustments made to the Stage Analysis contains confidential information and is not publicly available. However, Appendix A of this document and the FRIA provide a description of the steps taken in order to address the issue of incompatible technologies (see FRIA p. VI–10).

F. Weight Reduction

In the analyses for the NPRM, we included the possibility of limited vehicle weight reduction for vehicles over 5,000 lbs. curb weight where we determined that weight reduction would not reduce overall safety and would be a cost effective choice.[106] Use of the 5,000 lbs cut-off point was based on analysis in the Kahane study. The Kahane study found that the net safety effect of removing 100 pounds from a light truck is zero for light trucks with a curb weight greater than 3,900 lbs.[107] However, given the significant statistical uncertainty around that figure, we assumed a confidence bound of approximately 1,000 lbs. and used 5,000 lbs. as the threshold for considering weight reduction.[108]

Several commenters supported our assumption that manufacturers could respond to the CAFE standards with limited weight reductions that would not reduce safety. Conversely, several commenters stated that any weight reduction will lead to a reduction in safety. These comments are discussed below.

Before discussing the comments, we would like to clarify that our analysis does not mandate weight reduction, or any specific technology application for that matter. We performed the analysis for the NPRM and the final rule on the assumption that manufacturers would find it cost-effective to cut some weight out of light trucks that have a curb weight greater than 5,000 lbs. Our analysis relied exclusively on other fuel-saving technologies for lighter light trucks to demonstrate that manufacturers can comply with the required fuel economy levels established today without the need for unsafe compliance measures.

Honda cited several reports, which it asserted demonstrated that limited weight reductions would not reduce safety and could possibly decrease overall fatalities. Honda stated that the 2003 study by DRI found that reducing weight without reducing size slightly decreased fatalities, and that this was confirmed in a 2004 study by DRI that assessed new data and methodology changes in the 2003 Kahane Safety Study. Honda asserted that the DRI results tend to confirm ''that curb weight reduction would be expected to decrease the overall number of fatalities.''

DRI submitted an additional study, *Supplemental Results on the Independent Effects of Curb Weight, Wheelbase, and Track Width on Fatality Risk in 1985–1998 Model Year Passenger Cars and 1985–1997 Model Year LTVs,* Van Auken, R.M. and J. W. Zellner, May 20, 2005. This DRI study concluded that reductions in footprint are harmful to safety, whereas reductions in mass while holding footprint constant would benefit safety. The DRI study disagreed with NHTSA's finding that mass had greater influence than track width or wheelbase on the fatality risk of passenger cars in non-rollover crashes.

The Union of Concerned Scientists stated that recent studies indicate that increases in weight have very little impact. However, the Union of Concerned Scientists did not cite any specific study. Further, Environmental Defense stated that the Kahane study on which the agency relied for determining the weight reduction limitations was flawed. Environmental Defense stated that the Kahane study[109] does not adequately distinguish between the effects of size and weight on motor vehicle accident mortality, despite the large body of evidence suggesting that other factors besides vehicle weight, such as vehicle size and design, have critical implications for vehicle safety.

While NHTSA agrees that limited weight reduction to heavier vehicles will not reduce safety, we continue to disagree with DRI's overall conclusion, cited by Honda, that weight reductions while holding footprint constant would significantly benefit safety in lighter vehicles. NHTSA's analyses of the relationships between fatality risk, mass, track width and wheelbase in 4-door 1991–1999 passenger cars (Docket No. 2003–16318–16) found a strong relationship between track width and the rollover fatality rate, but only a modest (although significant) relationship between track width and fatality rate in non-rollover crashes. Even controlling for track width and wheelbase—*e.g.*, by holding footprint constant—weight reduction in the lighter cars is strongly, significantly associated with higher non-rollover fatality rates in the NHTSA analysis. By contrast, the DRI study of May 20, 2005 analyzed 4-door cars and found a strong relationship between track width and fatality risk, and non-significant associations of mass and wheelbase with fatality risk (Docket No. 2005–22223–78, p. 31). In other words, when DRI analyzed the same group of vehicles as NHTSA, they did not get the same results. This difference indicates that DRI's analytical method and/or database are not the same as NHTSA's.

The agency continues to stand by our analytical method and database and we continue to believe that weight reduction in lighter vehicles would reduce safety. We also continue to believe that weight reductions in the heavier light trucks, while holding footprint constant, will not likely result in net reduction in safety.

IIHS expressed similar concern with weight reduction as the agency, stating that the safety cost of reduced mass would be most apparent if the weight reductions were to occur among the smallest and lightest vehicles. Referencing the 2003 Kahane report, IIHS indicated that decreases in mass among vehicles weighing more than

[106] The amount of projected weight reduction was two percent for light trucks with a curb weight between 5,000 and 6,000 lbs and up to four percent for light trucks with a curb weight over 6,000 lbs.

[107] Kahane, Charles J., PhD, Vehicle Weight, Fatality Risk and Crash Compatibility of Model Year 1991–99 Passenger Cars and Light Trucks, October 2003. DOT HS 809 662. Page 161. Docket No. NHTSA–2003–16318 (*http://www.nhtsa.dot.gov/cars/rules/regrev/evaluate/pdf/809662.pdf*)

[108] See the discussion of ''Effect of Weight and Performance Reductions on Light Truck Fuel Economy'' in Chapter V of the PRIA.

[109] See footnote 90.

5,000 pounds could result in a net safety benefit. However, IIHS continued to caution that reducing mass reduces, on average, a vehicle's ability to protect its occupants, noting that the effects of mass on vehicle crashworthiness have been observed and documented (Kahane, 1997; Partyka, 1996; O'Neill *et al.*, 1974).

General Motors and the Alliance were more explicit in their concerns over the safety impact associated with weight reduction. The Alliance stated that the fundamental laws of physics dictate that smaller and/or lighter vehicles are less safe than larger/heavier counterparts with equivalent safety designs and equipment.

General Motors agreed that improvements in material strength, flexibility, and vehicle design have helped improve overall vehicle and highway safety. But, General Motors added, for a given vehicle, reducing mass generally reduces net safety. Further, General Motors stated that it does not intentionally reduce mass by replacing it with advanced materials, presuming that such action alone will result in improved protection for the occupants in a lighter vehicle: vehicles with larger mass will provide better protection to occupants involved in a crash than a vehicle of the same design with less mass, given equivalent crashes.

General Motors also questioned the agency's reliance on a 5,000 lbs. minimum vehicle weight for considering weight reduction, which was based on the finding of the 2003 Kahane report that reducing curb weight negatively impacts safety only at curb weights under 3,900 pounds. General Motors stated that the agency's conclusion is inconsistent with the sensitivity analysis performed by William E. Wecker Associates, Inc. and submitted to the ANPRM docket. General Motors stated that the inflection point on the Wecker report's graph for General Motors light trucks in both the periods of MYs 1991–1995 and MYs 1996–1999 is higher than 5,000 pounds.

Additionally, General Motors stated that the NPRM did not acknowledge or rationally respond to the main point of the Wecker report, which was that Dr. Kahane's ''analysis alone does not support the proposition that a crossover weight at or near 5,085 pounds is a robust, accurate description of the field performance of the [light truck] fleet[.]''

We believe that General Motors is confusing the 5,085 lbs. crossover weight (where the safety effect of mass reduction in a vehicle weighing exactly 5,085 lbs., is zero) with the breakeven point described in the NPRM, which is the point where the total effect of reducing all vehicles heavier than the breakeven weight by an equal amount is zero. NHTSA estimated that the breakeven point as described in the NPRM is 3,900 lbs., if footprint is held constant.

If the 3,900 lbs. estimate were perfectly accurate, we would be confident that weight reductions in vehicles down to 3,900 pounds would not result in net harm to safety. However, we agree with commenters that there is considerable uncertainty about the crossover weight and also the breakeven point. Therefore, in our analysis, we limited weight reduction to vehicles with a curb weight greater than 5,000 pounds. We believe that the 5,000 lbs. limit is sufficient so that we can be confident that such weight reductions will not have net harm on safety.

SUVOA encouraged NHTSA to emphasize the importance of making sure that CAFE requirements do not encourage vehicle downsizing ''or any other action that might have an adverse effect on safety.'' SUVOA cited several reports in support of its assertion that downsizing harms safety.[110]. As explained above, the agency has applied weight reduction only to those vehicles for which we are confident that such reduction will not negatively impact safety.

The Competitive Enterprise Institute stated that the agency's own rulemaking demonstrates the safety of weight, specifically the FMVSS No. 216, *Roof crush,* rulemaking. The Competitive Enterprise Institute noted that in that rulemaking, NHTSA determined that the proposed requirement of more protective roofs would ''add both cost and weight'' to the vehicles. This commenter also stated that NHTSA found that the stronger the roof crush standard, the more added weight it would entail. The Competitive Enterprise Institute also cited the IIHS, March 19, 2005 Status Report on fatality risks in different vehicles, which the commenter stated concluded that in each vehicle group, ''the heavier vehicles, like bigger ones, generally had lower death rates.''

The weight safety analysis performed by the agency for this rulemaking accounted for not only the occupant safety (crashworthiness) of the vehicle, but also the rollover propensity of the vehicle, and the safety of the occupants of other vehicles it strikes. While in some instances, the crashworthiness of a vehicle can be improved through design changes that add weight to a vehicle, design changes can also reduce a vehicle's weight without reducing crashworthiness, and may in some instances improve the safety of a vehicle (*e.g.*, reduce rollover propensity).

Environmental Defense commented that by limiting the use of weight reduction to heavier vehicles, the agency disregarded the likelihood that manufacturers would rely on weight reduction in smaller, lighter vehicles. Environmental Defense suggested that the improved baselines should reflect this weight reduction strategy.

Environmental Defense asserted that weight reduction is among the most common and cost-effective options available to manufacturers for improving vehicle fuel economy across the light truck fleet. However, Environmental Defense referenced estimates presented in DeCicco (2005) that suggest that the cost per pound of weight reduced through use of high-strength steel and advanced engineering techniques has been as low as, or lower than, 31 cents per pound reduced.

Moreover, Environmental Defense stated, the exclusion of mass reduction in NHTSA's analysis bears no relation to what will actually happen in the marketplace when standards are implemented. Environmental Defense argued that absent safety regulations prohibiting the use of mass reductions, manufacturers are likely to choose this compliance alternative in vehicles of all weights as a cost effective way to comply with CAFE. Environmental Defense stated that NHTSA should include mass reduction among its compliance alternatives for all light trucks.

As stated above, the agency does not dictate which fuel savings technologies must be applied to vehicles. Mass reduction is a compliance alternative for all light trucks. However, one of the considerations in setting fuel economy standards is to set standards that will not lead to a reduction in the safety of the light truck fleet. The standards established by the agency are those capable of being achieved by the manufacturers without the need to

[110] SUVOA provided the following cites in support of its assertion:

- 2001, the National Academy of Sciences affirmed that earlier downsizing of vehicles following the imposition of CAFE regulations resulted in an additional 1,300 to 2,600 deaths and an additional 20,000 serious injuries per year.
- A Harvard School of Public Health-Brookings Institution study in the 1990s found that vehicle downsizing due to federal fuel economy mandates increased occupant deaths by 14 to 27 percent.
- An in-depth analysis by USA Today in 1999, using NHTSA and automobile insurance industry data, found that since 1975, 7,700 additional deaths occurred for every mile per gallon gained. By 1999, vehicle downsizing had killed more than 46,000 Americans. Factoring in the ensuing six years through 2005, the total conservatively eclipses 55,000 deaths.

reduce safety. If the agency were to consider weight reduction as a compliance option for all light trucks, we are concerned that the resulting increased stringency would force unsafe downweighting.

VIII. Economic Assumptions

A number of commenters raised global issues related to the agency's proposed CAFE standards, questioning everything from how costs and benefits were calculated to whether the standard is necessary or beneficial at all. Aside from raising issues with specific economic assumptions relied upon by the agency, commenters also more broadly questioned the rationale of the light truck CAFE program in general.

The Competitive Enterprise Institute (CEI) argued that NHTSA's proposed CAFE standards are unnecessary and that they could potentially increase the nation's dependence on foreign oil. CEI argued that particularly since the 2005 hurricane season dramatically drove up fuel prices at the pump, vehicle sales of large SUVs and other relatively inefficient vehicles have plummeted. According to CEI, market forces have acted to improve the overall fuel economy of new vehicles without the need for regulatory intervention. (General Motors made a similar argument, as to how fuel economy standards are less efficient than market forces in terms of achieving economically optimal levels of fuel economy.)

Although the effect of market forces on fuel economy levels is a matter of debate, NHTSA does not have the option of leaving fuel economy to the markets. The agency is required by Congress to set light truck fuel economy standards for every model year at the maximum feasible level considering the need of the nation to conserve fuel, technological feasibility and economic practicability.

A. Costs of Technology

The Alliance, Sierra Research and most vehicle manufacturers argued that NHTSA has underestimated the costs of certain technologies. Specific comments are set forth below.

First, General Motors stated that the costs relied upon by the agency were derived from technologies designed for application to passenger cars, but which are being applied to light-duty trucks without consideration of the necessary adjustments for integrating such technologies while maintaining the truck's utility and function. For example, for heavier light trucks, installation of electric power steering would also require a switch to a 42-volt electrical system, and probably increased battery maintenance costs. General Motors argued that the additional costs associated with integrating technologies available on light vehicles into heavier vehicles was one of the primary reasons for the discrepancy between their internal costs estimates and NHTSA's costs estimates in the PRIA. General Motors further argued that both NAS and the estimates of Energy and Environmental Analysis (a consulting firm), inadequately document sources for the costs they include.

The Alliance, Ford, Honda, Nissan and DaimlerChrysler reiterated that technologies are not simply bolted onto the vehicle. Instead, extensive modifications are often required. These modifications involve a substantial investment. For example, the cost estimates of a given piece of engine technology do not include the costs of redesigning the engine, testing prototypes, mapping the engine, developing new vehicle calibrations, and integrating the technology with the vehicle. For this reason, Sierra Research and at least one vehicle manufacturer disagreed with the NAS cost multiplier of 1.4 and argued that it should be substantially greater.

For this rulemaking, the agency has decided to use the cost and effectiveness numbers that appear in the NAS report. The NAS committee reviewed many sources of information including presentations at public meetings, and available studies and reports. It also met with automotive suppliers and industry consultants including Sierra Research. The committee then used its expertise and engineering judgment aided by the information described above to derive its own estimates of costs and effectiveness. After the prepublication copy was released in July 2001, the committee reexamined its analysis. Representatives from the industry and other stakeholders were invited to critique the findings. Several minor errors were discovered and corrected before publication of the final report.

The NAS cost and effectiveness numbers are presented as ranges that reflect estimates for passenger cars, pickup trucks, and SUVs/minivans. However, under the NAS report, the availability of these technologies differs for various segments of the vehicle fleet. The NAS report breaks down the availability of technology for two classes of pickups (small and large) and four classes of SUVs/minivans (small SUV, midsize SUV, large SUV, and minivan). Each class has a unique set of technologies available to it. While some individual technologies can be applied to any type of vehicle, the sets of technologies available to passenger cars are not the same as the sets of technologies available to light trucks. Thus, the costs assigned to passenger cars are not being used for light trucks because the technologies differ and each set of technologies has a unique cost estimate. Further, the cost estimates in the NAS report include consideration of costs for light trucks (NAS, p. 40).

Second, commenters argued that the agency did not consider ''stranded'' costs (General Motors, Sierra Research). For example, the stringency of the Unreformed CAFE standard may force a manufacturer to begin purchasing 6-speed transmissions from an external supplier immediately. Consequently, in-house manufacturing efforts for which considerable resources may have already been spent would be abandoned without any return on that investment. Sierra Research also argued that NHTSA has not properly accounted for costs associated with the premature retirement of existing technology before its costs have been fully amortized. Thus, commenters argued that NHTSA incorrectly assumed costs of technologies introduced during normal product cycle turnover even when the technologies were actually attributed to vehicles mid-cycle.

Stranded costs are essentially one time write-offs that would be difficult to identify and even more difficult to quantify, especially in light of their offsetting tax savings implications. Write-offs of stranded costs are likely to occur occasionally during the routine course of business as manufacturers periodically find it necessary to curtail production plans in response to unplanned regulatory or market impacts. These write-offs will thus influence the long run cost of doing business. Although manufacturers typically attempt to price vehicles to maximize their profits, the impact of stranded costs on vehicle prices will be constrained by market conditions, and measuring their impact would be problematic.

As explained above in the technology discussion, the agency has constrained its fuel economy model to give deference to manufacturers' production plans. In determining manufacturer capabilities, significant design changes are initiated in conjunction with redesigns and vehicle introductions stipulated in production plans provided to NHTSA by vehicle manufacturers. The potential for stranded costs is thus minimized. Overall, NHTSA does not believe that the revised phase-in schedule of technologies assumed in its model would force manufacturers to incur significant stranded costs.

B. Fuel Prices

Many commenters stated that the fuel price estimates used in the agency's analysis and modeling were too low and should be revised to reflect the best current projections of market prices (SUVOA, NADA, Mercatus Center, Union of Concerned Scientists, and California State Energy Commission). Environmental organizations, citing the record prices for fuel at the pump, went further, arguing that more stringent standards are justified (Environmental Defense, NRDC, ACEEE).

In contrast, vehicle manufacturers requested that the agency not rely solely on higher fuel price forecasts to automatically increase the stringency of the CAFE standards (the Alliance, General Motors, Mitsubishi). Such commenters urged the agency to not allow CAFE standards to rise precipitously based upon a spike in oil commodity prices, thereby disregarding technology costs and other limitations. Specific comments related to fuel prices follow below.

Environmental Defense argued that NHTSA's fuel prices estimates in its CAFE proposal, based upon AEO2005, are too low. While Environmental Defense acknowledged NHTSA's stated intention to revise its fuel prices estimates in light of AEO2006 projections, it argued that even this forecast may be too low, particularly in light of private oil prices estimates of $42 to $100 per barrel over the analysis period. Accordingly, Environmental Defense urged NHTSA to utilize the best available fuel price forecasts in revising the level of the standards in the final rule.

NRDC made a similar argument regarding the proposal's fuel prices estimates, which it perceives to be too low. To remedy this problem, NRDC recommended that the agency use fuel price forecasts consistent with the world oil price forecasts reported in EIA's ''High B Oil Price Scenario'' or the International Energy Agency's World Energy Outlook 2005 ''Deferred Investment Scenario,'' forecasts which NRDC suggested are more consistent with recent world oil prices and current petroleum futures market prices.

As another suggestion for revising the NPRM's fuel prices estimates, the California State Energy Commission stated that future fuel prices are likely to be at least as high as the ''Base Case'' scenario adopted in the 2005 Integrated Energy Policy Report for California, which forecasts retail fuel prices (including Federal and California State taxes). The Commission recommended using this forecast, which it argued is more consistent with current fuel prices. According to the commenter, recent EIA forecasts (at least since 1996) have significantly underestimated actual future fuel prices.

The Alliance stated that while higher gasoline price forecasts may appear to justify further increases in fuel economy levels, ''NHTSA must proceed carefully and consider all of the ramifications of moving to higher levels than those proposed.'' Along the same lines, General Motors commented that increased fuel prices could lead to significantly higher CAFE standards under NHTSA's model; according to General Motors, a recent study by Resources for the Future (RFF) found that increasing the price per barrel of oil by $20 would lead to a CAFE target as much as 4 mpg higher.

In its comments, General Motors also compared the American light truck fleet with the European light truck fleet, stating that Europeans pay approximately $5 per gallon for gasoline, yet their vehicles do not use technologies beyond those present in the U.S. fleet. An appendix to General Motors' comments further analyzed the differences in fuel economy between American and European vehicles, suggesting that the fuel economy of vehicles on both side of the Atlantic is roughly comparable, once other relevant factors are taken into account (e.g., vehicle weight, transmission type, engine power, engine type, and premium gas usage). General Motors asked the agency to explain this apparent discrepancy between real world experience in Europe and NHTSA's analysis.

General Motors also stated that NHTSA's analysis did use the proper value for the tax on gasoline, which the American Petroleum Institute (API) currently reports to be $0.46 per gallon.

Mitsubishi stated that fuel prices are currently in a state of flux and recommended using AEO2006 in the final rule. However, Mitsubishi cautioned that raising the fuel economy target levels, based upon higher fuel prices, might not be economically practicable and could force manufacturers to completely reanalyze their business strategies.

The Mercatus Center commented that as part of the final rule, the agency should increase its fuel price forecasts and take steps to adequately address likely future volatility on fuel prices. Specifically, the Mercatus Center recommended adjusting the baseline sale mix and fuel economy levels from manufacturer product plans for future model years to reflect shifts in sales patterns toward more fuel-efficient models resulting from current high fuel prices and buyer concerns about continued fuel price volatility. It also urged NHTSA to include a separate estimate of the economic value of reduced fuel price volatility expected to result from lower fuel use.

Several commenters also noted that the State gasoline taxes in some states were changing as of January 1, 2006 and that the agency should update their gasoline tax estimates accordingly.

The agency will continue to rely on the most recent fuel price projections from the EIA from the Department of Energy. We consider the EIA projections to be the most reliable long-range projections. No one can predict the impact of hurricanes and other external factors that could affect the price of gasoline at particular points in time or in the short term. However, what we need are long range projections for 2008 to 2011, when this CAFE standard takes effect. In addition, the EIA's AEO2006 Early Release is the most recent projection available, and considers the most recent events.

Further, while commenters recommended that the agency rely on higher fuel prices, no commenter provided an alternative forecast that the agency believes to be more reliable than those published by EIA as part of its Annual Energy Outlook (AEO). NRDC did recommend that the agency rely on fuel price forecasts consistent with the world oil price forecasts reported in EIA's AEO 2005 ''High B Oil Price Scenario'' or the International Energy Agency's World Energy Outlook 2005. The ''Reference Case Scenario'' presented in AEO 2006, which is relied upon by the agency in the final rule, is on average almost 14 cents per gallon higher than the scenario suggested by NRDC.

The latest fuel price projections are taken from the EIA's Annual Energy Outlook 2006 (AEO2006 Early Release) reference case, which is the most recent projection available, translated into 2003 economics to match other cost estimates in the analysis, and are extended until 2047 to match the 36 year lifetime for light trucks produced for MY 2011. The estimated gasoline price per gallon in 2003 economics varies over the time period, starting at $2.16 in 2008, reducing to $1.96 in 2014, and then increasing to $2.39 by 2047.

The agency will consider additional fuel price projections (higher and lower than the reference case) from EIA in its uncertainty analysis; however, there is no way to adequately predict or analyze the volatility of fuel prices.

Since gasoline taxes are a transfer payment and not a societal cost, the value of gasoline taxes is subtracted from the estimated gasoline price to estimate the value of gasoline to society. The agency has updated its estimates of gasoline taxes, using the January 1, 2006, update in State gasoline taxes. In 2003 economics, Federal taxes are $0.176 and State and local taxes average $0.262 for a total of $0.438.

As will be discussed in this document, the agency has carefully considered the broad ramifications of the final rule and alternative stringency levels, and has not increased the fuel economy levels solely on the basis of a projection of higher gasoline prices.

The agency does not see the value of trying to explain the difference in fuel prices and technology between Europe and the United States, as requested by General Motors. As General Motors points out in its comments, there are a variety of factors which differentiate the U.S. and Europe. These jurisdictions have different legal/regulatory frameworks, and their driving publics have different expectations, all of which vehicle manufacturers endeavor to accommodate. Thus, the fuel economy situations in Europe and the U.S. are not directly comparable and any such effort would entail an extensive analysis, which is likely to generate inconclusive results and which is well beyond the scope of this rulemaking.

C. Consumer Valuation of Fuel Economy and Payback Period

Commenters differed in terms of their recommended approach for properly assessing consumer valuation of fuel economy and the payback period for fuel-saving technologies. As discussed below, some commenters favored focusing on the preferences of individual consumers using a short-term perspective, while others recommended focusing on the societal benefits to all consumers over the long term.

General Motors requested that the agency compare consumer preference for fuel economy versus vehicle utility, in order to determine consumer valuation of improved fuel economy. General Motors also asked NHTSA to consider how many vehicle sales would be deferred due to CAFE-related price increases. According to General Motors, history has shown that consumers value fuel economy increases of up to 1.2 percent per year, so any higher standard forces consumers to accept a lower level of performance utility than they would otherwise choose. However, General Motors did state that consumers are well informed and extremely rational, arguing that car buyers are less concerned with fuel economy improvements when gasoline cost $1.50 per gallon, as compared to marginal improvements when gasoline costs $2.50 per gallon.

According to the NADA, recent new light truck sales data suggest that, despite higher fuel prices, consumers continue to rank fuel economy below other purchase considerations, such as capacity, convenience, utility, performance, and durability. Thus, NADA suggested that NHTSA's fuel economy standards should not be permitted to result in undue constraints on light truck product availability or in significant price increases, which could in turn result in reduced sales, profits, and workforces, and the retention of older vehicles with poorer fuel efficiency.

The California State Energy Commission commented that stringency levels of fuel economy targets should be established by considering the value of fuel savings from vehicle owners' perspective over the first few years of each model year's lifetime, rather than from a society-wide perspective. For example, the California State Energy Commission argued that consumers appear to attach some value to owning hybrid vehicles beyond the fuel savings they produce, sometimes paying large price premiums (up to $3,500 compared to equivalent gasoline-powered models) and waiting extended periods of time for such vehicles to become available. The commenter stated that the size of the hybrid vehicle market is expected to grow significantly by MY 2010. According to the California State Energy Commission, such consumer valuation considerations should be taken into account as part of the CAFE standards.

Conversely, Environmental Defense argued that technology application should be based on societal costs, not private costs, and that the agency needs to consider benefits over the lifetime of the vehicle, as opposed to the consumer time horizon of 4.5 years.

The CAFE program's most immediate impacts are on individual consumers, but regulating fuel economy also has a broader societal effect that must be considered. The agency believes that CAFE standards should reflect the true economic value of resources that are saved when less fuel is produced and consumed, higher vehicle prices, and, to the extent possible, any externalities that impact the broader society. Consumer's perceptions of these values may differ from their actual impacts, but they will nonetheless experience the full value of actual fuel savings just as they will pay the full increased cost when the vehicle is purchased. Moreover, owners will realize these savings throughout the entire on-road life of each vehicle. While initial purchasers will only experience fuel savings for the limited time they typically own a new vehicle (4.5 years), subsequent (used vehicle) purchasers will continue to experience savings throughout the vehicle's useful life. The agency does restrict its analysis of sales impacts to the initial 4.5 year period under the assumption that initial buyer's purchase behavior will be influenced only by their perception of benefits they will receive while owning the vehicle, as opposed to benefits flowing to subsequent owners. However, the agency believes that the lifetime value of impacts from CAFE improvements should be fully reflected in its analysis of societal impacts.

D. Opportunity Costs

The Alliance commented that, in proposing its fuel economy standards, NHTSA did not consider the opportunity costs to consumers who may be forced to forego incremental improvements in vehicle performance, safety, capacity, comfort, and aesthetics (citing a 2003 study by the Congressional Budget Office (CBO) titled, ''The Economic Costs of Fuel Economy Standards Versus a Gasoline Tax,'' Chapter 2, pages 1–5). The Alliance also cited a recent study which found that a CAFE increase of 3 mpg results in a hidden tax of $0.78 per gallon of fuel conserved.[111] General Motors added that to the extent the CAFE standards force trade-offs between fuel economy and other vehicle attributes that consumers value, consumer welfare will be reduced and ''lost opportunity costs'' will be imposed on vehicle manufacturers.

Further, General Motors argued that NHTSA's engineering and economic analyses are incomplete because they do not account for the potential economic harm to automobile companies (which are already facing difficult financial challenges) and their employees, and the analyses do not include producer and consumer welfare losses. General Motors stated the Congressional Budget Office estimated a consumer welfare loss of $230 per vehicle.

In response, the agency notes that the CBO report cited by General Motors and the Alliance is based on estimates of consumer's preferences over a period

[111] The Alliance cited this study as: Andrew N. Kleit, ''Impacts of Long-Range Increases in Fuel Economy (CAFE) Standard,'' *Economic Inquiry* (April 2004), pages 279–294.

from roughly 1980 through 2001. The CBO report states that ''Consumers' preferences over the past 15 or 20 years have led automakers to increase vehicles' size and horsepower, while holding gasoline mileage more or less constant.'' The CBO report also acknowledges that if consumers' tastes change significantly, the report's conclusions would be affected. The period examined by CBO corresponds to the period when automakers created and successfully marketed SUVs as an alternative to passenger cars for routine driving. For most of this period, gasoline prices were stable and low by historical standards. Near the end of the period, prices began to rise, but since that time they have reached levels that are more than double the typical price during the period. In response, consumers have shown a dramatic shift in their purchase preferences. Sales of small passenger cars and fuel-efficient hybrids have increased, while sales of large SUVs have dropped. Circumstances have, thus, already overtaken the assumptions regarding consumer preferences used in the CBO analysis. Moreover, the CBO analysis is based on a CAFE regulation that achieves an assumed 10 percent reduction in gasoline consumption, a greater reduction than that which would be accomplished by this regulation. Thus, the agency does not believe that the $230 loss in consumer welfare estimated in the CBO report is an appropriate measure of the impact of CAFE reform.

NHTSA acknowledges that there are potential shifts in consumer welfare which are not reflected in its model (e.g., if a manufacturer reduced horsepower as a strategy to improve fuel economy, some consumers would value that horsepower loss more than the fuel economy gain). However, it believes that measuring these impacts is problematic, especially in light of the recent dramatic shift in gasoline prices and geopolitical events surrounding the world oil supply. Moreover, the agency is using its model, not as an absolute standard, but rather as an initial measure to consider in setting standards. The agency is cognizant of the financial difficulty facing automobile manufacturers and is striving to minimize costs by scheduling improvements in such a way that they would coincide with normal design cycles. Further, the agency believes that incrementally improving fuel economy across the vehicle fleet will not deprive consumers of their choice of vehicles. A wide variety of vehicle types will continue to be available, and consumers' selection of vehicles should still reflect their judgments of the relative value of fuel economy versus horsepower at the margin.

E. Rebound Effect

The ''rebound effect'' refers to the tendency for vehicle owners to increase the number of miles they drive a vehicle in response to an increase in its fuel economy, such as would result from more stringent CAFE standards. The rebound effect occurs because an increase in fuel economy reduces vehicle owners' fuel cost per mile driven, which is the typically largest component of the cost of operating a vehicle. Because even with improved fuel economy this additional driving uses some fuel, the rebound effect somewhat reduces the fuel savings (and related benefits) that result when fuel economy increases. The rebound effect is usually expressed as the percentage by which vehicle use increases when the cost of driving decreases due to an increase in fuel economy and/or a decrease in the price of fuel.

Commenters expressed a variety of views regarding the agency's estimate of the rebound effect that would be anticipated in response to the new CAFE standards. While some reviewers suggested that the estimate of the rebound effect the agency used is too low (Alliance, General Motors), others suggested that it is too high (Environmental Defense, NRDC, ACEEE, Union of Concerned Scientists, California State Energy Commission). Specific comments related to the rebound effect are set forth below.

In general, manufacturers and their associations deemed the 20-percent rebound rate relied upon by the agency to be conservative. For example, the Alliance argued that a 20-percent rebound effect is overly conservative, based upon recent studies. Specifically, the Alliance stated that a recent study of variation in U.S. light-duty vehicle use among different states over the period from 1966 to 2001 by Small and Van Dender estimated a long-term rebound effect of 24 percent over the entire period covered by the study.[112] This estimate implies that a 10-percent increase in fuel economy, which translates into a 10-percent decrease in fuel cost-per-mile driven, would ultimately stimulate a 2.4-percent increase in average annual miles driven using vehicles whose fuel economy is improved. According to the Alliance, an independent analysis by the Small and Van Dender data found that despite those authors' claim that the rebound effect had declined during the period they studied, the rebound effect remained at 24.6 percent at the end of this period.[113] The Alliance opined that the rebound effect is probably on the order of 35 percent, although it did not supply any data to substantiate this estimate.

According to General Motors, previous studies of changes in household motor vehicle and appliance use in response to improvements in their energy efficiency (which is measured by fuel economy in the case of vehicles) have shown that the rebound effect lowers energy savings by 20–50 percent. General Motors agreed with the agency that the increased driving resulting from the rebound effect also imposes various external costs, including increased collisions and traffic congestion. General Motors stated that it commissioned four studies of the rebound effect, each of which concluded that the rebound effect would be approximately 25 percent. However, it did not provide copies of the referenced studies. As General Motors did not provide these studies, the agency was unable to evaluate them. Nevertheless, General Motors stated that 20 percent is adequate for calculations related to rebound effect. No other vehicle manufacturers commented on this issue.

The National Automobile Dealers' Association commented that fuel savings should clearly be adjusted to reflect the rebound effect, but did not recommend a specific value of the rebound effect.

In contrast to the above commenters, Environmental Defense argued that the agency has overestimated the rebound effect because it relies upon earlier studies in the literature that tended to miss significant effects of variables such as income growth, and that did not have sufficiently large datasets to capture long-term changes in vehicle use. Citing the same 2004 study by Small and Van Dender referred to in the Alliance comments,[114] which combined data for each of the 50 states over a 36-year period, Environmental Defense noted the authors' finding that the rebound effect had declined to 12.1 percent when measured over the period from 1997–2001, primarily as a consequence

[112] Kenneth A. Small and Kurt Van Dender, ''The Effect of Improved Fuel Economy on Vehicle Miles Traveled: Estimating the Rebound Effect Using U.S. State Data, 1996–2001, Paper EPE–014, University of California Energy Institute, 2005; item #1702 in NHTSA Docket 22223. An earlier version of the study is item 15 in the same docket.

[113] Robert Crawford, ''Review and Assessment of VMT Rebound Effect in California,'' RW Crawford Energy Systems, Sept. 2004.

[114] See footnote 95.

of the higher income levels that prevailed during those years than over the entire period covered by the study. Environmental Defense argued further that if income growth continues during the period analyzed under the CAFE proposal, Small and Van Dender's analysis indicates that the rebound effect would continue to decline. The analyses Environmental Defense presented in its comments used an estimate of 5 percent for rebound effect, and it also urged NHTSA to adopt a similarly low estimate of the rebound effect, which Environmental Defense argued is in keeping with the most recent research in this area.

Other commenters also urged NHTSA to adopt a lower rate for the rebound effect, and they generally referred to the study by Small and Van Dender to support their positions. For example, NRDC suggested using a 6-percent rate for the rebound effect over the lifetime of MY 2008–2011 vehicles, which it argued would correctly recognize the effect of anticipated future income growth. ACEEE urged the agency to use a 10-percent rate, a change which it suggested would increase the monetized social benefits of Reformed CAFÉ for MY 2011 vehicles by about $1.3 billion, or approximately 30 percent.

Again, relying on results from the Small and Van Dender study, the Union of Concerned Scientists recommended that NHTSA reduce the rebound effect rate to not more than 10 percent. The commenter stated that NHTSA offered no justification for choosing the upper end of its discussed range (10–20 percent), arguing that results for the last years of the period analyzed in the study supported a long-run rebound effect of 6.8 percent or lower. Accordingly, the Union of Concerned Scientists stated that NHTSA should adopt 10 percent as a reasonable and conservative estimate of the rebound effect, and asserted that doing so would increase the ''social optimum'' fuel economy targets for 2011 by 1.4–1.9 mpg.

The California State Energy Commission called for a rebound effect of 12 percent, which it believes is reflective of the long-term rebound effect of 12.1 percent for California estimated by Small and Van Dender.[115]

NHTSA notes that all commenters who recommended a lower value for the rebound effect than the 20 percent estimate used in the NPRM analysis relied exclusively upon the recent study by Small and Van Dender as evidence supporting a smaller rebound effect. While the agency regards the Small and Van Dender study as an important contribution to the extensive literature on the magnitude of the rebound effect, it does not regard the very low values for the rebound effect reported in that study as persuasive for several reasons.

Unlike the studies relied upon by the agency in developing its estimate of the rebound effect, the Small and Van Dender analysis remains an unpublished working paper that has not been subjected to formal peer review, so the agency does not yet consider the estimates it provides to have the same credibility as the published and widely-cited estimates it relied upon.[116] The agency's interpretation of previously published estimates is that they support a range of 10–30 percent for the rebound effect in vehicle use. The agency elected to use the midpoint of that range in its analysis for the NPRM. If a peer-reviewed version of the Small and Van Dender study is subsequently published, the agency will consider it in developing its own estimate of the rebound effect for use in subsequent CAFE rulemakings.

After reviewing the various comments on the NPRM, the agency has elected to continue using a value of 20 percent for the rebound effect in its analysis of potential fuel savings from stricter CAFE standards for MY 2008–2011 light trucks. The agency will continue to monitor newly published research on the rebound effect (as well as on other critical parameters affecting fuel savings from CAFE regulation), and it will revise the estimates of the rebound effect it employs in future analyses of fuel savings if it concludes that new evidence points persuasively toward a different value.

F. Discount Rate

Discounting future fuel savings and other benefits is intended to measure the reduction in the value to society of these benefits when they are deferred until some future date rather than received immediately. The discount rate expresses the percent decline in the value of these benefits—as viewed from today's perspective—for each year they are deferred into the future. The agency used a discount rate of 7 percent per year to discount the value of future fuel savings and other benefits when it analyzed the CAFE standards proposed in the NPRM.

The Alliance, General Motors, the Mercatus Center, and Criterion Economics all argued that in assessing benefits and costs associated with the CAFE standards, the agency should rely on a discount rate greater than 7 percent. The Alliance stated that the Congressional Budget Office discounts consumers' fuel savings at a rate of 12 percent per year and that other recent studies of CAFE standards have also used that rate. According to the Alliance, that rate is slightly higher than the average interest rate that consumers reported paying to finance used car purchases in the most recent Consumer Expenditure Survey.[117] The Alliance argued further that consumers can be expected to discount the value of future fuel savings at a rate at least as high as their cost for financing the purchase of a vehicle whose higher price was justified by its higher fuel economy.

The Alliance based its assertion for use of 12 percent because, as it stated, this value was used in the NAS report and approximates the used car loan rate published in the Consumer Expenditure Survey. However, we note that the NAS report did not use a single discount rate. Instead, the NAS used both 12 percent and 0 percent discount rates due to the assumption that the proper discount rate was ''subjective.'' Therefore, NAS did not advocate a discount rate. As explained below, the vehicle loan rate faced by consumers is an appropriate measure of the discount rate.

General Motors suggested a discount rate of 9 percent, based on its assertions that new vehicles are financed at 8 percent and used vehicles at 10 percent. Essentially, General Motors is recommending that the agency rely on the interest for a car loan as the discount rate. General Motors also argued that fuel economy is not the only thing

[115] Kenneth A. Small and Kurt Van Dender, ''The Effect of Improved Fuel Economy on Vehicle Miles Traveled: Estimating the Rebound Effect Using U.S. State Data, 1996–2001, Paper EPE–014, University of California Energy Institute, 2005, Docket 22223–1702, Table 5, p. 19.

[116] These include, among others, David L. Greene, ''Vehicle Use and Fuel Economy: How Big is the Rebound Effect?'' The Energy Journal, 13:1 (1992), 117–143; David L. Greene, James R. Kahn, and Robert C. Gibson, ''Fuel Economy Rebound Effect for Household Vehicles,'' The Energy Journal, 20:3 (1999), 1–21; Jonathan Haughton and Soumodip Sarkar, ''Gasoline Tax as a Corrective Tax: Estimates for the United States,'' The Energy Journal, 17:2, pp. 103–126; S.L. Puller and L.A. Greening, ''Household Adjustment to Gasoline Price Changes: An Analysis Using Nine Years of U.S. Survey Data,'' Energy Economics, 21:1, pp. 37–52; Jones, Clifton T., ''Another Look at U.S. Passenger Vehicle Use and the 'Rebound' Effect from Improved Fuel Efficiency, The Energy Journal, 14:4 (1993), 99–110; and Goldberg, Pinelopi Koujianou, ''The Effects of the Corporate Average Fuel Efficiency Standards in the U.S.,'' The Journal of Industrial Economics, 46:1 (1998), 1–33.

[117] The Consumer Expenditure Survey (CE) program consists of two surveys collected for the Bureau of Labor Statistics by the Census Bureau—the quarterly Interview survey and the Diary survey—that provide information on the buying habits of American consumers, including data on their expenditures, income, and consumer unit (families and single consumers) characteristics. *http://www.bls.gov/cex/home.htm.*

which consumers value and that the agency should take efforts to separate private benefits from public externalities. While we are uncertain as to what General Motors is recommending, we assume that its comment suggests that a higher discount rate, based on car loan rates, is appropriate for discounting private benefits (those to buyers), while a lower rate is appropriate for social benefits (such as reductions in externalities). Criterion Economics also recommended use of a 9 percent discount rate in its comments, which it suggested is a conservative rate between the average real rates for new and used cars that adequately accounts for volatility in future energy prices.

As discussed further below, we agree in that loan rates for new and used cars should be considered when determining the appropriate discount rate. However, loan estimates made by both General Motors and Criterion Economics are considerably higher than data provided by the Federal Reserve Board, which estimates new loan rates (as of October 2005) of 6 percent for new cars and 9 percent for used cars.[118]

The Mercatus Center stated that the 7 percent discount rate selected by the agency is too low, and as a result, it results in the setting of standards that are inequitable, particularly to low-income households. According to published academic research referenced by the Mercatus Center, most households have discount rates higher than 7 percent, with low-income households having particularly high discount rates. Therefore, the Mercatus Center urged NHTSA to rely on discount rates of 12 percent for all households and as high as 20 percent for low-income households in evaluating proposed standards. However, the studies cited by Mercatus Center to justify these discount rates examine the implied discount rate for future energy savings that result when households purchase more energy-efficient appliances such as furnaces and air conditioners. These studies were generally conducted in the late 1970's and early 1980's and may not be representative of the discount rates for motor vehicles of the economic conditions 20–25 years later.

Environmental Defense, NRDC, and the Union of Concerned Scientists provided comments endorsing use of a lower discount rate. These organizations expressed their belief that a 7-percent discount rate is too high, proposing instead a rate of 3 percent. Environmental Defense and NRDC stated that OMB Circular A–4, *Regulatory analysis* (2003), recommends a discount rate of 3 percent when the regulation directly affects private consumption. These commenters asserted that the proposed CAFE regulation primarily and directly affects private consumption (i.e., by affecting the sales price of new vehicles and reducing the per-mile cost of driving). NRDC also argued that OMB Circular A–4 further indicates that lower rates may be appropriate for rules that produce benefits over multiple generations. Thus, these commenters recommended that a discount rate reflecting the social rate of time preference (i.e., a 3 percent real rate) should be used.

In response to Environmental Defense, the Union of Concerned Scientists, and NRDC, the guidelines in OMB circular A–4, New Guidelines for the Conduct of Regulatory Analysis, state that the agency should analyze the costs and benefits of a regulation at 3 percent and 7 percent discount rates, as suggested by guidance issued by the federal OMB.[119] The 3 percent and 7 percent rates reflect two potential evaluations of impacts: Foregone private consumption and foregone capital investment, respectively. In accordance with these guidelines, the agency analyzes the impacts of costs and benefits using both discount rates. However, this guidance does not state what discount rate should be used to determine the standards.

There are several reasons for the agency's choice of 7 percent as the appropriate discount rate to determine the standards. First, OMB Circular A–4 indicates that this rate reflects the economy-wide opportunity cost of capital. The agency believes that a substantial portion of the cost of this regulation may come at the expense of other investments the auto manufacturers might otherwise make. Several large manufacturers are resource-constrained with respect to their engineering and product-development capabilities. As a result, other uses of these resources will be foregone while they are required to be applied to technologies that improve fuel economy.

Second, 7 percent is also an appropriate rate to the extent that the costs of the regulation come at the expense of consumption as opposed to investment. As explained below, the agency believes a car loan rate is an appropriate discount rate because it reflects the opportunity cost faced by consumers when buying vehicles with greater fuel economy and a higher purchase price. The agency assumed that a majority of both new and used vehicles is financed and since the vast majority of the benefits of higher fuel economy standards accrue to vehicle purchasers in the form of fuel savings, the appropriate discount rate is the car loan interest rate paid by consumers.[120]

According to the Federal Reserve, the interest rate on new car loans made through commercial banks has closely tracked the rate on 10-year treasury notes, but exceeded it by about 3 percent.[121] The official Administration forecast is that real interest rates on 10-year treasury notes will average about 3 percent through 2016, implying that 6 percent is a reasonable forecast for the real interest rate on new car loans.[122] During the last five years, the interest rate on used car loans made through automobile financing companies has closely tracked the rate on new car loans made through commercial banks, but exceeded it by about 3 percent.[123] Consideration is given to the loan rate of used cars because some of the fuel savings resulting from improved fuel economy accrue to used car buyers. Given the 6 percent estimate for new car loans, a reasonable forecast for used car loans is 9 percent. Since the benefits of fuel economy accrue to both new and used car owners, a discount rate between 6 percent and 9 percent is appropriate. Assuming that new car buyers discount fuel savings at 6 percent for 5 years (the average duration of a new car loan)[124] and that used car buyers discount fuel savings at 9 percent for 5 years (the average duration of a used car loan),[125] the single constant discount rate that yields equivalent present value fuel savings is very close to 7 percent.

Further, reliance on the consumer borrowing rate is consistent with that of the Department of Energy (DOE) program for energy efficient appliances. For more than a decade, the Department of Energy has used consumer borrowing interest rates or ''finance cost'' to discount the value of future energy

[118] Federal Reserve Board, Statistical Release G.19: Consumer Credit, *http://www.federalreserve.gov/releases/g19/*.

[119] White House Office of Management and Budget, Circular A–4, September 17, 2003, p. 34, *http://www.whitehouse.gov/omb/inforeg/circular_a4.pdf*.

[120] Empirical evidence also demonstrates that used car purchasers do pay for greater fuel economy (Kahn, *Quarterly Journal of Economics*, 1986).

[121] See, *http://www.federalreserve.gov/releases/g20/hist/fc_hist_tc.txt*.

[122] See, *http://www.federalreserve.gov/releases/h15/data/Monthly/H15_TCMNOM_Y10.txt*.

[123] See, *http://www.federalreserve.gov/releases/g20/hist/fc_hist_tc.txt*.

[124] Id.

[125] Id.

savings in establishing minimum energy efficiency standards for household appliances. This includes (1) the financial cost of any debt incurred to purchase appliances, principally interest charges on debt, or (2) the opportunity cost of any equity used to purchase appliances, principally interest earnings on household equity. For example, for appliances purchased in conjunction with a new home, DOE uses real mortgage interest rates to discount future energy savings.[126] This approach is analogous to NHTSA's use of real auto loan rates to discount future gasoline savings in establishing CAFE standards.

The Union of Concerned Scientists also commented that NHTSA's methodology for calculating the discounted present value of certain external costs and benefits appears to be inconsistent. Specifically, the commenter stated that the benefits of petroleum market effects (monopsony[127] and disruption cost reductions) and reduced emissions of particulate matter (PM) and sulphur oxides (SO_X) and the external costs of increased congestion, noise, and crashes, appear to be discounted differently from the fuel cost savings, driving time, and refueling time savings. The Union of Concerned Scientists urged NHTSA to utilize the same methodology for calculating the discounted present value of all such CAFE-related elements.

In response to the Union of Concerned Scientists comment that the agency appears to have discounted different categories of benefits inconsistently, the agency notes that the three different categories identified in its comment each bear a different relationship to total fuel savings. As the commenter notes, fuel cost savings, the value of increased driving range (identified incorrectly as ''driving time'' in the PRIA), and the value of refueling time savings are directly related to lifetime vehicle use, and the agency's estimates of the values of these benefits reflect this relationship. However, benefits resulting from lower emissions of the pollutants PM and SO_X (which occur during petroleum refining) also depend partly on the fraction of fuel savings that is reflected in reduced domestic fuel refining (rather than reduced imports of refined gasoline), and in turn on the fractions of domestic refining that utilize domestically-produced and imported crude petroleum.[128] Similarly, the external costs of congestion, accidents, and noise resulting from added vehicle use depend on the magnitude of the rebound effect as well as on lifetime fuel savings. Thus these three categories of benefits would be expected to bear different relationships to total fuel savings, as confirmed by the Union of Concerned Scientists' comments.

G. Import Externalities (Monopsony, Oil Disruption Effects, Costs of Maintaining U.S. Presence and Strategic Petroleum Reserve)

General Motors commented extensively on the issue of externalities associated with the agency's CAFE proposal. As a general observation, General Motors stated that the CAFE proposal would result in a net externality cost on consumer welfare, because the externality costs (*e.g.*, congestion, noise, highway fatalities/injuries) exceed the externality benefits (*e.g.*, reduction in oil import dependence, reduction in pollution). General Motors stated that the agency's proposal did not identify any specific market failures that would justify its fuel economy regulation. The commenter asked the agency to present empirical estimates of reduced economic and environmental externalities resulting from the proposed CAFE standards, along with supporting analyses demonstrating how these benefits were estimated.

In its comments, General Motors also challenged certain specific figures related to externalities incorporated by the agency as part of the CAFE proposal. For example, General Motors expressed disagreement with the proposal's externality estimate of $0.106 per gallon, as well as the estimate of costs related to pollution. The commenter stated that the National Research Council estimates the total cost of economic and environmental externalities from fuel production and use to be $0.26 per gallon, and if this estimate is correct, consumers are already paying fuel taxes (which it estimated at $0.46 per gallon) that exceed the cost of these externalities. General Motors also asked the agency to address the research finding by Dr. Kleit purporting to show negative net benefits (*i.e.*, it will have net costs) for the MY 2005–2007 CAFE standards.[129]

In addition, General Motors argued that higher steady-state oil prices reduce any demand costs or monopsony power, and energy demand from China and other emerging economies will only strengthen this trend. The company disagreed with the monopsony estimate of $0.061 per gallon relied upon by the agency. General Motors further argued that the agency relied upon the monopsony value reported in a 1997 study by Lieby *et al.*, but stated that this study assumes no cartel of producers such as OPEC. According to General Motors, in light of the potential for OPEC to respond to U.S. efforts to decrease demand, the monopsony value of $0.061 is too high. General Motors stated that like Resources for the Future, it believes that using U.S. monopsony power has marginal benefits at best, and that at worst, attempting to use it could actually provoke retaliatory pricing or supply responses by OPEC that would harm the U.S. economy.

General Motors also challenged the oil disruption cost of $0.045 per gallon included in the proposal. According to General Motors, the agency has not addressed Congressional Research Service and the Bohi and Toman studies which reported that the only reason for oil disruption is an increase in price (*i.e.*, an oil price ''shock''), so because the CAFE standards do not affect the price of gasoline, there should be no disruption effect.

General Motors expressed skepticism regarding the externality costs related to pollution contained in the CAFE proposal. According to General Motors, because U.S. refineries operate at 95 percent of capacity and routinely

[126] See, Residential Furnaces and Boilers ANOPR Technical Support Document, Chapter 8, at *http://www.eere.energy.gov/buildings/appliance_standards/residential/furnaces_boilers_1113_r.html.*

[127] Demand costs for imported oil (often termed market power or ''monopsony'' costs) arise because the world oil price appears to be partly determined through the exercise of market power by the OPEC cartel, and because the U.S. is a sufficiently large purchaser of foreign oil supplies that its purchases can affect the world price. The combination of OPEC market power and U.S. ''monopsony'' power means that increasing domestic petroleum demand that is met through higher oil imports can cause the world price of oil to rise, and conversely that declining U.S. imports can reduce the world price of oil.

[128] In the NPRM, benefits from reduced petroleum market externalities were also incorrectly assumed to depend on the fraction of fuel savings that is reflected in lower imports of crude petroleum and refined gasoline (rather than on total U.S. petroleum consumption). In response to comments by the Union of Concerned Scientists and other reviewers, this error has been corrected in the Final Regulatory Impact Analysis accompanying this Rule.

[129] Dr. Kleit's analysis simply assumes that manufacturers have already made all applications of fuel economy technology to their models for which the value of the resulting fuel savings exceeds the cost of installing the technology. Andrew N. Kleit, ''Short- and Long-Range Impacts of Increases in the Corporate Average Fuel Economy (CAFE) Standard,'' February 7, 2002, Docket #11419–168159.

Under this assumption, any increase in the stringency of CAFE will always produce negative net benefits (i.e., net costs), because the technology applications necessary to comply with the more stringent standard will each have costs that exceed the value of fuel savings they produce.

purchase pollution permits (credits) from others, any reduction in demand for fuel would likely result in these refineries simply purchasing fewer permits, rather than reducing emissions or capacity. General Motors stated that the only pollution cost externality resulting from the CAFE standards is likely to be increased tailpipe emissions from the rebound effect.

Criterion Economics commented that NHTSA's CAFE proposal ''argued the wrong case,'' in that externalities alone should be the determinant of socially optimal CAFE levels (*i.e.*, allowing the marketplace to determine privately optimized CAFE targets). According to Criterion Economics, mandatory increases in fuel economy above market-determined levels would generate marginal private costs that exceed marginal private benefits. In support of its position that only externalities should be considered in setting CAFE standards, Criterion Economics provided a figure illustrating the interaction of marginal social benefits, marginal social costs, marginal private benefits, and marginal private costs to argue that the market automatically determines the optimal level for private benefits. Criterion Economics recommended that the agency revise the CAFE standards to reflect socially optimal levels based on externality costs and benefits.

In contrast, NRDC and Environmental Defense argued that monopsony costs are underestimated in the proposal. Environmental Defense stated that monopsony costs should range from $0.083 (under the EIA reference scenario) to $0.198 per gallon (under a $65 per barrel oil price scenario). Environmental Defense also commented that there is an arithmetic error in NHTSA's application of disruption and adjustment costs (which are otherwise conceptually correct), and it argued that in setting final CAFE standards, the agency should address non-quantified externalities such as strategic petroleum reserve and national security costs, at least qualitatively if not quantitatively.

The California State Energy Commission argued that the agency's estimate of $0.106 for oil import externalities is too low and should be increased to $0.33 per gallon of gasoline. The California State Energy Commission broke down this estimate as follows: $0.12 per gallon for oil import externalities; $0.01 to reflect costs of gasoline spill remediation; $0.02 to reflect damage from criteria pollutant emissions resulting from fuel delivery volumes, and $0.18 to reflect damage costs of greenhouse gas emissions. The Commission based its recommendation upon values reported in a 2003 report titled ''Benefits of Reducing Demand for Gasoline and Diesel.''

The agency believes that assessing the economic case for increasing the stringency of the light truck CAFE standard requires a comprehensive analysis of the resulting benefits and costs to the U.S. economy, rather than simply comparing the external costs associated with petroleum use and fuel production to current fuel taxes. The benefits of more stringent CAFE standards include the market value of the savings in resources from producing less fuel, together with the resulting reductions in the costs of economic externalities associated with petroleum consumption, and of environmental externalities caused by fuel production. The costs imposed on the U.S. economy by more stringent CAFE regulation include those costs for manufacturing more fuel-efficient vehicles, as well as the increased external costs of congestion, accidents, and noise from added driving caused by the rebound effect.

Vehicle buyers value improved fuel economy using retail fuel prices and miles per gallon, but may consider fuel savings only over the time they expect to own a vehicle, while the value to the U.S. economy of saving fuel is measured by its pre-tax price, and includes fuel savings over the entire lifetime of vehicles. Thus it cannot simply be assumed that the interaction of manufacturers' costs and vehicle buyers' demands in the private marketplace will determine optimal fuel economy levels, and that these levels should only be adjusted by Federal regulation if the external costs of fuel production and use exceed current fuel taxes.

The analysis reported in the FRIA estimates the value of each category of benefits and costs separately, and it compares the total benefits resulting from each alternative CAFE level to its total costs in order to assess its desirability. This more complete accounting of benefits and costs to the U.S. economy from reducing fuel use is necessary to assess the case for CAFE regulation generally, and for increasing the stringency of the current light truck CAFE standard in particular.

In response to comments on the specific values of certain externalities employed in the NPRM analysis, the agency agrees that higher world oil prices increase the monopsony or demand costs imposed by U.S. petroleum purchases, while greater sensitivity of the supply of oil imported by the U.S. to variation in its price (a higher elasticity of petroleum supply) reduces the monopsony costs associated with variation in U.S. oil demand.[130] Thus, the value of the monopsony effect used in the FRIA analysis reflects the Energy Information Administration's recent Annual Energy Outlook 2006 forecast of future world oil prices, which is significantly higher than previously projected by EIA (see FRIA p. VIII–31). The FRIA continues to use the midpoint of the range of values for the elasticity of oil imports suggested in the study by Leiby *et al.* to estimate the monopsony cost of increased U.S. petroleum use (see FRIA p. VIII–33).

However, the agency also notes that only a fraction of the monopsony cost of increased U.S. oil consumption is imposed on domestic purchasers of petroleum and refined products, since part of the burden of higher world oil prices is borne by foreign purchasers. As a result, that same fraction of any reduction in monopsony costs resulting from lower U.S. oil purchases is exactly offset by revenue losses to domestic petroleum producers, so it does not represent a net savings to the U.S. economy. Thus, in order to include only the fraction that represents a net savings to U.S. purchasers, the savings in monopsony costs from reduced fuel use must be adjusted by the percent of U.S. petroleum consumption that is imported. This results in a monopsony value of $0.044 per gallon.

In contrast, the entire reduction in total U.S. petroleum demand that results from more stringent CAFE standards reduces potential costs to the U.S. economy from rapid increases in world oil prices, because (as the studies cited by reviewers of the NPRM point out) these costs depend on total U.S. petroleum consumption rather than on the fraction that is imported. The agency agrees that petroleum buyers' use of hedging strategies and private oil inventories can reduce these costs, but the significant costs of adopting these strategies will also be reduced as declines in U.S. petroleum demand moderate the potential effect of rapid fluctuations in world oil prices. Thus the analysis presented in the FRIA continues to employ the agency's previous estimate ($0.045 per gallon) of the reduction in the price shock component of U.S. oil consumption externalities that is likely to result from more stringent CAFE regulation (see FRIA VIII–34).

Finally, the agency believes that while costs for U.S. military security in oil-

[130] For the exact relationship among monopsony costs, oil prices, and the elasticity of supply of imported oil, see Leiby *et al.*, p. 26 Docket No. NHTSA–2005–22223–27.

producing regions and for maintaining the Strategic Petroleum Reserve will vary in response to long-term changes in U.S. oil imports, these costs are unlikely to decline significantly in response to the modest reduction in the level of U.S. oil imports that would result from the proposed CAFE standard for MY 2008–2011 light trucks. The U.S. military presence in world regions that represent vital sources of oil imports also serves a range of security and foreign policy objectives that is considerably broader than simply protecting oil supplies. As a consequence, no savings in government outlays for maintaining the Strategic Petroleum Reserve or a U.S. military presence are included among the benefits of the light truck CAFE standard adopted for MY 2008–2011.

Combined, the externalities cost per gallon added to the pre-tax price per gallon in the FRIA is $0.088.[131] This compares to the PRIA estimate of $0.106 per gallon.

H. Uncertainty Analysis

The California State Energy Commission stated NHTSA's proposal does not adequately deal with the primary source of uncertainty in setting standards—the extent to which the application of additional technology could be justified by higher future fuel prices. This commenter stated that the agency's uncertainty analysis should first examine the sensitivity of optimum standards to variation in retail fuel prices only, and then analyze effect of alternative stringency levels on social benefits.

In response, we note that the purpose of the uncertainty analysis is to examine uncertainty surrounding the impact of the proposed and final rules. OMB Circular A–4 requires formal probabilistic uncertainty analysis of complex rules where there are large, multiple uncertainties whose analysis raises technical challenges or where effects cascade and where the impacts of the rule exceed $1 billion. CAFE meets these criteria on all counts. However, the commenter appears to be concerned primarily with uncertainty surrounding the CAFE standard selection process, rather than that surrounding the impacts of the selected standards. The agency believes that its selection of CAFE levels should be based on its best estimates of all input variables used to estimate optimized social benefits. An examination of the uncertainty of outcomes in this process would produce information of academic interest but would not alter the agency's reliance on the most probable outcome for setting standards. It is also not clear that uncertainty surrounding the price of gasoline is greater than that surrounding other variables used in the NHTSA model. In fact, the range of uncertainty for both the effectiveness and cost of technologies includes more potential variation than the three fuel price scenarios examined in the uncertainty analysis. Since each of these factors influences the calculation of optimized social benefits, the agency does not believe it would be useful to isolate only the uncertainty in fuel prices.

I. The 15 Percent Gap

The agency assumes that there is a 15 percent difference between the EPA fuel economy rating and the actual fuel economy achieved by vehicles on the road. For example, if the overall EPA fuel economy rating of a light truck is 20 mpg, the actual on-road fuel economy achieved by the average driver of that vehicle is expected to be 17 mpg (20*.85). NRDC and the Union of Concerned Scientists commented that the 15-percent reduction the agency applied to reported fuel economies to adjust for in-use fuel economy performance is too low, and both commenters recommended using an on-road gap of 20 percent. The Union of Concerned Scientists stated that the EPA is in the process of revising its estimates of real-world fuel economy in response to widespread consumer dissatisfaction with the reliability of its present adjustment. In support of its recommendation to use a 20-percent reduction, NRDC cited the range of 20 to 23 percent relied upon by EIA's National Energy Modeling System (NEMS) over the expected lifetimes of MY 2008–2011 vehicles (See AEO2005 Table 47). General Motors stated that it agrees with a 15 percent on-road fuel economy gap.

On February 1, 2006, the Environmental Protection Agency proposed test changes to their fuel economy testing to bring them closer to on-road fuel economy (71 FR 5426). In its proposal, EPA estimated that the actual highway driving fuel economy estimate would be 5 to 15 percent lower than the EPA fuel economy rating and that the actual city driving fuel economy estimate would be 10 to 20 percent lower than the EPA fuel economy rating for most vehicles. However, the EPA has not issued a final rule on this issue. NHTSA will continue to rely on an overall fuel economy adjustment factor of 15 percent, consistent with current EPA regulations. In future rulemakings the agency will consider new regulations as issued by the EPA.

J. Pollution and Greenhouse Gas Valuation

In its comments, General Motors maintained that increases in emissions of criteria pollutant resulting from the rebound effect are not likely to be offset by reduced refinery emissions, as assumed in the agency's analysis. As noted earlier, General Motors argued that domestic refineries are subject to strict emission caps, and they must buy permits (credits) in order to support current production. It concluded that a small reduction in overall ''demand for fuel would allow domestic refineries to simply buy fewer pollution permits without changing the emissions at the refineries.''

General Motors also asserted that domestic refineries produce at over 95 percent of capacity, and that all increases in demand for refined products must be met by imports. Therefore, General Motors concluded that a reduction in demand for fuel would not reduce domestic refinery output and corresponding pollutants, but instead would cause a reduction in imports of refined products such as gasoline.

In response to General Motors' comments, the agency notes that there are currently two cap-and-trade programs governing emissions of criteria pollutants by large stationary sources. The Acid Rain Program seeks to limit NO_X and SO_2 emissions, but applies only to electric generating facilities and thus will not affect refinery emissions.[132] The NO_X Budget Trading Program is also primarily intended to reduce electric utility emissions, but does include some other large industrial sources such as refineries. However, as of 2003, refineries participating in the program accounted for less than 5% of total NO_X emissions by U.S. refineries.[133] In addition, some refineries could be included among the sources of NO_X emissions that will be controlled under the recently-adopted Clean Air Interstate Rule, which is scheduled to take effect beginning in 2009.[134] However, refinery NO_X

[131] The $0.088 value represents the value for reducing U.S. demand on the world market plus the value for reducing the threat of supply disruptions. See Table X–3 in the FRIA.

[132] See *http://www.epa.gov/airmarkets/arp/index.html.*

[133] Estimated from EPA, NO_X Budget Trading Program (SIP Call) 2003 Progress Report, Appendix A, *http://www.epa.gov/airmarkets/cmprpt/nox03/NBP2003AppendixA.xls,* and National Air Quality and Emissions Trends Report 2003, Table A–4, *http://www.epa.gov/air/airtrends/aqtrnd03/pdfs/a4.pdf.*

[134] The Clean Air Interstate Rule also requires reductions in SO_2 emissions and establishes an emissions trading program to achieve them, but

Continued

emissions could only be affected in states that specifically elect to include sources other than electric generating facilities in their plans to comply with the rule. The EPA has indicated that it expects states to achieve the emissions reductions required by the Clean Air Interstate Rule primarily from the electric power industry.[135] Thus the agency continues to believe that any reduction in domestic gasoline refining resulting from the adopted CAFE standard will be reflected in reduced refinery emissions of criteria pollutants.

Environmental organizations stated that the agency must attach some value to reducing greenhouse gas emissions, and adjust the benefits of more stringent CAFE standards accordingly. NRDC recommended a value of $10 to $25 per ton of CO_2 emissions reduced by fuel savings from stricter CAFE, based on values assigned by the California Public Utilities Commission, Idaho Power Co., and the European Union emissions program. Environmental Defense stated that the agency should use a value of $50 per ton of reduced CO_2 emissions. The Union of Concerned Scientists similarly objected to the zero value assigned to reduced emissions of greenhouse gases in the CAFE proposal, and instead recommended using a value of $50 per ton of carbon (corresponding to approximately $0.15 per gallon of gasoline).

The estimated reductions in emissions of criteria pollutants from gasoline refining and distribution used in the PRIA analysis were adjusted to reflect only the fraction of fuel savings that is expected to reduce domestic refining, rather than imports of refined gasoline. They were also adjusted to include only reductions in emissions that occur during domestic extraction and transportation of crude petroleum feedstocks. The estimates of these reduced emissions from crude oil extraction and gasoline refining used in the FRIA continue to reflect these adjustments (see FRIA p. VIII–60).

The agency continues to view the value of reducing emissions of CO_2 and other greenhouse gases as too uncertain to support their explicit valuation and inclusion among the savings in environmental externalities from reducing gasoline production and use. There is extremely wide variation in published estimates of damage costs from greenhouse gas emissions, costs for controlling or avoiding their emissions, and costs of sequestering emissions that do occur, the three major sources for developing estimates of economic benefits from reducing emissions of greenhouse gases.[136] Moreover, as stated above, commenters did not reliably demonstrate that the unmonetized benefits, which include CO_2, and costs, taken together, would alter the agency's assessment of the level of the standard for MY 2011. Thus, the agency determined the stringency of that standard on the basis of monetized net benefits.

Additionally, costs for remediating gasoline spills are highly variable depending on the volume of fuel released, the environmental sensitivity of the immediate environment, and the presence of specific fuel additives. As a consequence, the agency has elected to include no monetary value for reducing greenhouse gas emissions or remediating fuel spills among the benefits of reducing gasoline use via more stringent fuel economy regulation.

K. Increased Driving Range and Vehicle Miles Traveled

General Motors argued that the value of time spent refueling should be zero. General Motors stated that during the fuel economy test EPA requires fuel tanks to contain a fixed percentage of gasoline compared to tank capacity and that manufacturers have reduced gasoline tank volume on average in response to higher fuel efficiency.

Sierra Research added that range is a design criterion and that there is no basis for assuming that this criterion will change in response to an increase in CAFE standards. Sierra Research provided illustrations purported to show the relationship between fuel capacity and fuel economy standards, and fuel economy and range for 2004 light trucks, in order to demonstrate that increased fuel economy standards might not result in increased vehicle range.

The following reflects our understanding of vehicle driving range and tank size. Typically, the tank size for a model is determined when the model is designed, and the tank size does not change for small incremental improvements in fuel economy (as would occur by virtue of these standards) until the vehicle is redesigned. Thus, until redesign, increased fuel economy would result in increased driving range, and the value of time for reduced refueling is real. If tank downsizing does occur, then there is a cost savings to manufacturers which could be subtracted from technology costs. One way or another, there is a benefit. Thus, the agency is retaining its benefit estimates for increased driving range.

General Motors questioned whether NHTSA's estimate of the average vehicle's lifetime mileage (152,032 miles) was overstated. NADA also cautioned that the agency's fuel conservation predictions should reflect an appropriate range of fuel price and vehicle-miles-traveled assumptions.

In response to the comments by General Motors and NADA, the agency notes that the lifetime mileage estimate reported in the NPRM does not apply to the average vehicle; instead, it represents the average accumulated mileage of a vehicle that survives for a full 36 years. As the accompanying vehicle survival rates indicate, only a small fraction of vehicles originally produced in any model year are expected to survive to this age. The agency has recently updated its estimates of survival probabilities and average annual mileage by vehicle age, and these updated estimates are utilized to calculate the impacts of CAFE standards reported in the FRIA accompanying this final rule.[137] Further, as discussed below in Section XII. Comparison of the final and proposed rule, the agency has adjusted the vehicle miles traveled schedule to reflect increases in the fuel price forecasts.

L. Added costs from congestion, crashes and noise

General Motors agreed with the agency's cost estimates related to traffic congestion, crashes, and noise. However, the commenter again stated its belief that the proposed CAFE standards would result in a net externality cost—not benefit—in terms of consumer welfare. Specifically, General Motors stated that the costs associated with increased congestion, noise, and highway fatalities and injury costs resulting from increases in driving outweigh the benefits associated with

only electric generating facilities are included in the rule's SO_2 emissions trading program; see EPA, Clean Air Interstate Rule: Basic Information, *http://www.epa.gov/cair/basic.html#timeline.*

[135] See EPA, Clean Air Interstate Rule: Basic Information, *http://www.epa.gov/cair/basic.html#timeline,* and ''Fact Sheet: Clean Air Interstate Rule,'' *http://www.epa.gov/cair/pdfs/cair_final_fact.pdf.*

[136] Environmental Defense submitted studies regarding the valuation of greenhouse gases. However, the studies were submitted over three months after the close of the comment period and less than one month before the agency's statutory deadline for issuing a MY 2008 standard. These studies have been docketed (NHTSA–2005–2223–2250, 2251).

[137] The data sources and procedures used to develop these updated estimates of vehicle survival and usage are reported in NHTSA, ''Vehicle Survivability and Travel Mileage Schedules,'' Report DOT HS 809 952, National Center for Statistics and Analysis, January 2006, Docket NHTSA–2005–22223–2218. See FRIA p. VIII–11.

decreased oil import dependence and pollution reduction.

NHTSA agrees that this is a true observation made by General Motors on the agency's analysis, although we believe the commenter overstates its significance. We say this because the savings in lifetime fuel expenditures significantly outweigh the combined net externalities costs and the costs of added technology, making this a cost-beneficial rule.

M. Employment Impacts

The California State Energy Commission commented that the agency mentioned the potential for the CAFE proposal to result in job losses, but it did not discuss the issue of employment in detail. The Commission stated that increasing CAFE stringency may actually increase employment among automobile manufacturers and related sectors, although union employment and employment in the petroleum manufacturing industry might decline. Without going into detail, the commenter stated that several previous studies have concluded that increasing CAFE standards could increase U.S. employment and economic output. The Commission also suggested that by requiring U.S. automakers to produce more fuel-efficient vehicles, stricter CAFE standards could enhance the competitive positions of those manufacturers in international markets where fuel prices are typically higher, thereby increasing total sales, production volumes, and domestic employment. The Commission asked the agency to address the issue of the employment impacts of its CAFE standards more explicitly in the final rule.

The Marine Retailers Association of America (MRAA) expressed concern that increases in CAFE levels could lead to vehicle downsizing, which in turn could have a negative impact upon the boating industry. According to the MRAA, there are approximately 17 million recreational boats in the U.S., about 80 percent of which are pulled by a light truck or SUV. MRAA stated that to the extent vehicle downsizing occurs, manufacturers may find it more difficult to produce a vehicle with adequate horsepower and torque to tow a boat, and without an adequate vehicle to tow a boat, many consumers may simply decide not to purchase a boat. Accordingly, the MRAA asked NHTSA to carefully consider the employment, sales, and other impacts of its CAFE proposal upon the boating industry.

The agency believes that the CAFE impact on jobs is fairly minor and there are counterbalancing impacts. The agency estimates that higher prices will result in a small loss of sales, which negatively impacts employment. On the other hand, in a few limited cases, the requirements could result in the use of additional new technology, which would increase employment. Both of these impacts on jobs are anticipated to be very minor, and the counterbalancing impacts will be near zero. Very few light trucks are exported for sale and we believe that the proposed increases in fuel economy are unlikely to change these sales volumes appreciably. Thus, we expect that there is little chance of improving the competitive position of the manufacturers in international markets as a result of revised light truck CAFE standards.

The agency has not included changes in vehicle performance as part of its strategy for the manufacturers to improve fuel economy and changes in weight were not accompanied by changes in horsepower. Thus, our assumptions include no changes that would affect the boating industry. However, our assumptions do not require a manufacturer to follow our predicted course of action.

IX. MY 2008–2010 Transition Period

As stated above, the agency is providing a transition period during MYs 2008–2010. During this period, manufacturers have the option of complying under the standard established under the Unreformed CAFE system or the standard established under the Reformed CAFE system.

A. Choosing the Reformed or Unreformed CAFE System

As part of the transition to a fully phased-in Reform CAFE system in MY 2011, during MYs 2008–2010, manufacturers have the option of complying under the Reformed CAFE system or the Unreformed CAFE system. Manufacturers are required to announce their selection for a model year, and that selection will be irrevocable for that MY. However, a manufacturer is permitted to select the alternate compliance option in the following MY. Beginning MY 2011, a manufacturer must comply only under the Reformed CAFE system.

In the NPRM, we proposed that a manufacturer would announce its selection as part of its mid-model year report, as filed according to 49 CFR 537.7. In order to provide manufacturers a greater level of flexibility, the final rule does not require a manufacturer to elect one of the two compliance options until the end of the model year. This will permit a manufacturer to determine its actual fuel economy before determining whether to elect compliance under the Unreformed or Reformed CAFE system. Within 45 days following the end of the model year, a manufacturer must submit to the agency a report indicating whether it has elected to comply with the Reformed or Unreformed CAFE program for that model year.

B. Application of Credits Between Compliance Options

The EPCA credit provisions operate under the Reformed CAFE system in the same manner as they do under the Unreformed CAFE system. The harmonic averages used to determine compliance under the Reformed CAFE system permit the amount, if any, of the credits earned to be calculated as under the Unreformed CAFE system:

Credits = (Actual CAFE − Required CAFE) * 10 * Total Production Credits earned in a model year can be carried backward or forward as currently done in the Unreformed CAFE system.

Further, credits are transferable between the two systems. Both Unreformed CAFE and Reformed CAFE use harmonic averaging to determine fuel economy performance of a manufacturer's fleet. Under Reformed CAFE, fuel savings from under- and over-performance with each category are generated and applied almost identically to the way in which this occurs under the Unreformed CAFE system. As a result, the two systems generate credits with equal fuel savings value. Therefore, credits earned in a model year under Unreformed CAFE are fully transferable forward to a model year under the Reformed CAFE system, up to the statutory limit of three years. Likewise, credits under Reformed CAFE can be carried back to Unreformed CAFE.

X. Impact of Other Federal Motor Vehicle Standards

A. Federal Motor Vehicle Safety Standards

The EPCA specifically directs us to consider the impact of other Federal vehicle standards on fuel economy. This statutory factor constitutes an express recognition that fuel economy standards should not be set without due consideration given to the effects of efforts to address other regulatory concerns, such as motor vehicle safety and emissions. The primary influence of many of these regulations is the addition of weight to the vehicle, with the commensurate reduction in fuel economy.

Several manufacturers commented on the evaluation of Federal motor vehicle standards, generally stating that the agency's estimated weight impacts were too low. Our response to these comments and a summary of our evaluation are provided below. A detailed discussion of the evaluation is provided for in the FRIA (see FRIA p. IV–2).

The agency has evaluated the impact of the Federal motor vehicle safety standards (FMVSS) using MY 2007 vehicles as a baseline. We have issued or proposed to issue a number of FMVSSs that become effective between the MY 2007 baseline and MY 2011. These have been analyzed for their potential impact on light truck fuel economy weights for MYs 2008–2011: The fuel economy impact, if any, of these new requirements will take the form of increased vehicle weight resulting from the design changes needed to meet new FMVSSs.

The average test weights (curb weight plus 300 pounds) of the light truck fleet for General Motors, Ford, and DaimlerChrysler in MY 2008, MY 2009, MY 2010 and MY 2011 are 4,744, 4,800, 4,792, and 4,786,[138] respectively. Thus, overall, the three largest manufacturers of light trucks expect weight to remain almost unchanged during the time period addressed by this rulemaking. The changes in weight include all factors, such as changes in the fleet mix of vehicles, required safety improvements, voluntary safety improvements, and other changes for marketing purposes. These changes in weight over the three model years would have a negligible impact on fuel economy.

1. FMVSS 138, Tire Pressure Monitoring System

As required by the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, NHTSA is requiring a Tire Pressure Monitoring System (TPMS) be installed in all passenger cars, multipurpose passenger vehicles, trucks and buses that have a Gross Vehicle Weight Rating of 10,000 pounds or less. The effective dates are based on the following phase-in schedule:

20 percent of light vehicles produced between September 1, 2005 and August 31, 2006,

70 percent of light vehicles produced between September 1, 2006 and August 31, 2007,

All light vehicles produced after September 1, 2007 are required to comply.

Thus, for MY 2008, an additional 30 percent of the fleet will be required to meet the standard as compared to MY 2007. We estimate from a cost teardown study that the added weight for an indirect system is about 0.156 lbs. and for a direct system is 0.275 to 0.425 lbs. Initially, direct systems will be more prevalent, thus, the increased weight is estimated to be average 0.35 lbs. (0.16 kilograms). Beginning in MY 2008, the weight increase from FMVSS No. 138 is anticipated to be 0.11 pounds (0.05 kilograms).

As stated in the TPMS final rule,[139] by promoting proper tire inflation, the installation of TPMS will result in better fuel economy for vehicle owners that previously had operated their vehicles with under-inflated tires. However, this will not impact a manufacturer's compliance under the CAFE program. Under the CAFE program, a vehicle's fuel economy is calculated with the vehicle's tires at proper inflation. Therefore, the fuel economy benefits of TPMS have not been considered in this rulemaking.

2. FMVSS 202, Head Restraints

The final rule requires an increase in the height of front seat outboard head restraints in pickups, vans, and utility vehicles, effective September 1, 2008 (MY 2009). If the vehicle has a rear seat head restraint, it is required to be at least a certain height.[140] The initial head restraint requirement, established in 1969, resulted in the average front seat head restraints being 3 inches taller than pre-standard head restraints and adding 5.63 pounds [141] to the weight of a passenger car. With the new final rule, we estimate the increase in height for the front seats to be 1.3 inches and for the rear seat to be 0.26 inch, for a combined average of 1.56 inches.[142] Based on the relationship of pounds to inches from current head restraints, we estimate the average weight gain across light trucks would be 2.9 pounds (1.3 kilograms).

3. FMVSS 208, Occupant Crash Protection (Rear Center Seat Lap/Shoulder Belts)

This final rule requires a lap/shoulder belt in the center rear seat of light trucks. There are an estimated 5,061,079 [143] seating positions in light trucks needing a shoulder belt, where they currently have a lap belt. This estimate of seating positions is a combination of light trucks, SUVs, minivans and 15 passenger vans that have either no rear seat, or one to four rear seats that need shoulder belts. This estimate was based on sales of 7,521,302 light trucks in MY 2000. Thus, the average light truck needs 0.67 shoulder belts. The average weight of a rear seat lap belt is 0.92 lbs. and the average weight of a manual lap/shoulder belt with retractor is 3.56 lbs.[144] Thus, the anticipated weight gain is 2.64 pounds per shoulder belt. We estimate the average weight gain per light truck for the shoulder belt would be 1.8 pounds (0.8 kilograms).

A second, potentially more important, weight increase depends upon how the center seat lap/shoulder belt is anchored. The agency has allowed a detachable shoulder belt in this seating position, which could be anchored to the ceiling or other position, without a large increase in weight. If the center seat lap/shoulder belt were anchored to the seat itself, typically the seat would need to be strengthened to handle this load. If the manufacturer decides to change all of the seats to integral seats, having all three seating positions anchored through the seat, then both the seat and flooring needs to be strengthened. The agency requested information about manufacturer plans for complying with this requirement and after reviewing the confidential submissions, NHTSA estimates that the average weight gain per light truck for the shoulder belt would be 0.36 lbs (0.16 kg) compared to MY 2007. For the anchorage, the average weight increase would be 0.2 lbs (0.09 kg) or more.

The effective dates are based on the following phase-in schedule:

50 percent of light vehicles produced between September 1, 2005 and August 31, 2006,

80 percent of light vehicles produced between September 1, 2006 and August 31, 2007,

100 percent of light vehicles produced after September 1, 2007.

[138] This figure is for the fleet not including MDPVs for a more accurate comparison to the fleet numbers for MYs 2008 through 2010. The figure including MDPVs is 4,832 lbs.

[139] 70 FR 18136, 18139; April 8, 2005; Docket No. 2005–28506.

[140] The compliance date for the upgraded requirements applicable to head restraints voluntarily installed at rear outboard seating positions recently was amended from September 1, 2008, to September 1, 2010 (see, 71 FR 12415; March 9, 2006).

[141] Tarbet, Marcia J., ''Cost and Weight Added by Federal Motor Vehicle Safety Standards for Model Years 1968–2001 in Passenger Cars and Light Trucks'', NHTSA, December 2004, DOT–HS–809–834. Pg. 51. (*http://www.nhtsa.dot.gov/cars/rules/regrev/evaluate/809834.html*).

[142] ''Final Regulatory Impact Analysis, FMVSS No. 202 Head Restraints for Passenger Vehicles'', NHTSA, November 2004, Docket No. 19807–1, p. 74.

[143] ''Final Economic Assessment and Regulatory Flexibility Analysis, Cost and Benefits of Putting a Shoulder Belt in the Center Seats of Passenger Cars and Light Trucks'', NHTSA, June 2004, Docket No. 18726–2, p. 33.

[144] Tarbet 2004, p. 84.

Thus, for MY 2008, an additional 20 percent of the fleet will be required to meet the standard. We estimate the average weight gain per light truck for the shoulder belt would be 0.36 lbs (0.16 kg) [1.8 pounds (0.8 kilograms) * 0.2] compared to MY 2007. For the anchorage, the average weight increase would be 0.2 pounds (0.09 kg) or more.

4. FMVSS 208, Occupant Crash Protection (35 mph Frontal Impact Testing)

The advanced air bag rule requires 35 mph belted testing with the 50th percentile male dummy with a phase-in schedule of:

35 percent of light vehicles produced between September 1, 2007 and August 31, 2008,

65 percent of light vehicles produced between September 1, 2008 and August 31, 2009,

100 percent of light vehicles produced after September 1, 2009.[145]

The impacts of this requirement were not considered in the evaluation for the NPRM. Evaluation of the 35 mph belted test has been added in response to comment from General Motors that raised the issue. About 85 percent of the fleet already meets the test based on NCAP results. It is assumed that pretensioners and load limiters would be the countermeasures used to pass the test. The estimated combined weight of these features is 2.4 pounds for the two front outboard seats. Thus, the average incremental weight would be 0.36 lbs (0.16 kg).

5. FMVSS 301, Fuel System Integrity

This final rule amends the testing standards for rear end crashes and resulting fuel leaks. Many vehicles already pass the more stringent standards, and those affected are not likely to be pick-up trucks or vans. It is estimated that weight added will be only lightweight items such as a flexible filler neck. We estimate the average weight gain across this vehicle class would be 0.24 lbs (0.11 kg).

The effective dates are based on the following phase-in schedule:

40 percent of light vehicles produced between September 1, 2006 and August 31, 2007,

70 percent of light vehicles produced between September 1, 2007 and August 31, 2008,

100 percent of light vehicles produced after September 1, 2008 are required to comply.

Thus, 60 percent of the fleet must meet FMVSS 301 during the MY 2008–2010 time period. Thus, the average weight gain during this period would be 0.14 lbs (0.07 kg).

B. Potential Future Safety Standards and Voluntary Safety Improvements

There are several safety standards that have recently been proposed, or that the agency is required by Congress to propose in the near future that could impact some of the MY 2008–2011 vehicles. In most cases, these proposals or future proposals are already being met voluntarily by a part of the fleet.

Additionally, the agency has historically considered the impact of voluntary safety improvements. The agency has expressed concern that overly stringent CAFE standards might discourage manufacturers from pursuing voluntary improvements (53 FR 39275, 39296; October 6, 1988). Currently, there are improvements that are being made voluntarily to meet market demand and/or to perform better on government or insurance industry tests involving vehicle ratings. In our analysis for this final rule, the potential future safety standards and voluntary improvements have been combined without regard to effective date, even though the final effective dates for the potential future safety standards may be later than MY 2011.

1. Anti-Lock Brakes and Electronic Stability Control (ESC)

Many manufacturers are planning to install ESC on all their light vehicles. Recent congressional legislation contained in section 10301 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users of 2005 (SAFETEA–LU)[146] requires the Secretary of Transportation to ‘‘establish performance criteria to reduce the occurrence of rollovers consistent with stability enhancing technologies’’ and to ‘‘issue a proposed rule * * * by October 1, 2006, and a final rule by April 1, 2009.’’ A requirement by NHTSA in this area could potentially be effective with MY 2011.

The ESC system needs anti-lock brakes to work appropriately. Anti-lock brakes add about 20 pounds to the weight of a light truck. Currently, about 91 percent of all light trucks have anti-lock brakes. Thus, if all light trucks added anti-lock brakes, average light truck weight would increase by 1.8 pounds. ESC is estimated to add about 9 pounds to a vehicle. In 2005, an estimated 23 percent of light trucks have ESC. Thus, if all light trucks added ESC, average light truck weight would increase by 6.9 pounds. So, the total weight increase is 8.7 pounds (3.95 kg.).

2. Roof Crush, FMVSS 216

On August 23, 2005, NHTSA published an NPRM proposing to upgrade the agency's safety standard on roof crush resistance. (70 FR 49223) The NPRM proposed to extend the standard to vehicles with a GVWR of 10,000 pounds or less, increase the force applied to 2.5 times each vehicle's unloaded weight, and replace the current limit on the amount of roof crush with a requirement to maintain enough headroom for a mid-size adult male occupant.

The Alliance, Ford, DaimlerChrysler and Toyota commented that the agency should have included the weight impact of the FMVSS 216 amendments in its analysis. The agency agrees. Manufacturers' estimates of the weight implications of compliance with the proposed FMVSS No. 216 ranged from minimal to tens of pounds.

As estimated at the time of the FMVSS 216 NPRM, the proposed upgrade was estimated to increase average vehicle weight by 6.07 pounds. The proposed effective date was the first September 1 occurring three years after publication of the final rule.

In addition to the comments on the CAFE NPRM, NHTSA received a number of comments on the weight estimates in response to the Roof Crush NPRM. Other manufacturers commented on the Roof Crush NPRM that the agency's weight estimates were too low. However, other commenters indicated that weight estimates were too high because they said that the agency did not consider alternative, lighter, materials that manufacturers could use to comply with the standard. The agency is still evaluating all of the comments to the Roof Crush NPRM and estimates that, if a final rule were issued, it would be in 2007. Therefore, for purposes of this CAFE rule, the agency is using the estimates made at the time of the Roof Crush NPRM and assuming an effective date of September 1, 2010.

3. Side Impact and Ejection Mitigation Air Bags (Thorax and Head Air Bags)

Many manufacturers are installing side impact air bags (thorax bags, combination head/thorax bags, or window curtains). NHTSA proposed an oblique pole test as part of FMVSS 214 on May 17, 2004 (69 FR 27990). Based on current technology, this NPRM would result in head protection by either a combination head/thorax side

[145] The standard will be fully effective on September 1, 2010 when it includes small manufacturers, multi-stage manufacturers and alterers.

[146] Pub. L. 109–59, 119 Stat. 1144 (2005).

air bag or window curtains. SAFETEA–LU also requires the use of window curtain air bags for ejection mitigation, which would result in taller and wider window curtains that would be tethered or anchored low to keep occupants in the vehicle.

Assuming in the future that the typical system will be thorax bags with a window curtain, the average weight increase would be 11.55 pounds (4.77 + 6.78) or 5.25 kg (2.07 + 3.08). In MY 2005, about 31 percent of the fleet had thorax air bags, 7 percent had combination air bags and, and 25 percent had window curtains. The combined average weight for these systems in MY 2005 was 3.49 pounds (1.59 kg). Thus, the future increase in weight for side impact air bags and window curtains compare to MY 2005 installations is 8.06 pounds (11.55–3.49) or 3.66 kg (5.25–1.59).

Another area that could result in an increase in weight is if the manufacturers include structure to get a higher score in the IIHS higher side impact barrier test. Public data is not available to estimate what voluntary weight increases have been added or will be added to get a better score in this test.

4. Offset Frontal Crash Testing

IIHS has been testing and rating vehicles using an offset deformable barrier crash test at 64 km/h. Many manufacturers have redesigned their vehicles to do better in these tests and have increased the weight of their vehicles. Four light trucks that the agency has tested, which improved from a poor rating to a marginal or good rating in the IIHS testing, increased their weights, some with other redesigns, as follows:

TABLE 14.—INCREASES IN WEIGHT TO IMPROVE OFFSET FRONTAL TESTING

	Before	After redesign	Increase in weight
SUV	1997 Chevrolet Blazer (4,686 lbs.)	2002 Trailblazer (5,181 lbs.)	[147] 495 lbs.
SUV	1999 Mitsubishi Montero Sport (4,646 lbs.)	2001 Mitsubishi Montero Sport (4,715 lbs.)	69 lbs.
Pickup	2001 Dodge Ram 1500 (4,930 lbs.)	2002 Dodge Ram 1500 (4,969 lbs.)	39 lbs.
Minivan	1996 Toyota Previa (3,810 lbs.)	1998 Toyota Sienna (3,937 lbs.)	127 lbs.

[147] Part of the explanation for the weight increase between the Blazer and Trailblazer is an increase of approximately 1,070 sq. in. in footprint.

These weight increases have an affect on the vehicle's fuel economy. However, many vehicles have already been redesigned with this offset frontal test in mind. Whether increases in weight like this will continue for other vehicles in the future is unknown.

C. Cumulative Weight Impacts of the Safety Standards and Voluntary Improvements

After making the changes in response to comments discussed above, NHTSA estimates that weight additions required by FMVSS regulations that will be effective in MYs 2008–2011, compared to the MY 2007 fleet will increase light truck weight by an average of 4.07 pounds or more (1.83 kg or more). Likely weight increases from future safety standards or voluntary safety improvements will add 22.83 pounds or more (10.37 kg or more) compared to MY 2005 installations.

The Alliance, DaimlerChrysler, Ford, General Motors and Toyota argued that the weight additions projected by NHTSA for FMVSS regulations that will be effective in MYS 2008–2011 is too low. NHTSA projected an average of 15.46 pounds (including both FMVSS requirements and voluntary safety improvements) and a CAFE impact of 0.04 mpg. Only Ford provided a total estimate which could be compared to this number, and their estimate was significantly higher.

In some instances the manufacturers' weight estimates are similar to NHTSA's, in some instances they are less than NHTSA's, but often they are more than NHTSA's. The agency's estimates are based on cost and weight tear down studies of a few vehicles and cannot possibly cover all the variations in the manufacturers' fleets. The manufacturer's estimates of the fuel economy impact of added weight on mpg have typically been less than NHTSA's estimates. NHTSA estimated that an increase of 3–4 pounds [148] results in a decrease of 0.01 mpg, the manufacturers' data show that an increase of up to 7 pounds results in a decrease of 0.01 mpg. The combination of the manufacturers estimating more safety weight impacts, but that weight having less impact on miles-per-gallon, has resulted in similar impacts being estimated by NHTSA and the manufacturers. The agency has not questioned the manufacturers' estimates closely because the differences in the overall fuel economy impact due to required safety standards as estimated by Ford, General Motors, and NHTSA is small. A more detailed discussion of the impact of safety improvements is provided in the FRIA (see FRIA p. IV–2).

D. Federal Motor Vehicle Emissions Standards

1. Tier 2 Requirements

Pursuant to its authority under the Clean Air Act, on February 10, 2000, the Environmental Protection Agency (EPA) published a final rule establishing new Federal emission standards for passenger cars and light trucks (*see* 65 FR 6698). Known as the ''Tier 2'' Program, the new emissions standards in EPA's final rule cover both light-duty vehicles (i.e., passenger cars and light trucks with a GVWR of 6,000 pounds or less) and medium-duty passenger vehicles (MDPVs) (i.e., vehicles with either a curb weight of more than 6,000 pounds or a GVWR of more than 8,500 pounds and which otherwise meet the EPA definition (as discussed previously in this notice)).

The ''Tier 2'' standards are designed to focus on reducing the emissions most responsible for the ozone and particulate matter (PM) impact from these vehicles (*e.g.*, NO_X and non-methane organic gases (NMOG), consisting primarily of hydrocarbons (HC)) and contributing to ambient volatile organic compounds (VOC). In addition to establishing new emissions standards for vehicles, the Tier 2 standards also establish standards for the sulfur content of gasoline.

For new passenger cars and lighter light trucks (rated at less than 6,000 pounds GVWR), the Tier 2 standards' phase-in began in 2004, and the standards are to be fully phased in by 2007. For MDPVs, the phase-in schedule under the Tier 2 Program requires that 50 percent of the MDPV fleet must comply in MY 2008 and that 100 percent comply by MY 2009.

Prior to model year 2008, EPA also regulates MDPVs under ''Interim-Non-

[148] In reality, the fuel economy impact depends on the baseline weight of the vehicle.

Tier 2'' standards, applicable to MDPVs in accordance with a phase-in schedule beginning with MY 2004. The phase-in schedule requires compliance at the following levels: 25 percent in 2004, 50 percent in 2005, 75 percent in 2006, and 100 percent in 2007. Thus, beginning in 2008, half of new MDPVs are expected to comply with Tier 2 and the other half with ''Interim Non-Tier 2 Standards.'' (Once the Tier 2 standards for MDPVs are fully implemented, the Interim-Non-Tier 2 standards will be eliminated.)

When issuing the Tier 2 standards, EPA responded to comments regarding the Tier 2 standard and its impact on CAFE by indicating that it believed that the Tier 2 standards would not have an adverse effect on fuel economy.

In their confidential product plan submissions, several manufacturers stated that the Tier 2 requirements have an effect on fuel economy through additional weight and design requirements. However, after careful consideration, we have concluded that the impacts of the Tier 2 standards on fuel economy would not be significant for the following reasons. First, manufacturers themselves have estimated that the resulting reduction in fuel economy during MYs 2008–2010, in comparison to MY 2007, would be no greater than 0.04 mpg. Furthermore, with the exception of MDPVs, the Tier 2 requirements will be fully implemented in MY 2007, prior to the MYs that are the subject of this rulemaking for CAFE.

2. Onboard Vapor Recovery

On April 6, 1994, EPA published a final rule controlling vehicle-refueling emissions through the use of onboard refueling vapor recovery (ORVR) vehicle-based systems (*see* 59 FR 16262). These requirements applied to light-duty vehicles (cars) beginning in the 1998 model year, and were phased in over three model years. The ORVR requirements also apply to light-duty trucks with a GVWR of 6,000 pounds or less beginning in model year 2001, being phased in over three model years. For light-duty trucks with a GVWR of 6,001–8,500 lbs, the ORVR requirements first applied in the 2004 model year and were phased in over three model years.

The ORVR requirements impose a weight penalty on vehicles, as they necessitate the installation of vapor recovery canisters and associated tubing and hardware. However, the operation of the ORVR system results in fuel vapors being made available to the engine for combustion while the vehicle is being operated. As these vapors provide an additional source of energy that would otherwise be lost to the atmosphere through evaporation, the ORVR requirements do not have a negative impact on fuel economy, despite the associated weight increase.

In its comments, Honda disagreed with the agency's assertion that ORVR systems do not have a negative impact on fuel economy because the systems make available for combustion vapors that would otherwise be lost to the environment. Honda stated that the agency's assertion is correct for ''in-use fuel economy,'' but it is not true for the test procedures used to determine fuel economy under CAFE, because the fuel economy test procedures rely on a carbon balance equation. Honda stated that the measured fuel economy of a vehicle under the fuel economy test procedures is exactly the same, whether or not the ORVR system makes fuel vapors available to the engine for combustion.

NHTSA reiterates that ORVR provides a slight fuel economy benefit with respect to in-use fuel economy. NHTSA acknowledges that Honda's point is also correct—that this fuel economy benefit is not distinguishable in the Federal test procedure (FTP) or highway test cycle measurements. However, ORVR is not expected to have a significant effect on the fuel economy values measured on the FTP and highway tests. Further, the slight on-road fuel economy benefit realized is not utilized by NHTSA to set fuel economy standards.

In its rulemaking proceedings for ORVR, EPA conducted an extensive analysis on increases in vehicle weight due to the addition of ORVR hardware and software. A discussion of the ORVR weight penalty is contained in EPA's ''Final Regulatory Impact Analysis: Refueling Emission Regulations for Light-Duty Vehicles and Trucks and Heavy-Duty Vehicles,'' January 1994; Chapter 5 Economic Impact, section 5.3.2.1. If mechanical seal ORVR systems are more widely used in the future than liquid seal ORVR systems (which represent approximately 95–98 percent of today's vehicles), the weight penalty could increase above that discussed in EPA's RIA. However, any increase in vehicle weight due to more widespread use of mechanical seal ORVR systems would be negligible and not be expected to be a major fuel economy design consideration.

3. California Air Resources Board—Clean Air Act Section 209 Standards

The Clean Air Act (CAA) generally prohibits States or any other political subdivision from adopting any standard relating to the control of emissions from new motor vehicles (CAA section 209(a); 42 U.S.C. 7543(a)). However, the statute provides that the State of California may issue such standards upon obtaining a waiver from the EPA (CAA section 209(b); 42 U.S.C. 7543(b)). The State of California has established several emission requirements under section 209(b) of CAA as part of its Low Emission Vehicle (LEV) program. California initially promulgated these section 209(b) standards in its LEV I standards, and it has subsequently adopted more stringent requirements under section 209(b) of the CAA in its LEV II regulations. The relevant LEV II regulations are being phased in for passenger cars and light trucks during the 2004–2007 model years.[149]

The LEV II amendments restructure the light-duty truck category so that trucks with a GVWR rating of 8,500 pounds or less are subject to the same low-emission vehicle standards as passenger cars. The LEV II Program also includes more stringent (than LEV I) emission standards for passenger car and light-duty truck LEVs and establishes standards for ''ultra low emission vehicles'' (ULEVs).

The LEV II Program also has requirements for ''zero emission vehicles'' (ZEVs) that apply to passenger cars and light trucks up to 3,750 lbs. loaded vehicle weight (LVW), beginning in MY 2005. Trucks between 3,750 lbs. LVW and 8,500 lbs. GVWR are phased in to the ZEV regulation from 2007–2012. The ZEV requirements begin at 10 percent in 2005 and ramp up to 16 percent for 2018 under different paths.

Compliance with more stringent emission requirements of the section 209 CAA requirements in the LEV II program is most often achieved through more sophisticated combustion management. The associated improvements and refinement in engine controls generally improve fuel efficiency and have a positive impact on fuel economy.[150] However, such gains may be diminished because the advanced technologies required by the program can affect the impact of other fuel-economy improvements (primarily due to increased weight). The agency has considered this potential impact in our evaluation of manufacturers' product plans.

[149] As of the end of 2005, ten states have adopted the LEV II program, including Connecticut, Maine, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington.

[150] Northeast States for Coordinated Air Use Management, ''White Paper: Comparing the Emissions Reductions of the LEV II Program to the Tier 2 Program,'' October 2003.

XI. Need of the Nation To Conserve Energy

EPCA specifically directs the Department to balance the technological and economic challenges related to fuel economy with the nation's need to conserve energy. While EPCA grew out of the energy crisis of the 1970s, the United States still faces considerable energy challenges today. U.S. energy consumption has been outstripping U.S. energy production at an increasing rate. This imbalance, if allowed to continue, will undermine our economy, our standard of living, and our national security. (May 2001 National Energy Policy (NEP) Overview, p. viii)

As was made clear in the first chapter of the NEP, efficient energy use and conservation are important elements of a comprehensive program to address the nation's current energy challenges:

> America's current energy challenges can be met with rapidly improving technology, dedicated leadership, and a comprehensive approach to our energy needs. Our challenge is clear—we must use technology to reduce demand for energy, repair and maintain our energy infrastructure, and increase energy supply. Today, the United States remains the world's undisputed technological leader: but recent events have demonstrated that we have yet to integrate 21st-century technology into an energy plan that is focused on wise energy use, production, efficiency, and conservation.
> (Page 1–1)

The concerns about energy security and the effects of energy prices and supply on national economic well-being that led to the enactment of EPCA persist today. The demand for petroleum is steadily growing in the U.S. and around the world.

The Energy Information Administration's International Energy Outlook 2005 (IEO2005)[151] and Annual Energy Outlook 2006 (Early Release) (AEO2006) indicate growing demand for petroleum in the U.S. and around the world. U.S. demand for oil is expected to increase from 21 million barrels per day in 2004 to 28 million barrels per day in 2030. In the AEO2006 reference case, world oil demand increases through 2030 at a rate of 1.4 percent annually, from 82 million barrels per day in 2004 to 118 million barrels per day in 2030 (AEO2006). Approximately 67 percent of the increase in world demand is projected to occur in North America and emerging Asia. Energy use in the transportation sector is projected to increase at an annual rate of 1.8 percent through 2025 (AEO2006).

To meet this projected increase in demand, worldwide productive capacity would have to increase by more than 36 million barrels per day over current levels. OPEC producers are expected to supply 40 percent of the increased production. In contrast, U.S. crude oil production is projected to increase from 8.4 million barrels per day in 2004 to 9.62 million in 2015, and then begin declining, falling to 8.9 million barrels per day in 2025. By 2025, 60 percent of the oil consumed in the U.S. would be imported oil. [152]

Energy is an essential input to the U.S. economy, and having a strong economy is essential to maintaining and strengthening our national security. Secure, reliable, and affordable energy sources are fundamental to economic stability and development. Rising energy demand poses a challenge to energy security, given increased reliance on global energy markets. As noted above, U.S. energy consumption has increasingly been outstripping U.S. energy production.

Conserving energy, especially reducing the nation's dependence on petroleum, benefits the U.S. in several ways. Improving energy efficiency has benefits for economic growth and the environment, as well as other benefits, such as reducing pollution and improving security of energy supply. More specifically, reducing total petroleum use decreases our economy's vulnerability to oil price shocks. Reducing dependence on oil imports from regions with uncertain conditions enhances our energy security and can reduce the flow of oil profits to certain states now hostile to the U.S. Reducing the growth rate of oil use will help relieve pressures on already strained domestic refinery capacity, decreasing the likelihood of product price volatility.

We believe that the continued development of advanced technology, such as fuel cell technology, and an infrastructure to support it, may help in the long term to achieve reductions in foreign oil dependence and stability in the world oil market. The continued infusion of advanced diesels and hybrid propulsion vehicles into the U.S. light truck fleet may also contribute to reduced dependence on petroleum. In the shorter term, our Reformed CAFE final rule will encourage broader use of fuel saving technologies, resulting in more fuel-efficient vehicles and greater overall fuel economy.

We have concluded that the increases in the light truck CAFE standards that will result from today's final rule will contribute appropriately to energy conservation and the comprehensive energy program set forth in the NEP. In assessing the impact of the standards, we accounted for the increased vehicle mileage that accompanies reduced costs to consumers associated with greater fuel economy and have concluded that the final rule will lead to considerable fuel savings. While increasing fuel economy without increasing the cost of fuel will lead to some additional vehicle travel, the overall impact on fuel conservation remains decidedly positive.

We acknowledge that, despite the CAFE program, the United States' dependence on foreign oil and petroleum consumption has increased in recent years. Nonetheless, data suggest that past fuel economy increases have had a major impact on U.S. petroleum use. The NAS determined that if the fuel economy of the vehicle fleet had not improved since the 1970s, U.S. gasoline consumption and oil imports would be about 2.8 million barrels per day higher than they are today. Increasing fuel economy by 10 percent would produce an estimated 8 percent reduction in fuel consumption. Increases in the fuel economy of new vehicles eventually raise the fuel economy of all vehicles as older cars and trucks are scrapped.

Our analysis in the EA indicates that Reformed CAFE standards will result in an estimated 73 million metric tons of CO_2 over the lifetime of the vehicles (see EA p. 31). They will further reduce the intensity of the greenhouse gas emissions generated by the transportation sector of the national economy, consistent with the President's overall climate change policies. However, NHTSA has not monetized greenhouse gas reduction benefits in this rule, given the scientific and economic uncertainties associated with developing a proper estimation of avoided costs due to climate change.

XII. Comparison of the Final and Proposed Standards

The standards established in today's final rule are more stringent than those proposed in the NPRM. Moreover, the Final Rule subjects MDPVs to the light truck CAFE program beginning in MY 2011, where as the NPRM did not include the regulation of these vehicles. By applying more stringent standards to a more encompassing definition of light trucks, the final rule requires higher fuel efficiency from more vehicles than was proposed in the NPRM. The fuel savings estimated to result from the standards adopted today are 4.4 billion gallons from the MYs 2008–2010 Unreformed standards, 4.9 billion gallons from the

[151] See *http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2005).pdf.*

[152] AEO2006, Table A20, International Petroleum Supply and Disposition Summary.

MYs 2008–2010 Reformed standards, and an additional fuel savings of over 2.8 billion gallons from the MY 2011 Reformed standard.

TABLE 15.—INDUSTRY-WIDE FUEL ECONOMY LEVELS REQUIRED BY PROPOSED AND FINAL REFORMED CAFE STANDARDS

MY	Proposed	Final	Increase
2008	22.6	22.7	+0.1
2009	23.1	23.4	+0.3
2010	23.4	23.7	+0.3
2011	23.9	24.0	+0.1

The total fuel saving estimated to result from the Reformed CAFE standards for MYs 2008–2011 is approximately 7.8 billion gallons. However, in the NPRM the agency estimated that the Reformed CAFE standards as proposed would potentially save 10.2 billion gallons of fuel over the lifetimes of light trucks manufactured during these same model years. The lower estimated fuel savings of the final rule despite adopting more stringent standards can be explained by a number of factors that affected the agency's analysis. These include: changes in the Volpe model, higher fuel price forecasts, revisions to the Reformed CAFE standard, and changes to manufacturers' product plans.

Some of these factors increased the estimated fuel savings for the final rule compared to the level reported in the NPRM, while others reduces the rule's estimated fuel savings. These factors are each discussed below.

A. Changes in the Volpe Model

There were two changes made to the Volpe model between the analysis reported in the NPRM and the analysis conducted for the final rule, a revision to the maximum lifetime of light trucks and a revision to how the model applied technologies. First, the maximum lifetime of light trucks was extended from 25 to 36 years, and the fraction of vehicles originally produced during a model year that remain in service at each age was increased to reflect this longer lifetime. These changes were made in response to NHTSA's detailed analysis of R.L. Polk registration data for recent model year light trucks. These changes increase fuel savings resulting from any increase in CAFE standards because they increase the number of miles driven (and the amount of fuel consumed under the Baseline standard) during a vehicle's expected lifetime. This change increased the total fuel savings estimated to result from the Reformed CAFE standards by 0.2 billion gallons.

The second change to the Volpe CAFE model was a revision to the way it applied technology to achieve increased fuel economy. The Reformed CAFE system establishes required fuel economy levels, in part, by setting fuel economy targets through a marginal cost-benefit analysis. As noted above, this analysis applies technologies until the marginal cost of the technology equals the marginal benefits of that technology. The higher fuel prices projected by EIA after the NPRM might be expected to cause the model to apply a greater amount of fuel saving technology in the final rule than in the NPRM, and potentially result in final standards that are more stringent than those adopted today. This did not occur, in part, because of the revised technology assumptions incorporated in the Volpe model, as explained below.

The agency revised its technology assumptions to be more consistent with the estimates in the NAS report about the number of years needed to implement each of the various technologies and in response to comments from manufacturers. To achieve consistency with the NAS report, we reduced the projected rates of technology implementation employed by the model. In their comments, several manufacturers stated that greater leadtime than that provided in the NPRM is needed for the introduction of technologies across a manufacturer's fleet of vehicles and that some technologies would only be introduced or added to vehicles in conjunction with a major vehicle redesign or a vehicle introduction. Honda stated that it can take 10 years from the point of initial introduction of a technology until the point at which that technology is employed throughout a manufacturer's fleet. Honda and Toyota cite the NAS report which concluded that application of existing technologies will ''probably require 4 to 8 years.'' Honda further stated that phase-in rates have a critical impact on lead time requirements. Nissan, citing the NAS report, stated that overly aggressive implementation of technologies has the potential to ''adversely affect manufacturers, their suppliers, their employees, and consumers.'' These concerns were echoed by Ford and the Alliance.

In response to these comments, the agency re-evaluated the ''phase-in'' assumptions used in the Volpe model. ''Phase-in'' caps represent the maximum fraction of a manufacturer's model line or fleet to which a technology can be applied when it is initially introduced. For example, we assumed that low friction lubricants could be fully implemented in a period of four years, with equal rates of implementation in each year. This translates to a ''phase-in'' cap of 25 percent (100 percent phase-in divided by 4 years).

The agency has decreased the implementation rate for most technologies to provide implementation rates consistent with the NAS estimate of 4 to 8 years. This resulted in decreasing phase-in caps, with many ranging from 25 percent (4 year introduction) to 17 percent (approximately 6 years, the midpoint of the NAS estimate). The agency assumed shorter implementation rates for technologies that did not require changes to the manufacturing line. For other technologies (*e.g.*, hybrid and diesel powertrains) we employed phase-in caps as low as 3 percent, to reflect the major redesign efforts and capital investments required to implement these technologies. A detailed comparison of the phase-in caps used in the NPRM analysis and the final rule analysis is provided in Appendix B of this document.

In addition to revisions based on the NAS report, the agency also made revisions to the Volpe model in response to specific manufacturers' comments. Changes to the Volpe model include deleting the use of some technologies for specific manufacturers and delaying implementation of some technologies to coincide with product redesigns/model introduction. The changes instituted by the agency involve technology phase-in schedules and deleting some technologies from consideration. For the NPRM, the Volpe analysis excluded additional application of automatic transmissions with aggressive shift logic. In consideration of the extremely limited planned use of automatically-shifted manual (*i.e.*, clutch) transmissions (ASMTs) the revised Volpe analysis also excludes additional applications of ASMTs. Although these technologies may eventually appear on vehicles during the MY 2011 timeframe, the agency is aware of technical and regulatory burdens that likely will be difficult to overcome during MYs 2008–2011.

Manufacturers' updated 2005 product data showed that they plan to include some technologies on their MY 2008–11 light trucks that had previously been utilized in the agency's NPRM analysis to increase fuel economy from its baseline level originally specified in manufacturers' 2004 product plans. Manufacturers claimed that because they added these technologies after submitting product plan data to the agency in 2004, that the agency was double counting the effect of these technologies. The agency disagrees. The analysis for the NPRM was based on the product plans submitted in 2004. The analysis for the final rule is based on the updated product plans manufacturers provided the agency in response to the August 2005 RFC. If a technology was applied to a vehicle model in the NPRM, and that same technology was utilized by manufacturers on the same vehicle in their updated product plans, the agency did not apply that technology to that vehicle in the analysis it conducted for the final rule. In other words, the agency did not project the use of a technology on a model that a manufacturer stated was already equipped with that technology.

Manufacturers also provided information stating that certain technologies, which the agency had projected in its NPRM analysis, were incompatible with their products. In response, the agency hasn't projected the use of certain technologies on specific products for specific manufacturers that claimed technology incompatibility. In almost all cases, these technologies were classified as being available for use on other products, both for the specific manufacturers that claimed incompatibility with some products and for other manufacturers' products. The computer model used to implement the Volpe Analysis, as well as the Stage analysis, used ''engineering constraints'' to apply general (*i.e.*, industry-wide) limits on the application of some technologies in consideration of technical issues (as opposed to product planning or lead time considerations, which are addressed separately).

Further, the agency constrained the introduction of two technologies (aerodynamic drag reduction and materials substitution) to coincide with a major vehicle redesign or a vehicle introduction. Constraining these technologies to major redesigns is consistent with manufacturer practice, given that applying such technologies requires changes to integral design components such as paneling. These constraints are in addition to the ''engineering constraints'' discussed above.

Additionally, the agency itself has removed technologies included in the NAS report from consideration due to indications that these technologies will not be available for implementation nor are any manufacturers planning to incorporate these technologies in their vehicles during the MYs 2008–2011 time frame. For the NPRM, the Volpe analysis excluded additional application of automatic transmissions with aggressive shift logic. For the final rule the Volpe analysis also excluded application of automatically-shifted manual (*i.e.*, clutch) transmissions in consideration of its limit planned application.

The changes to the technology assumptions relied upon by the Volpe model reduced the estimated fuel savings for the final Reformed CAFE standards, in comparison to the proposed Reformed CAFE standards, by 1.5 billion gallons of fuel. Considered together, the changes to the Volpe model reduced the fuel savings estimated for the Reformed CAFE standards, again in comparison with the proposed standards, by 1.3 billion gallons of fuel.

B. Higher Fuel Price Forecasts

As stated above, the agency is relying on the most recent EIA forecasts for fuel prices for the final rule. In the NPRM, the agency relied on gasoline prices ranging from $1.51–1.58 a gallon. In the final rule, the agency is relying on the updated fuel price forecast, which provides a range of gasoline prices of $1.96–2.39 a gallon. These higher fuel prices had the effect of raising the optimized fuel economy targets for MY 2011 under the Reformed CAFE standard.[153] This, in turn, raised the estimate of fuel savings resulting from the Reformed standard by 0.7 billion gallons.

However, as discussed in Chapter VIII, higher fuel prices increase the per-mile cost of driving and therefore are expected to reduce the average number of miles driven each year by light trucks (an impact of the ''rebound effect,'' discussed above). The effect of the resulting reduction in lifetime use of MY 2008–11 light trucks is to reduce fuel savings resulting from the Reformed CAFE standard by 0.7 billion gallons, offsetting the gain that occurred due to higher fuel prices. However, this 0.7 billion gallon reduction results from the effect of higher fuel prices on usage of all four model years of light trucks affected by the Reformed CAFE standard (2008–11), while the 0.7 billion increase in fuel savings resulting from higher fuel prices resulted from higher fuel economy targets for only MY 2011 light trucks. The impact of higher standards for MY 2011 was thus offset by the combined impact of less driving over the 4 model years combined.

C. Revisions to the Reformed CAFE System

The fuel savings estimates for the Reformed CAFE system reported in the NPRM and final rule also differ because the Reformed CAFE system adopted by the final rule differs in certain details from the Reformed CAFE system described in the NPRM. First, the Reformed CAFE system adopted in the final rule replaces the footprint category system for setting fuel economy targets with a continuous function. While the continuous function closely follows the shape of the step function of the category system, slight differences reduced the fuel savings estimate for the Reformed CAFE standard reported in the NPRM by less than 0.1 billion gallons.

Second, as stated above, the Reformed CAFE standards adopted in the final rule set fuel economy targets for MY 2008–10 that are more stringent than those proposed in the NPRM. This occurs because the targets for those model years are set by equalizing total industry-wide compliance costs with those of the Unreformed CAFE standards. Estimated compliance costs for the Unreformed standards are higher in the final rule than in the NPRM because manufacturers' updated product plans already include several of the lower cost fuel improvement technologies, and therefore, the analysis applies technologies with higher costs in order to achieve the same fuel economy level under the proposed Unreformed CAFE system. Setting fuel economy targets under the Reformed CAFE system to equal these higher Unreformed CAFE compliance costs therefore results in more stringent targets. This change increased the estimated fuel savings resulting from the Reformed standard described in the NPRM by 1.6 billion gallons.

Finally, the Reformed CAFE system adopted in the final rule includes MDPVs beginning in MY 2011, while the NPRM excluded MDPVs in all model years. Including MDPVs under the Reformed standard in MY 2011 increased the estimate of fuel savings by 0.3 billion gallons.

The net effect of changes to the Reformed CAFE system in the final rule, as opposed to the Reformed CAFE system in the NPRM, accounts for 1.8 billion more gallons of fuel saved.

D. Updated Product Plans

The most important factor contributing to the difference between the fuel savings estimated for the

[153] Because the fuel economy targets for MY 2008–10 are set by equating industry-wide compliance costs for the Reformed CAFE standard to those under the Unreformed standard (rather than by the optimization process used in MY 2011), higher fuel prices do not affect the targets for those years.

proposed and final rules is changes in the product plans supplied by the manufacturers between the NPRM and final rule. In developing the NPRM, the agency relied upon manufacturer product plans provided in response to the 2003 ANPRM. Following publication of the RFC in association with the 2005 NPRM, manufacturers provided updated product plans. These updated product plans indicate that in comparison to their previous plans, several manufacturers intend to increase production of smaller vehicles, which typically have higher fuel economies, and to utilize more fuel-saving technologies across their fleets.

Table 16 below illustrates a sampling of the fuel-economy baselines relied on in the NPRM and the baselines relied upon for the final rule.

TABLE 16.—BASELINE FUEL ECONOMIES RELIED UPON IN THE NPRM AND FINAL RULE

Manufacturer	MY 2008 (mpg)		MY 2009 (mpg)		MY 2010 (mpg)	
	NPRM	Final	NPRM	Final	NPRM	Final
General Motors	21.2	21.3	21.4	21.4	21.4	21.6
Ford	21.7	21.7	22.1	21.9	22.4	22.9
DaimlerChrysler	21.9	22.0	22.3	22.0	22.3	22.4
Toyota	22.9	22.5	22.9	22.4	22.9	22.9
Honda	24.5	24.5	24.5	24.5	24.5	24.5
Nissan	20.7	21.0	20.8	21.0	21.3	21.2

The changes to product plans reflect a decrease in the planned production of larger light trucks, which typically have lower fuel economy performances. The product plans indicate that manufacturers are planningto produce less of the ladder-frame type of SUVs and more unibody crossover vehicles, which typically have higher fuel economy. This shift in the mix of vehicle sizes results in a higher overall average CAFE requirement for the entire vehicle fleet, which increases lifetime fuel savings for MY 2008–2011 light trucks by 2.4 billion gallons.

At the same time, many of the technology improvements that the agency applied in setting standards for the NPRM are thus no longer available to increase fuel economy, because they are now being utilized to achieve the higher baseline fuel economy levels reflected in manufacturers' revised product plans. These technologies include a variety of engine improvements and upgraded transmissions, many of which were applied by the agency to increase baseline fuel economy to the level of the standards proposed in the NPRM, and others that represent changes in manufacturers' plans for technology introduction. Other changes in the revised product plans include an increase in the projected number of hybrid vehicles that manufacturers plan to produce. Not only do manufacturers plan to increase their production of current hybrid models, but they also are planning to introduce hybrid versions of both existing and new vehicles. As to be expected, the additional hybrid vehicles had a beneficial effect on manufacturers' baseline CAFE levels.

If the agency's analysis for the NPRM applied a technology to improve the fuel economy of a light truck model but its manufacturer's updated product plan indicated that it now planned to utilize the same technology on that model, that technology was then unavailable to the agency in its analysis of how manufacturers could improve fleet fuel economy to meet the standards considered in the final rule. While the effect of that technology is still reflected in the vehicle's lower lifetime fuel consumption, that effect now appears to result from its manufacturer's decision to utilize it even in the absence of any action by the agency to increase CAFE standards, rather than from its efforts to comply with the standard established by the final rule.

Thus the limited availability of technologies during the period subject to this rulemaking, in part, has resulted in the final standards being set at the same or similar levels as those initially proposed. The fuel savings attributable directly to the rule is the reduction in fuel consumption from the level that would occur with a manufacturer's planned baseline. Because the level of the final standards is close to what was proposed, but the fuel economy levels represented in manufacturers' baselines have generally improved, the amount of fuel savings directly attributable to the final standards appears to be less than that projected in the NPRM.

The increase in baseline fuel economy of resulting from additional technologies accounts for a lifetime fuel savings of 5.3 billion gallons for MY 2008–2011 light trucks, which are no longer included in the fuel savings estimated for the Final Rule. Thus the net effect of revised manufacturer product plans is to reduce the fuel savings attributed to the Reformed CAFE standard in the NPRM by 2.9 billion gallons (5.3 minus 2.4 billion gallons).

E. Evaluating the Adopted Reformed CAFE System

The variety of factors that contributed to the revised fuel savings estimate for the Reformed CAFE standard adopted in the final rule make it difficult to compare the fuel savings estimate reported in the final rule with the estimate reported in the NPRM for the proposed Reformed CAFE standards. The combination of changes to manufacturers' product plans with revisions to the Volpe model and its assumptions account for a decrease in the agency's estimate of fuel savings that will result from the Reformed CAFE standards from the 10.2 billion gallons reported in the NPRM to 7.8 billion gallons in this rule. Had these changes not been made, the adopted Reformed CAFE standards would likely have saved significantly more fuel than the 10.2 billion gallons reported in the NPRM.

In a broader sense, the fuel efficiency of the light truck fleets that will be produced in MYs 2008–2011 will be significantly higher than that of the fleets that were originally planned when manufacturers submitted their initial product plans to NHTSA in 2004. This improvement in fuel efficiency reflects manufacturers' response to the higher fuel prices through fuel economy improvements to their fleets and a shift towards smaller vehicles, as well as the improvements in fuel economy required by the CAFE standards adopted in this rule. Because current and forecasted gasoline prices have risen dramatically since manufacturers submitted their initial plans, consumer preferences have shifted away from the largest models toward more modestly-sized and fuel efficient light trucks. Some of the fuel savings previously attributed to the proposed CAFE standards now appear to result from manufacturers' responses to changed market conditions.

In addition, the Reformed CAFE proposal announced in the NPRM put manufacturers on notice that fuel efficiency standards for light trucks would increase, and that future standards would challenge manufacturers to improve fuel efficiency for all light truck models, regardless of their size. The revised product plans that manufacturers submitted in response to the NPRM responded to these factors, and the changes to model assumptions discussed above, in conjunction with the more stringent Reformed CAFE standards adopted by the final rule, will significantly improve the fuel efficiency of light trucks produced in MY 2008–2011. The revised product plans that manufacturers submitted following publication of the NPRM responded to these changed conditions, and together with the more stringent standards adopted by this rule, the more fuel efficient vehicles that will be produced in MYs 2008–2011 will consume approximately 11 billion fewer gallons of fuel over their lifetimes than they would have based on the manufacturers' initial product plans.

A more meaningful comparison can be made between the fuel savings estimates for the adopted Reformed CAFE standard and the NPRM Reformed CAFE standard when both are calculated using the modeling assumptions and manufacturer product plan data that were used in the analysis conducted for the Final Rule. We re-estimated fuel savings for the NPRM Reformed CAFE standards using the revised Final Rule modeling assumptions and product plans, and found that the Reformed standard presented in the NPRM would save 5.5 billion gallons under these revised assumptions. This contrasts with the previously-reported fuel savings estimate of 7.8 billion gallons for the adopted Reformed CAFE standard. Thus increasing the stringency of the final rule and including MDPVs in 2011 together increased lifetime fuel savings projected to result from the rule by 2.3 billion gallons (equal to 7.8 billion minus 5.5 billion gallons).

XIII. Applicability of the CAFE Standards

A. Inclusion of MDPVs in MY 2011

The agency is extending the applicability of the light truck CAFE program to include vehicles defined by the EPA as ''medium duty passenger vehicles'' (MDPVs) beginning in MY 2011. As explained below, the agency finds that standards for these vehicles are feasible, and that these vehicles are used for substantially the same purpose as vehicles rated at not more than 6,000 lbs. GVWR. Further, the inclusion of these vehicles in MY 2011 will result in a savings of 251 million gallons of fuel over the lifetime of those vehicles. The regulation of these vehicles under the CAFE program will begin with the 2011 MY.

In the NPRM, the agency requested comment on extending the applicability of the CAFE program to include MDPVs. The EPA defines ''MDPV''as a ''heavy duty vehicle'' [154] with a GVWR less than 10,000 lbs. that is designed primarily for the transportation of persons. The MDPV definition excludes any vehicle which:

(1) Is an ''incomplete truck'' as defined in this subpart; or

(2) Has a seating capacity of more than 12 persons; or

(3) Is designed for more than 9 persons in seating rearward of the driver's seat; or

(4) Is equipped with an open cargo area (for example, a pick-up truck box or bed) of 72.0 inches in interior length or more. A covered box not readily accessible from the passenger compartment will be considered an open cargo area for purposes of this definition.[155]

The agency is incorporating the EPA MDPV definition into the definition of ''automobile'' in 49 U.S.C. 523.3, such that these vehicles will be regulated as light trucks. The MDPV definition essentially includes SUVs, short bed pick-up trucks, and passenger vans, which are within the specified weight and weight-rated ranges.

Under EPCA, the agency can regulate vehicles with a GVWR between 6,000 lb. and 10,000 lb. under CAFE if we determine that (1) standards are feasible for these vehicles, and (2) either that these vehicles are used for the same purpose as vehicles rated at not more than 6,000 lbs. GVWR, or that their regulation will result in significant energy conservation.

In the NPRM, the agency discussed its preliminary analysis of the feasibility of including MDPVs and the impact of their inclusion on the fuel savings of the CAFE standards. The agency expressed its belief that fuel economy technologies applicable to vehicles with a GVWR below 8,500 lbs. might be applicable to MDPVs, *e.g.*, low-friction lubricants, 6-speed transmissions and cylinder deactivation. In addition, since MDPVs are already required by EPA to undergo a portion of the testing necessary to determine fuel economy performance under the CAFE program (See 40 CFR Part 600 Subpart F), the agency expressed its belief that meeting the additional testing requirements would not be unreasonably burdensome.

Moreover, the agency's preliminary estimate was that inclusion of MDPVs in the MY 2011 Reformed CAFE standard could save additional fuel. The agency stated that we were not considering inclusion of the heavier rated vehicles in MYs 2008–2010, as our estimates indicated that their inclusion would lead to a loss in overall fuel savings. The agency sought comment on whether MDPVs should be included in the final rule for MY 2011.

Commenters were divided as to whether MDPVs should be included in the CAFE definition of light trucks. Although the NPRM requested comment on the inclusion of MDPVs, most responses addressed all vehicles up to 10,000 lbs. GVWR. Manufacturers and their trade associations were opposed to including these heavier vehicles in the CAFE program, stating that subjecting these vehicles to CAFE standards was not feasible and that these vehicles are used for substantially different purposes than vehicles with a GVWR under 6,000 lbs. Environmental organizations, States, and state organizations supported the inclusion of these vehicles, stating that including these vehicles is feasible, will result in significant fuel savings, and is appropriate as the primary use of most of these vehicles is to transport passengers. No commenter addressed the questions concerning alternate ways to encourage improving fuel economy of these vehicles.

The Alliance, Ford, Nissan, General Motors, and the Recreational Vehicle Industry Association (RVIA) opposed establishing standards applicable to any vehicle with a gross vehicle weight rating (GVWR) greater than 8,500 lbs. (heavier light trucks). Manufacturers stated that subjecting such vehicles to the CAFE program was not feasible and that these vehicles are used for a substantively different purpose than vehicles with a GVWR less than 6,000 lbs. (lighter light trucks). Additionally, compared to the 120 billion gallons of fuel used by light trucks per year, General Motors stated that the estimated fuel savings cannot be considered significant. Moreover, the Alliance and Ford stated that inclusion of these vehicles would primarily impact only one manufacturer (a domestic manufacturer) and therefore would undercut the agency's goal of establishing a more equitable regulatory

[154] The EPA defines ''heavy duty vehicle'' as a motor vehicle that is rated at more than 8,500 lbs. GVWR; or that has a vehicle curb weight of more than 6,000 lbs.; or that has a basic vehicle frontal area in excess of 45 square feet.

[155] 40 CFR 86.1803–01.

framework. Therefore, these commenters argued, inclusion of such vehicles in the CAFE program is impermissible under EPCA.

The Union of Concerned Scientists, NRDC, NESCAUM, Environmental Defense, U.S. PIRG, Sierra Club, National Environmental Trust, Rocky Mountain Institute, SUN DAY, Connecticut Department of Environmental Protection, AAA, Representatives Baldwin *et al.*, Pennsylvania Department of Environmental Protection, ACEEE and STAPPA and ALAPCO supported expanding the definition of light truck to include all vehicles with a GVWR between 8,500 lbs. and 10,000 lbs.

NRDC and Environmental Defense stated EPCA not only permitted the expansion of the light truck definition, but that the statute's directive to consider the Nation's need to conserve energy mandated an expansion. First, NRDC stated that many of the technologies evaluated in the NAS report could be applied to all vehicles with a GVWR between 8,500 lbs. and 10,000 lbs. Second, NRDC stated the fuel savings from including MDPVs would be significant. However, NRDC did not provide any discussion as to why the savings would be considered significant. Third, NRDC stated that the EPA and CARB already recognize a segment of these vehicles as primarily passenger-carrying vehicles through the MDPV classification. UCS and Environmental Defense cited a Polk survey to support the proposition that the heavier light trucks are used for substantially the same purposes as the lighter light trucks.

Environmental Defense stated that a separate class could be established for all vehicles with a GVWR between 8,500 lbs. and 10,000 lbs., so as not to detract from the fuel savings of the fleet currently regulated. NESCAUM stated that by not including all vehicles with a GVWR less than 10,000 lbs in the CAFE program, the structure would maintain an incentive for manufacturers to ''upweight'' vehicles in order to remove vehicles from the standards.

The agency concludes that inclusion of MDPVs in MYs 2008–2010 would lower the fleet-wide required fuel economy level for those years by approximately 0.3 mpg.[156] The net effect of including MDPVs in the MY 2008–2010 Reformed CAFE standards would be a reduction in overall fuel savings of almost 1.1 billion gallons.

The agency has determined that regulation of the MDPV fuel economy beginning MY 2011 is consistent with the criteria set forth in EPCA for expanding the applicability of the light truck CAFE program. First, regulation of these vehicles is feasible. Second, in establishing the MDPV definition, the EPA determined that these vehicles are used primarily to transport passengers,[157] a use substantially similar to vehicles with a GVWR less than 6,000 lbs. GVWR. Moreover, the analysis performed for the final rule indicates that inclusion of MDPVs in the light truck CAFE program for MY 2011 will lead to a savings of 251 million gallons of fuel.

In 1977, the agency extended the definition of ''automobile'' under CAFE to include certain light trucks with a GVWR greater than 6,000 lbs. The agency stated that for regulation of these vehicles to be feasible the expanded definition of ''automobile'' must be consistent with that adopted by the EPA for emissions purposes (42 FR 63184, 63185–6; December 15, 1977). In 1976, the EPA established maximum curb weight (6,000 lbs.) and maximum frontal area (45 ft^3) limitations on the trucks subject to emissions testing. The agency noted that the EPA concluded that vehicles that exceed those limitations are not used for the same type of service as those with smaller cab areas and curb weights (42 FR 63186). Consistent with the EPA regulations we amended the definition of automobile to include light trucks with a GVWR up to and including 8,500 lbs., that have a curb weight of less than 6,000 lbs. and a frontal compartment space less than 45 ft^2 (49 CFR 523.3). As General Motors noted in its comments, the agency linked the feasibility of regulating vehicles to the existence of EPA emission test procedures and data.

To generate data necessary to determine compliance with the fuel economy requirements, vehicles representative of manufacturer's model lines are subject to city and highway chassis dynamometer tests (40 CFR Part 600). Vehicles classified as ''light trucks'' under the current CAFE definition are required to undergo this testing for the EPA emissions requirements. Because both the fuel economy and emissions requirements rely on the same tests, the test burden to manufacturers is minimized.

Under the EPA's Tier 2 requirements, requirements for MDPVs to undergo city chassis dynamometer emission testing under Tier 2 are being phased-in starting in MY 2008 (50 percent) with all MDPVs subject to the testing in MY 2009 (40 CFR 86.1811–04(j)). The Tier 2 regulation exempts MDPVs from highway chassis dynamometer testing. Therefore, MDPVs are not subject under Tier 2 to the complete set of tests necessary for the fuel economy requirements. However, we have determined that this additional testing will not be burdensome for the manufacturers.

The EPA estimates that regulating MDPVs under the fuel economy standards would require approximately 50–100 city/highway paired tests at a cost of $2,000 per pair, plus an additional $50,000–100,000 per test vehicle for test preparation (i.e., a coast-down analysis[158] and appropriate mileage accumulation). Based on these estimates, the industry-wide compliance test costs for MDPVs range from $2.1 million to $8.2 million. The EPA noted that this cost could potentially be further reduced due to carry-over tests and the fact that a manufacturer is permitted to certify up to 20 percent of its fleet through an analytical process that does not require vehicle testing.

The Alliance and Ford stated that the fuel economy of the heavier light trucks is currently not known; therefore the agency has no baseline from which to set standards. As MDPVs are not currently required to undergo chassis dynamometer testing, several manufacturers asserted that the agency did not have adequate information to determine a baseline fuel economy for these vehicles from which potential fuel savings could be projected. The EPA and several manufacturers provided the agency with data that has allowed us to estimate a fuel economy baseline for MDPVs. These data predominately cover MDPVs with gasoline power trains. NHTSA has developed additional data for MDPVs, including diesels, by extrapolating from the performance of sister vehicles with a GVWR less than 8,500 lbs. Since the data supplied by the EPA was based on emission testing

[156] Under the Unreformed CAFE structure, maximum feasible standards are set with particular consideration given to the least capable manufacturer, which has been determined to be General Motors for this proposed rule. A large percentage of the MDPVs are produced by General Motors and, due to their weight, have very low fuel economy. The inclusion of these vehicles would lead to greater fuel savings by General Motors, but less by the other manufacturers. This would occur because the addition of the low fuel economy MDPVs in MYs 2008–2010 would depress the level of General Motors' CAFE and therefore depress the level of the Unreformed CAFE standards. Since the MY 2008–2010 Reformed CAFE standards are set so as to roughly equalize industry-wide costs with the MY 2008–2010 Unreformed CAFE standards, depressing the Unreformed CAFE standards for MYs 2008–2010 would also depress the Reformed CAFE standards for those years.

[157] 65 FR 6698; February 10, 2000.

[158] A coast-down analysis is used to determine a vehicle's horsepower for running the chassis dynamometer tests.

conducted on ''worst case'' vehicles, rather than best sellers as would be done for fuel economy, the baseline derived from this data is conservative.

Vehicles with a GVWR greater than 8,500 lbs that are not defined as MDPVs (e.g., heavier rated long bed pick-up trucks) are not subject to EPA testing that provides the data necessary to determine compliance with the CAFE program. Inclusion of the heavier-rated-non-MDPVs would increase the test burden for manufacturers. These vehicles would be subject to a whole new testing regime. Moreover, because these vehicles are not subject to comparable testing requirements, there is not sufficient data to estimate a fuel economy baseline. Without a reliable baseline, the agency is unable to determine fuel economy targets that would result in required fuel economy levels that are economically practicable and technologically feasible.

Aside from the ability to obtain test data and the determination of a baseline, technologies are available that can be applied to MDPVs in order to improve fuel economy performance. The agency recognizes that not all technologies that are applied to vehicles with lighter weight ratings are applicable to MDPVs. However, we have identified several technologies that could be applied, for example, 6-speed transmissions, multiple valves per cylinder, variable valve timing, and cylinder deactivation.

Commenters provided a variety of survey data on the use of vehicles with a GVWR greater than 8,500 lbs and less than 10,000 lbs. The Alliance, General Motors, Ford, and Nissan stated that the heavier light trucks are used for commercial, agricultural and utility reasons distinct from the uses of vehicles with a GVWR less than 6,000 lbs. Ford cited recent Ford New Vehicle Customer Studies (NVCS) that determined that SUVs in the MDPV category are used for towing 80 percent more often than midsize SUVs. In addition, Ford stated that for the 2004 MY, commercial and fleet users made up 63 percent of Ford Excursion buyers. However, Ford did not indicate as to whether the use of the Excursions in these fleets was primarily to transport people, or to perform more ''work-like'' functions. Ford also stated that full size vans in the MDPV category are used for significantly different purposes; of all the E-Series trucks sold, 84 percent are purchased for commercial purposes, and as commercial use of these full size vans increases, consumer use of these vehicles as passenger or conversion vans is decreasing. General Motors asserted that when considering vehicle use, the agency must focus on ''peak'' use.

The Union of Concerned Scientists and Environmental Defense cited a Polk survey to support the proposition that the heavier light trucks are used for substantially the same purpose as the lighter light trucks. According to the Polk survey, the daily use light trucks, broken down by percentage, is as follows: Commuting (53.8 percent), personal trips (33.6 percent), carrying passengers (29.6 percent), hauling (4.3 percent), towing (4.0 percent), and off-road use (3.7 percent). Union of Concerned Scientists stated that the Polk study found that use patterns of light, medium, and heavy pickup trucks are substantially the same overall, with a few notable exceptions. The Union of Concerned Scientists and Environmental Defense stated that this data demonstrate that vehicles with a GVWR greater than 8,500 lbs. and less 10,000 lbs are used for substantially similar purposes.

As stated above, the EPA determined that MDPVs are used primarily to transport passengers. In establishing the definition, the EPA stated:

> We are defining medium-duty passenger vehicles as any complete heavy duty vehicle less than 10,000 pounds GVWR *designed primarily for the transportation of persons.* (65 FR 6698, 6849; February 10, 2000; emphasis added).

Additionally, the EPA noted that that in crafting the definition, it made a distinction based on bed length,

> [B]ecause a vehicle introduced with a shorter bed would have reduced cargo capacity and would likely have increased seating capacity relative to current pick-ups, making it more likely to be used primarily as a passenger vehicle. Id.

In establishing the final rule, the EPA demonstrated an effort to distinguish vehicles that are used primarily to transport people from vehicles used for more ''work-like'' functions. The transportation of passengers is a use that is substantially similar to the use of vehicles with a GVWR less than 6,000 lbs. As in the 1977 final rule, we are amending the definition of automobile consistent with the EPA's determination.

The agency also considered Ford's comment that inclusion of MDPVs would result in disparate impacts under Reform CAFE. Ford specifically stated that the target for a category containing MDPVs would have to be lowered to account for the reduction in the overall capability of the category fleet. Therefore, manufacturers that do not produce MDPVs, but that have other vehicles in that category, would receive a less stringent target. On the other hand, Environmental Defense stated that a separate class could be created for heavier vehicles so as to not reduce the target for vehicles which are already regulated.

After considering these comments, the agency has decided not to regulate MDPVs as a separate class of light truck. First, we note that issues regarding the impact of MDPVs on the largest vehicle category are no longer applicable. Under the continuous function, vehicles will be compared to targets assigned to each vehicle's footprint value. Further, as the agency has stated previously when deciding whether to establish separate standards for 2WD and 4WD vehicles, ''the fact that standards must be average fuel economy standards indicates that the manufacturers should be given some opportunity to balance vehicles with different fuel economies to ensure, consistent with the need to conserve energy, that a reasonable variety of vehicle types can be produced to satisfy consumer demand.'' (42 FR 13807, 13811; March 14, 1977)

Since the manufacturers of MDPVs are all full-line manufacturers, the agency has decided that on balance it is advantageous to regulate these vehicles with all light trucks in order to provide manufacturers the flexibility of either improving the fuel economy of these vehicles, relying on improvements in other vehicles to offset the fuel economy of these vehicles, or some combination of these two strategies.

Finally, we have determined that inclusion of MDPVs in MY 2011 will result in an additional fuel savings of 251 million gallons of fuel.

B. ''Flat-Floor'' Provision

In the NPRM, the agency tentatively decided to amend the ''flat floor provision'' in the light truck definition (49 CFR 523.5) so that the definition expressly includes vehicles with seats that fold and stow in a vehicle's floor pan. The agency stated that we tentatively determined that these seats are functionally equivalent to removable seats and minimize safety concerns that arise from the potential to improperly re-installed seats. The agency said that its goal was treating passenger vans and mini vans in a similar fashion.

In response to commenters, the agency is amending the flat-floor provision to accommodate certain folding seats, but also to restrict the group of vehicles relying on the flat floor provision to qualify as a light truck to those vehicles having at least 3 rows of designated seating positions as standard equipment. That is, a vehicle would qualify only if it had at least 3 rows of seats, the 2nd and 3rd of which are capable of creating a flat cargo surface through either folding or detachment.

The current regulation classifies as a light truck any vehicle with readily removable seats that, once removed, leave a flat floor level surface. In pertinent part, the current regulatory text reads as follows:

Permit expanded use of the automobile for cargo-carrying purposes or other nonpassenger-carrying purposes through the removal of seats by means installed for that purpose by the manufacturer or with simple tools, such as screwdrivers and wrenches, so as to create a flat, floor level, surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior.[159]

This definition is only one of several classifying light trucks, and historically, it has operated, as originally intended, to bring only minivans and full size passenger vans into the light truck category. Sport utility vehicles qualify as light trucks because they have the indices of off-road capability: a 4-wheel drive system and certain dimensional characteristics.[160] While the criteria used for SUVs remain viable, the definition pertaining to minivans has become outdated in that it does not bring all minivans and passenger vans into the light truck category.

The Alliance, Ford, Nissan, AIAM, and General Motors stated that the proposed revision to the flat floor provision reflects current market conditions and that the agency properly acknowledged the risks of improperly re-installed seats. However, Ford, Nissan, and General Motors, requested that the agency clarify the term ''stowing of foldable seats in the vehicle floor pan'' to appropriately capture minivans and exclude passenger vehicles with seats that have only the seatback fold (e.g., station wagons). DaimlerChrysler, Mitsubishi, and Johnson Controls raised concern that the proposed amendment would not capture all minivans, given that the design of folding seats is not limited to those that stow under the floor pan. DaimlerChrysler and Johnson Controls recommended that the agency adopt a flat loading surface requirement in conjunction with a minimum volume criterion.

As discussed in the NPRM, minivans traditionally subject to light truck CAFE standards began offering various seat designs that are intended to be functionally similar to removable seats, while remaining attached at some point to the vehicle. In the NPRM we recognized seats that fold and stow in a vehicle's floor pan; i.e., flush with the vehicle's floor, thereby creating a flat surface that is dimensionally indistinguishable from the surface floor that would exist if the same seats were removed instead of being stowed.[161] There are still other minivans that offer seats that fold so as to create a different/new continuous flat cargo surface that is located above the floor level. The current definition of light trucks has the potential of subjecting minivans that offer stowable seats to passenger vehicle CAFE standards, while subjecting very similar minivans featuring removable seats to light truck standards.

In response to comments, we are adopting a revision to the flat-floor provision that recognizes the various designs that permit seats to fold and stow. The provision adopted today replaces the ''flat, floor level surface'' language with a requirement that removal or stowing of seats creates a ''flat, leveled surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior.'' This new language eliminates the need to define ''floor pan'' and does not require seat designs to store in any particular manner.

Several commenters raised concern with revising the flat-floor provision. The Union of Concerned Scientists, Environmental Defense, and the New York Department of Environmental Conservation opposed the proposed revision, stating that it would widen the existing light truck ''loophole.'' Furthermore, the Union of Concerned Scientists stated that the original justification for the flat floor provision no longer applies. The Union of Concerned Scientists stated that the flat floor provision was established to reflect that passenger vans were derived from cargo vans, but that this is no longer true. (In the July 28, 1977 rulemaking, the agency stated that station wagons should not be classified as light trucks because, in part, they are built on a car chassis rather than a truck chassis (see 42 FR 38362, 38367). The Union of Concerned Scientists stated that while cargo vans and pickup trucks currently share the same platform, minivans do not.

First, the agency continues to conclude that in general, minivans are appropriately classified as light trucks. Minivans offer fuel economy compromising utility features normally associated with light trucks. Specifically, unlike the smaller passenger cars, all minivans feature three rows of seats, thus offering greater passenger carrying capability.[162] Further, data from *http://www.Edmunds.com,* NHTSA CAFE Database, and the Automotive News Data Center indicate that minivans offer significantly larger cargo carrying capacity compared to passenger cars (see Table 17 below).

TABLE 17.—MAXIMUM CARGO CAPACITY OF MINIVANS

Vehicle	Type	Maximum cargo capacity
DCX R-class	Minivan	85 cu. ft.
DCX Pacifica	Minivan	80 cu. ft.
DCX Caravan/Town & Country SWB	Minivan	147 cu. ft.
Honda Odyssey	Minivan	147 cu. ft.
Toyota Sienna	Minivan	149 cu. ft.
Ford Freestar/Mercury Monterey	Minivan	137 cu. ft.
GM Uplander/Terraza/Montana	Minivan	120 to 137 cu. ft.
Nissan Quest	Minivan	149 cu. ft.
Mazda MPV	Minivan	127 cu. ft.
Chevy HHR	Wagon	56 cu. ft.
Audi A4	Wagon	59 cu. ft.
DCX E-class	Wagon	69 cu. ft.
Saab 9–5	Wagon	73 cu. ft.

[159] See 49 CFR 523.5(a)(5).

[160] Sport Utility Vehicles of different sizes qualify as light trucks because they are equipped with a 4-wheel drive system and because they have higher ground clearance and steeper approach and departure angles.

[161] For example, Chrysler Town and Country and Dodge Caravan feature ''Stow 'n Go'' seating.

[162] Only one minivan, the Chrysler Pacifica, does not offer a third row as standard equipment.

TABLE 17.—MAXIMUM CARGO CAPACITY OF MINIVANS—Continued

Vehicle	Type	Maximum cargo capacity
Volvo V70	Wagon	71 cu. ft.
Volvo V50	Wagon	63 cu. ft.
Jaguar X-type	Wagon	50 cu. ft.
BMW 530 ix	Wagon	58 cu. ft.
Dodge Magnum	Wagon	72 cu. ft.
Pontiac Vibe/Toyota Matrix	5-door hatchback	54 cu. ft.
Mazda 3	5-door hatchback	31 cu. ft.

Both of these capabilities affect fuel economy because in order to accommodate additional seats and provide greater cargo carrying capacity, Minivans are made larger and heavier than passenger cars. The seats themselves add significant weight to these vehicles. In addition to fuel economy compromising utility features, we previously explained that continued inclusion of minivans in the light truck standard is justified, in part, based on their good performance in crash tests.[163] The same cannot be readily said for a diverse population of station wagons and hatchbacks that may have flat-folding seats, because some of them are very small and potentially less safe.

However, the agency recognizes the risk of expanding the light truck definition to include vehicles not intended to be in that class, i.e., station wagons and hatchbacks. In order to focus the definition only on those vehicles that the agency believes should be included in the light truck category, we believe it is appropriate to restrict the group of vehicles relying on the flat floor provision to qualify as a light truck to those also having at least 3 rows of designated seating positions as standard equipment. That is, a vehicle could qualify only if it had at least 3 rows of seats, the 2nd and 3rd of which are capable of creating a flat cargo surface through either folding or detachment. The regulatory text would read as follows:

> For vehicles equipped with at least 3 rows of designated seating positions as standard equipment, permit expanded use of the automobile for cargo-carrying purposes or other nonpassenger-carrying purposes through the removal or stowing of seats so as to create a flat, leveled surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior.

The agency has chosen to adopt the ‘‘third row’’ criterion for four reasons. First, this definition best advances our goal of subjecting all minivans to one CAFE standard, and eliminates an artificial distinction between minivans depending on whether they have folding seats or removable seats. Second, an obvious advantage of this approach is simplicity and objectivity. For example, this definition would not require complicated cargo capacity measurements in order to determine whether a vehicle is a light truck, as would be required under DaimlerChrysler's suggestion. Third, compared to geometric criteria, such as a minimum cargo volume, this approach is less susceptible to gaming, as it is unlikely that smaller vehicles that the agency believes should not be subject to the light truck standards would be equipped with 3rd row seats. Finally, the 3rd row seat criterion ensures that vehicles classified as light trucks continue to include those that offer added utility features contemplated by Congress when it created a separate CAFE standard for light trucks.

In addition to furthering our goal of subjecting all minivans to the CAFE standard for light trucks, the provision adopted today limits the number of vehicles that will be reclassified as light trucks. After examining *http://www.Edmunds.com,* NHTSA CAFE Database, and the Automotive News Data Center, we found that only a Volvo V70 (≤ 10,000 annual sales) has a flat-folding 3rd row seat, and would thus qualify as a light truck. By contrast, other alternatives considered by the agency would not necessarily bring all minivans under one standard, and could also have the unintended effect of reclassifying a more substantial number of passenger cars as light trucks.

We note that small sport utility vehicles without 3rd row seats would nevertheless qualify as light trucks based on other existing criteria; i.e., availability of 4-wheel drive or approach angles and minimum clearance. Thus, our approach is expected to have few unintended consequences. Nevertheless, some vehicles previously classified as light trucks would no longer be subject to the light truck CAFE standard. One such vehicle is a Chrysler PT Cruiser, which qualifies now as a light truck because it has a removable rear seat which creates a flat floor. However, the PT cruiser does not have a 3rd row of seats. Also, one minivan, the Chrysler Pacifica does not offer a third row as standard equipment. To provide manufacturers adequate time to adjust their product plans to the new provision we are making the new definition effective beginning in MY 2012, the change will not have any immediate impact on MYs 2008–2011 vehicles.

In order to provide additional flexibility we are permitting manufacturers to rely on either the old or the revised definition of light trucks until MY 2012. This will ensure that a vehicle previously subject to light truck CAFE standards would not immediately become subject to the pasenger car standard thus upsetting the manufacturers' compliance plans. At the same time, those manufacturers currently offering minivans with folding seats would be able to take advantage of the new definition immediately.

We do not anticipate that the provision adopted today will result in manufacturers installing third row seating for the sole purpose of compliance with the light truck CAFE program. Installing third row seats presents practical difficulties (*e.g.*, limited headroom) and costs associated with making this change in vehicles with smaller interior volume. Specifically, we believe the costs of redesigning small vehicles to feature 3rd row seats will outweigh potential benefits of subjecting these vehicles to the light truck standard. Further, small vehicles such as hatchbacks, will likely be compared to fuel economy targets comparable to that of the passenger car CAFE standard, thus further reducing the incentive to make major design changes for the purpose of classifying such vehicle as a light truck.

XIV. Additional Issues

A. Limited-Line Manufacturer Standard

Porsche requested that the agency establish a separate standard for limited-line manufacturers, stating that manufacturers that produce only one or two light trucks are not afforded the flexibility provided through fleet-wide

[163] See August 2005 NPRM (70 FR 51414 at 51456).

averaging. Porsche noted that it manufacturers only a single model of light truck that Porsche stated is designed to ''satisfy a specific consumer demand.'' Porsche argued that it would have even greater difficulty in complying under the Reformed CAFE system, as its light truck would fall within a category that has a target more stringent than the Unreformed CAFE standard. Porsche stated that the agency had authority to establish a limited-line manufacturer standard, and had previously done so for ''limited product line trucks'' for MYs 1980 and 1981.

When the agency first established the light truck CAFE program, we established a separate standard for limited product line light trucks. This standard was to accommodate light trucks manufactured by companies which did not produce passenger automobiles and thus did not have access to passenger automobile engine and emission control technology (43 FR 11995, 11996; March 23, 1978). The limited product line light truck standard was established primarily to address the unique compliance issues facing International Harvester, as International Harvester's engines were derivatives of medium duty trucks (above 10,000 lbs GVWR). We noted that International Harvester did not have experience with ''state-of-the-art'' emission controls, which other manufacturers had obtained in the passenger car market, and that International Harvester would be at a disadvantage attempting to comply with both the emission and fuel economy standards then being established (43 FR 11995, 11998).

While the limited product line light truck standard was established to address compliance difficulties of a limited line light truck manufacturer, the light truck class was defined, in part, by vehicle characteristic, *i.e.*, it applied only to trucks with basic engines, as that term was defined by the EPA. The agency discontinued the limited line truck classification beginning in MY 1982, stating that the vehicle class was designated merely to provide a transition period (45 FR 20871, 20877; March 31, 1980).

The agency does not agree with Porsche's suggestion that the company's particular circumstances support establishment of a separate fuel economy standard for limited-line manufacturers, or for vehicles of the type manufactured by limited-line manufacturers as was previously done in response to issues faced by International Harvester. Porsche stated that it faces a disadvantage because it makes only a single high performance truck and has no ''legitimate'' opportunity to comply, and that compliance is made more difficult by the reforms established today. Although some manufacturers have chosen to participate in market segments that make it easier for them to meet CAFE, we note that all manufacturers must meet particular challenges when complying with a standard.

Porsche is correct in that in the very first years in which CAFE standards were in effect, the agency established a separate light truck standard for light truck manufacturers who did not use passenger car engines in their trucks. This separate standard, promulgated in 1978, offered a degree of relief to International Harvester, a company struggling to meet both CAFE and emissions standards with limited resources. As indicated above, the separate standard was not intended to provide International Harvester permit relief, but to provide it with additional time to gain the expertise necessary to comply with the standards.

NHTSA finds it difficult to equate Porsche's present position with that of International Harvester in 1978. Unlike International Harvester, which had been producing a family of larger light trucks whose basic design remained unchanged from the early 1960's, Porsche began the design process knowing that CAFE standards would apply to its product. Porsche presumably entered the light truck market after determining that the costs of compliance or paying penalties were offset by the benefits of doing so. While the increase in CAFE standards established by this final rule will require that Porsche increase its efforts to build more fuel efficient light trucks, the company cannot state that its designs pre-date CAFE, that an increase in CAFE standards was not foreseeable or that it is not technologically feasible for Porsche to meet the standards.

As indicated above, NHTSA does not believe that present market conditions dictate establishing a separate fuel economy standard for Porsche or other limited-line manufacturers. We are also not convinced by Porsche's argument that doing so would be consistent with Congressional intent. Porsche has correctly noted that the House Report for EPCA stated that ''the Secretary could, in setting classes of non-passenger automobiles, establish separate classes for types of non-passenger automobiles manufactured by small manufacturers.'' (H.R. Rep. No. 94–340 at 90.) However, we point out that the report refers to ''types of vehicles.'' We question whether Congress intended for the agency to set standards based on manufacturer characteristics, as opposed to vehicle characteristics.

When the agency established CAFE standards for limited product line light trucks, that class included only vehicles with a specific engine type. While the reform established today results in different required fuel economy standards for different manufacturers based on product mix, the standard still relies on differentiating vehicles based on a vehicle characteristic, *i.e.*, footprint.

B. Credit Trading

Nissan recommended that the agency implement a credit trading program that permits manufacturers to buy and sell credits. Nissan stated that such a program would allow manufacturers to earn credits for exceeding their fleet-wide fuel economy target, and sell or trade those credits to other manufacturers. Nissan believes that such a program is consistent with the goals of the EPCA statute and would improve overall fuel economy by providing added incentives for the achievement of greater fuel economy improvements. Nissan asserted that such a program also would allow greater flexibility in CAFE compliance without causing a negative overall impact on fuel economy, and in fact, it could successfully benefit the environment. Nissan provided an analysis in support of the agency's authority to establish such a credit trading program.

The agency is not adopting a credit trading program as suggested by Nissan. While the agency has not explored in detail a credit trading program, we question whether the agency has authority for such a program. A review of 49 U.S.C. 32903—the specific provision addressing CAFE credits for exceeding fuel economy standards—does not appear to support credit trading. That section persistently refers only to ''a manufacturer'' or ''the manufacturer,'' thereby suggesting to us that Congress intended that only the particular manufacturer who earned the credits be permitted to use them. For example, section 32903(a) provides that

> When the average fuel economy of passenger automobiles manufactured by a manufacturer . . . exceeds an applicable average fuel economy standard . . . the manufacturer earns credits. The credits may be applied to—(1) any of the 3 consecutive model years immediately before the model year for which the credits are earned; and (2) to the extent not used under clause (1) of this subsection, any of the 3 consecutive model years immediately after the model year for which the credits are earned.

(Emphasis added.) Also, section 32903(d) states that, The Secretary of Transportation shall apply credits to a model year on the basis of the number of tenths of a mile of gallon by which the manufacturer involved was below the applicable average fuel economy standard.

(Emphasis added.) Moreover, we believe that the Reformed CAFE program adopted today provides manufacturers with sufficient flexibility as to obviate the need for a credit trading program.

C. Reporting Requirements

Today's final rule requires manufacturers to report on a model and configuration level, a vehicle's footprint. This information will be used to determine a vehicle's applicable fuel economy target.

The Alliance opposed reporting footprint on at a vehicle-configuration level. The Alliance suggested that footprint values should be reported by model on a body style and wheelbase level along with associated projected sales volumes. The Alliance stated that body-style and wheelbase level of detail could be easily compiled and submitted. Conversely, for some manufacturers, the Alliance stated, reporting on a configuration level would require programming changes in corporate databases and reports.

The agency is maintaining the footprint reporting requirements as proposed. If reporting were to be required at the level suggested by the Alliance, models that are offered with varying footprint values may not be captured. For example, the Ford base F150, is offered with in several versions with different body styles and wheelbases. However, these versions are each offered in with different engine, transmission, and drive type configurations. Each of these configurations may have a different fuel economy performance. Under the Alliance's suggestion, these configurations would not be captured.

The Alliance also stated that the agency should eliminate some of data required for the CAFE reports, specifically: Catalytic converter, SAE net rated power in kilowatts, total drive ratio, axle ratio, frontal area, optional equipment, number of forward speeds (already indicated by transmission class). The Alliance stated that this information is no longer relevant.

The NPRM did not propose to revise the data reporting requirements aside from requiring the footprint related data and elimination of data currently required to be reported is outside the scope of this rulemaking. Moreover, consideration of such revisions would require coordination with the EPA to ensure consistency between the two agencies' regulatory programs, given the joint responsibilities under EPCA. However, the agency will work to evaluate the necessity of the data currently required to be reported and will consider potential revisions in future rulemakings.

D. Preemption

Summary of NHTSA's position

In mandating federal fuel economy standards under EPCA, Congress has expressly preempted any state laws or regulations relating to fuel economy standards. A State requirement limiting CO_2 emissions is such a law or regulation because it has the direct effect of regulating fuel consumption. CO_2 emissions are directly linked to fuel consumption because CO_2 is the ultimate end product of burning gasoline. Moreover, because there is but one pool of technologies for reducing tailpipe CO_2 emissions and increasing fuel economy available now and for the foreseeable future, regulation of CO_2 emissions and fuel consumption are inextricably linked. It is therefore NHTSA's conclusion that such regulation is expressly preempted.

A State requirement limiting CO_2 emissions is also impliedly preempted under EPCA. It would be inconsistent with the statutory scheme, as implemented by NHTSA, to allow another governmental entity to make inconsistent judgments made about how quickly and how much of that single pool of technology can and should be required to be installed, consistent with the need to conserve energy, technological feasibility, economic practicability, employment, vehicle safety and other relevant concerns.

NHTSA's statement in the NPRM about preemption

In the NPRM, NHTSA reaffirmed its judgment that State regulation of motor vehicle tailpipe emissions of CO_2 is both expressly and impliedly preempted by statute:

We reaffirm our view that a state may not impose a legal requirement relating to fuel economy, whether by statute, regulation or otherwise, that conflicts with this rule. A state law that seeks to reduce motor vehicle carbon dioxide emissions is both expressly and impliedly preempted.

Our statute contains a broad preemption provision making clear the need for a uniform, federal system: "When an average fuel economy standard prescribed under this chapter is in effect, a State or a political subdivision of a State may not adopt or enforce a law or regulation related to fuel economy standards or average fuel economy standards for automobiles covered by an average fuel economy standard under this chapter." 49 U.S.C. 32919(a). Since the way to reduce carbon dioxide emissions is to improve fuel economy, a state regulation seeking to reduce those emissions is a "regulation related to fuel economy standards or average fuel economy standards."

Further, such a regulation would be impliedly preempted, as it would interfere [with] our implementation of the CAFE statute. For example, it would interfere the careful balancing of various statutory factors and other related considerations, as contemplated in the conference report on EPCA, we must do in order to establish average fuel economy standards at the maximum feasible level. It would also interfere with our effort to reform CAFE so to achieve higher fuel savings, while reducing the risk of adverse economic and safety consequences.[164]

During the comment period on the NPRM, some commenters questioned the correctness of NHTSA's judgment as well as the appropriateness of reaffirming it in the NPRM.

The appropriateness of our discussing preemption in the NPRM

We discussed our views about preemption in the NPRM for several reasons. First, the agency was guided by Executive Order 13132, Federalism, and by Section 3(b)(1)(B) of Executive Order 12988, Civil Justice Reform. Second, we were guided by a desire to obtain comments from State and local officials and other members of the public in order to inform fully the agency's position on this important issue.

Third, we were also guided by statements of the Supreme Court, which has encouraged agencies to consider the preemptive effects of their rulemakings during the rulemaking process, rather than waiting until litigation ensues to do so.[165] Finally, from time to time over the years, NHTSA has raised the issue of preemption in its rulemaking notices when the agency judged it appropriate to do so, as have other agencies within the Department of Transportation. E.g., 54 FR 11765 (March 1989); 58 FR 68274 (December 1993) and 70 FR 21844 (April 2005).

Public Comments About the Merits of Our Views on Preemption

The motor vehicle manufacturers and their associations agreed with the agency's position regarding federal preemption under § 32919(a) of EPCA. Nissan supported that position with a detailed legal analysis. Conversely, several of the environmental groups and

[164] 70 FR 51414, 51457.

[165] *See, e.g., Hillsborough County* v. *Automated Medical Laboratories, Inc.*, 471 U.S. 707, 718 (1985); *Medtronic, Inc.*, v. *Lohr*, 518 U.S. 470, 506 (1996) (Justice Breyer, in concurrence); and *Geier* v. *American Honda Motor Co.*, 529 U.S. 861, 908 (2000) (Justice Stevens, in dissent).

States,[166] and a number of U.S. Senators and Representatives, disagreed with the agency's position that a State carbon dioxide (CO_2) standard is expressly and impliedly preempted.

Nissan argued that California's proposed CO_2 standard is expressly preempted by EPCA's broadly worded preemption provision. A State standard is preempted even if it does not directly address fuel economy; it is sufficient if it simply relates to fuel economy.

That commenter noted that the text of EPCA's preemption provision is similar to that of the preemption provision in the Employee Retirement Income Security Act (ERISA). The Supreme Court has found that a state law is ''related to'' a benefits plan under ERISA and thus preempted by ERISA's preemption provision ''if it has a connection with or reference to such a plan.''

Nissan said that California's greenhouse gas standard is connected to fuel economy. California's greenhouse gas regulation is, in effect, a fuel economy regulation. The emission of one greenhouse gas, CO_2, is related to fuel economy. The only means for vehicle manufacturers to reduce vehicular CO_2 emissions is through making improvements to fuel economy. This is evident from CARB's report, which discusses the maximum feasible and cost effective technologies available and the identification of technologies that are in fact fuel economy improvements.

Nissan also said that California's standard also interferes with the nationally uniform plan that CAFE establishes for governing the fuel efficiency of the U.S. fleet and is therefore impliedly preempted. A state law or standard may be impliedly preempted because the federal interest is so dominant that Congress intends to occupy a regulatory field with no room for state supplementation (field preemption) or because the federal government has enacted a complete regulatory scheme in an area such that any state action would be inconsistent with the federal legislation (conflict preemption).

Nissan concluded by arguing that individual state laws setting fuel economy standards would be impliedly as well as expressly preempted. It argued that those laws would conflict with EPCA, which authorizes DOT to develop and administer a national CAFE program. Neither the EPA, nor States are permitted to interfere with the CAFE regulatory regime currently established by Congress under EPCA. Because, as noted above, the emission of CO_2 is related to fuel economy and because the only way to reduce CO_2 is through fuel economy technologies, any effort to do so by EPA or the States would interfere with Congressional objectives under EPCA.

Taken together, the primary arguments of the opponents of preemption were as follows:

The opponents argued that the preemption waiver provision of the Clean Air Act expressly recognizes the right of California to adopt and enforce its own standards for ''air pollutants'' emitted by motor vehicles (*i.e.*, emissions standards), and the right of the other States to adopt and enforce standards identical to California's standards.[167] They said that Congress ratified and strengthened the preemption waiver provision in 1977, two years after the enactment of EPCA in 1975. Thus, they argue, Congress could not have intended EPCA to limit the rights they believe are recognized by the Clean Air Act.

The opponents believe further that a State CO_2 standard, including California's GHG/CO_2 equivalent emissions standard, is not preempted under EPCA's express preemption provision, Section 32919(a). They offered two arguments in support of this belief.

First, they argued that EPCA does not expressly preempt a State CO_2 standard. They believe that statute's express preemption provision should be read narrowly, preempting State standards that regulate fuel economy itself, but not State standards that have a stated purpose other than improving fuel economy (*i.e.*, reducing emissions) and merely have the effect of increasing fuel economy.

Second, they argued that the intent of Congress concerning the relationship between State motor vehicle emissions standards and CAFE standards under EPCA is expressed in the Act's provision setting out the factors to be considered in setting CAFE standards (''decisionmaking factors provision''), Section 32902(f), not its express preemption provision. The decisionmaking factors provision requires NHTSA to consider technological feasibility, economic practicability, the effect of other Government standards on fuel economy, and the need of the nation to conserve energy, in determining the level at which it should set each CAFE standard. The opponents said the decisionmaking factors provision subordinates the CAFE standards to all State emissions standards, not vice versa.

In addition, the opponents of preemption appear to have argued that there is no implied (conflict) preemption because State CO_2 standards and CAFE standards have different objectives and because NHTSA did not show how a State CO_2 standard would adversely affect the CAFE standards. They argue further that, in the event of a conflict, CAFE standards must give way to the emissions standards per the decisionmaking factors provision.

NHTSA's Response to Public Comments on the Merits

Background

Fuel Economy Provisions of the Energy Policy and Conservation Act

EPCA established the CAFE program, mandating the issuance and implementation of standards for passenger cars and light trucks. The statute specifies that the passenger car standard is 27.5 mpg unless the agency finds that the maximum feasible level for a model year is different, and sets it at that level. It directs NHTSA to establish light truck standards at the maximum feasible level, subject to four statutorily specified factors.[168]

The Act specifies that the agency is to determine the maximum feasible level after considering technological feasibility, economic practicability, the effect of other motor vehicle standards on fuel economy, and the need of the Nation to conserve energy.[169] The agency has historically included the potential for adverse safety consequences when deciding upon a maximum feasible level. The overarching principle that emerges from the enumerated factors and the court-sanctioned practice of considering safety and links them together is that CAFE standards should be set at a level that will achieve the greatest amount of fuel savings without leading to significant adverse economic or other societal consequences.[170]

EPCA specifies that compliance with CAFE standards is to be determined in accordance with test and calculation procedures established by EPA. 49 U.S.C. 32904(c). Under the procedures established by EPA, compliance with the CAFE standards is based on the rates

[166] California, Connecticut, Maine, Massachusetts, New York, New Jersey, Oregon, Pennsylvania, and Vermont.

[167] Clean Air Act §§ 209(b), 177, 42 U.S.C. 7543 and 7507.

[168] 49 U.S.C. 32902(a).

[169] 49 U.S.C. 32902(f).

[170] Average Fuel Economy Standards for Light Trucks; Model Years 2008–2011, 70 FR 51414, 51424 (August 30, 2005) (to be codified at 49 CFR pt. 533).

of emission of CO_2, CO, and hydrocarbons from covered vehicles, but primarily on the emission rates of CO_2. In the measurement and calculation of a given vehicle model's fuel economy for purposes of determining a manufacturer's compliance with federal fuel economy standards, the role of CO_2 is approximately 100 times greater than the combined role of the other two relevant carbon exhaust gases. Given that the amount of CO_2, CO, and hydrocarbons emitted by a vehicle varies directly with the amount of fuel it consumes, EPA can reliably and accurately convert the amount of those gases emitted by that vehicle into the miles per gallon achieved by that vehicle.

Congress explicitly and broadly preempted all state laws and standards relating to fuel economy standards:

[w]hen an average fuel economy standard prescribed under this chapter [49 U.S.C.S. §§ 32901 *et seq.*] is in effect, a State or a political subdivision of a State may not adopt or enforce a law or regulation related to fuel economy standards or average fuel economy standards for automobiles covered by an average fuel economy standard under this chapter.[171]

Congress did not include a provision authorizing any waivers of that preemption provision for any State for any reason.

Clean Air Act

Congress has also preempted all state standards relating to the control of motor vehicle emissions:

[n]o State or any political subdivision thereof shall adopt or attempt to enforce any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines.[172]

However, Congress has also expressly authorized EPA to waive the preemption provision under the Clean Air Act for states that adopted emissions control standards before 1966.[173] While California is the only State that meets that criterion, and thus is the only state that can obtain a waiver of the preemption provision, the Clean Air Act permits other States to adopt California emission standards.[174]

Current State GHG Standards [175]

The GHG standard purports to regulate four motor vehicle climate change emissions:

- CO_2, CH_4 and N_2O emissions resulting directly from operation of the vehicle,
- CO_2 emissions resulting from operating the air conditioning system,
- HFC (refrigerant) emissions from the air conditioning system due to either leakage, losses during recharging, or release from scrappage of the vehicle at end of life, and
- Upstream emissions associated with the production of the fuel used by the vehicle.[176]

As is shown later in the discussion of preemption, compliance with the GHG standards will be based primarily on the CO_2 emission rates of vehicles. The States will measure the amounts of emissions of these four gases and then convert them into ''CO_2-equivalent'' emissions.[177] This reflects the status of CO_2 as the reference gas for measuring the global warming potential of greenhouse gases.

Constitutional basis for preemption

Preemption results from Article VI of the U.S. Constitution, which provides that federal law ''shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, any Thing in the Constitution or Laws of any State to the Contrary notwithstanding.''

Principles of preemption

The Supreme Court has held that preemption may be express or implied:

State law may be preempted by express language in a congressional enactment,* * * by implication from the depth and breadth of a congressional scheme that occupies the legislative field * * *, or by implication because of a conflict with a congressional enactment.[178]

Discussion

In response to the public comments and letters from members of Congress, we have re-analyzed all issues carefully as set forth below, and determined, based on existing and foreseeable technologies for reducing CO_2 emissions from motor vehicles, that the effect under EPCA and the Supremacy Clause of the U.S. Constitution is that State regulation of those emissions is preempted.

Any Regulation Governing Carbon Dioxide Emissions From Motor Vehicles Relates to Average Fuel Economy Standards and Is Expressly Preempted Under 49 U.S.C. Chapter 329

EPCA contains a broadly worded provision expressly preempting any State standard or regulation that is ''related to'' a fuel economy standard:[179]

[49 U.S.C.] 32919. Preemption

(a) General. When an average fuel economy standard prescribed under this chapter [49 U.S.C.S. §§ 32901 *et seq.*] is in effect, a State or a political subdivision of a State may not adopt or enforce a law or regulation *related to* fuel economy standards or average fuel economy standards for automobiles covered by an average fuel economy standard under this chapter.

(Emphasis added.)

While the express preemption provision on its face uses expansive language, any ambiguity regarding the appropriate reading of the provision, particularly in relation to other statutory provisions, must be resolved in light of the policy considerations embodied in EPCA. In NHTSA's judgment, this language includes, but is not limited to, explicit fuel economy standards issued by States. Because the only technologically feasible, practicable way for vehicle manufacturers to reduce CO_2 emissions is to improve fuel economy,[180] NHTSA's considered view is that a State regulation that requires vehicle manufacturers to reduce those emissions is a ''regulation related to fuel economy standards or average fuel economy standards.'' [181] This view is consistent with the legislative history of the preemption provision, and with the

[171] 49 U.S.C. 32919(a).

[172] 42 U.S.C. 7543 (a).

[173] 42 U.S.C. 7543 (b).

[174] 42 U.S.C. 7507.

[175] According to the National Academy of Sciences, Massachusetts, New York, New Jersey, Connecticut, Rhode Island, Vermont, and Maine have adopted the California GHG emissions standard. In addition, Washington State has adopted the standard contingent upon Oregon's adoption of it. Oregon ''has adopted temporary rules . . . and is scheduled to propose permanent rules in the summer of 2006.'' State and Federal Standards for Mobile Source Emissions, prepublication copy, 145 (2006).

This discussion of preemption focuses on the details of the California standard in order to provide the clearest possible expression of the underlying technical rationale for why that standard is not consistent with NHTSA's authority to regulate fuel economy. This specific discussion should not be interpreted to mean that other standards would be acceptable.

[176] Title 13, California Code of Regulations (CCR) § 1961.1(a)(1)(B)1.a. For vehicles certified on conventional fuels (*e.g.*, gasoline), CARB's regulation does not encompass upstream emissions (*i.e.*, emissions associated with the production and transportation of the fuel used by the vehicle). California Environmental Protection Agency, Air Resources Board, Regulations To Control Greenhouse Gas Emissions From Motor Vehicles, Final Statement Of Reasons (FSOR), at 6–7.

[177] California Environmental Protection Agency, Air Resources Board, Regulations To Control Greenhouse Gas Emissions From Motor Vehicles, Initial Statement Of Reasons (ISOR), p. 48.

[178] *Lorillard Tobacco Co.* v. *Reilly*, 533 U.S. 525, 540 (2001).

[179] 70 FR, at 51457 (August 30, 2005).

[180] NHTSA recognizes that regulating the producers of motor vehicle fuels can contribute to the reduction of CO_2 emissions. The preemption provision of EPCA does not preempt State regulation of those fuels. However, it does preempt State regulation of the manufacturers of motor vehicles directly related to fuel economy, including regulation of CO_2 emissions of their vehicles.

[181] Id.

Supreme Court's interpretation of similar provisions.

The legislative history of that provision confirms that Congress intended to be broadly preemptive in the area of fuel economy regulation. The Senate bill [182] would have preempted State laws only if they were ''inconsistent'' with federal fuel economy standards, labeling, or advertising, while the House bill [183] would have preempted State laws only if they were not ''identical to'' a Federal requirement. The express preemption provision as enacted preempts all State laws that relate to fuel economy standards. No exception is made for State laws on the ground that they are consistent with or identical to federal requirements.

In interpreting the express preemption provisions of other statutes containing the identical ''relates to'' language found in EPCA, the Supreme Court has found this language to be very expansive. A State law relates to a Federal law if the State law ''has a connection with or refers to'' the subject of the Federal law. The Court made the latter finding first under ERISA [184] and then, based on its ERISA cases and the use of identical language, under the Airline Deregulation Act (ADA).[185] ''Since the relevant language of the ADA is identical, we think it appropriate to adopt the same standard here * * * ''[186] Particularly since the Airline Deregulation Act's situation is a law involving transportation, we think its interpretation of the phrase ''relates to'' is instructive here.

In particular, the Court has provided guidance on the ultimate limits of a strictly textual approach in interpreting either the phrase ''relates to'' or the phrase ''has a connection with,'' given the existence of unending relationships and ''infinite connections'' and the resulting potential for an overly extensive application of ERISA's preemption provision, the Court declined to take that approach in interpreting that provision in *Blue Cross & Blue Shield Plans* v. *Travelers Ins. Co.*[187] The Court said that to determine whether a State law has a forbidden connection, it would instead look ''both to the *objectives of the ERISA statute as a guide to the scope of the state law* that Congress understood would survive, as well as to *the nature of the effect of the state law on ERISA plans. California Div. of Labor Standards Enforcement* v. *Dillingham Constr., N.A., Inc.*, 519 U.S. 316, 325 (1997), quoting *Travelers,* * * *, at 656 * * * '' (Emphasis added.) (Internal quotations omitted.) [188]

Even under that sort of analysis, however, the results would be unchanged here. Congress had a variety of interrelated goals in enacting EPCA and has charged NHTSA with balancing and achieving them. Among them was the overarching one of improving motor vehicle fuel economy.[189] To achieve that goal, Congress did not simply mandate the issuance of fuel economy standards set at whatever level NHTSA deemed appropriate. Nor did it simply say that levels must be set consistent with the criteria it specified in Section 32902(f). It went considerably further, mandating the setting of standards at the maximum feasible level.

Congress also sought national uniform fuel economy standards ''[i]n order to avoid any manufacturer being required to comply with differing State and local regulations with respect to automobile or light-duty truck fuel economy.'' [190] To that end, it expressly preempted State and local laws and regulations relating to fuel economy standards.

Other congressional objectives underlying EPCA include avoiding serious adverse economic effects on manufacturers and maintaining a reasonable amount of consumer choice among a broad variety of vehicles. Congress was explicitly concerned that the CAFE program be carefully drafted so as to require levels of average fuel economy that do not have the effect of either ''imposing impossible burdens or unduly limiting consumer choice as to capacity and performance of motor vehicles.'' [191] These concerns are equally applicable to the manner in which that program is implemented.

To guide the agency toward the selection of standards meeting these competing objectives, Congress specified four factors that NHTSA must consider in determining which level is the maximum feasible level of average fuel economy and thus the level at which each standard must be set.

These are technological feasibility, economic practicability, the effect of other Government standards on fuel economy, and the need of the Nation to conserve energy. In addition, ''NHTSA has always examined the safety consequences of the CAFE standards in its overall consideration of relevant factors since its earliest rulemaking under the CAFE program.'' [192]

While the Court in *Travelers* said State laws found to have ''only a tenuous, remote, or peripheral connection'' to ERISA's purposes, especially in areas of traditional State regulation, are not preempted,[193] NHTSA has concluded that a State GHG standard is not such a law. As explained at length below, to the extent that it regulates tailpipe CO_2 emissions, a State GHG standard has a direct and very substantial effect on EPCA's objectives, placing it virtually at the very center of the reach of EPCA's express preemption provision, not at or even near its periphery. Thus, there is no need here to address issues about the definition or location of the outer reaches of the provision's application.

As explained below, CO_2 emissions account for over 90 percent of all CO_2 equivalent emissions from a motor vehicle. Accordingly, a State standard regulating GHG emissions expressed as CO_2 equivalent emissions is, to a very substantial extent, a State CO_2 emissions standard. To that extent, a State GHG standard is fuel economy standard in almost all but name and stated purpose. It would have virtually the same effects as a fuel economy standard. Thus, NHTSA has concluded that a State GHG standard does not incidentally affect vehicle manufacturers; it directly targets them.

Likewise, in NHTSA's view, such a standard does not incidentally affect decisions by manufacturers to add fuel saving technologies to their vehicles. Because the only currently practical way for vehicle manufacturers to reduce CO_2 tailpipe emissions is through application of fuel saving technologies [194] and no technologies are even under development that would make possible reduction of CO_2 emissions independent of reducing fuel consumption,[195] such a standard directly targets manufacturers and compels the use of those technologies. Therefore, the agency has concluded

[182] S. 1883, 94th Cong., 1st Sess., Section 509.

[183] H.R. 7014, 94th Cong., 1st Sess., Section 507 as introduced, Section 509 as reported.

[184] *Shaw* v. *Delta Airlines, Inc.,* 463 U.S. 85, 97 (1983).

[185] *Morales* v. *Trans World Airlines, Inc.,* 504 U.S. 374, 384 (1992).

[186] Ibid.

[187] 514 U.S. 645, 656, 658–662 (1995),

[188] *Egelhoff* v. *Egelhoff*, 532 U.S. 141, 147 (2001).

[189] *Center for Auto Safety* v. *NHTSA*, 793 F.2d 1322, 1340 (D.C. Cir. 1986).

[190] S. Rep. No. 94–179, 25 (1975).

[191] H. Rep. No. 94–340, 87 (1975).

[192] *Competitive Enterprise Institute* v. *NHTSA*, 901 F.2d 107, 120 at n.11 (D.C. Cir. 1990).

[193] *Blue Cross & Blue Shield Plans* v. *Travelers Ins. Co.*, 514 U.S. 645, 658–662 (1995).

[194] Essentially all of the technologies identified by the California Air Resources Board for reducing CO_2 emissions are among the technologies listed by the National Academy of Science in its 2002 report on reforming the CAFE program and improving fuel economy. The essential identity of the two lists confirms the fact that, currently, the only method for reducing CO_2 emissions is to reduce fuel consumption.

[195] EPA has reached a similar conclusion. See 68 FR 52922, 52929.

that the effect of a State GHG standard on vehicle design and performance is the same as that of fuel economy standards.

Commenters opposing preemption suggested that the purpose of a State law, not its effects, should determine whether there is preemption. Since the purpose of a State GHG regulation for motor vehicles is regulating CO_2 and other GHG emissions from motor vehicles, not fuel economy, they suggest that there can be no preemption under EPCA's express preemption provision. This limited view regarding the extent of preemption under that provision is inconsistent with NHTSA's expert analysis, which is guided by and comports with the Supreme Court's discussion of the similarly worded express preemption provisions in ERISA and the ADA. As noted above, in resolving ambiguity regarding preemption under a Federal law, the Court looks at the effects of a State law on the subject addressed by the Federal law to aid in determining if there is preemption.[196]

A federal statute's broadly worded express preemption provision does not lose its preemptive effect because a State cites a purpose other than or in addition to the purpose of that federal statute.[197] In *Gade*, the Supreme Court said that ''[i]n assessing the impact of a state law on the federal scheme, we have refused to rely solely on the legislature's professed purpose and have looked as well to the effects of the law.'' [198]

The agency's conclusions here that the EPCA preemption provision is expansive and preempts State emissions regulations that have the practical effect of regulating fuel economy are fully in keeping with earlier views expressed by the government. Further, they are consistent with views that EPA has articulated.

In June 2002, the U.S. District Court for the Eastern District of California issued an order granting plaintiff automobile manufacturers' and dealers' motion for preliminary injunction and issuing a preliminary injunction in *Central Valley Chrysler-Plymouth* v. *California Air Resources Bd.*, No. CV–F–02–5017 REC/SMS, 2002 U.S. Dist. LEXIS 20403 (E.D. Cal. June 11, 2002) (enjoining California zero-emission-vehicle (ZEV) rule). The court found that the plaintiffs had shown that the ZEV rule was ''related to'' fuel economy standards because it had the purpose and practical effect of regulating fuel economy. The court also found that ''preemption cannot be avoided by intertwining preempted requirements with nonpreempted requirements.''

In October 2002, the United States filed an amicus curiae brief in support of affirming the June 2002 order in *Central Valley Chrysler-Plymouth, Inc. et al.* v. *Michael P. Kenny*, No. 02–16395, (9th Cir. 2002), pointing out that EPCA contains a broadly stated provision expressly preempting state regulations ''related to'' fuel economy standards. The government further pointed out that, unlike the Clean Air Act, EPCA does not contain an exception allowing a state law that regulates fuel economy, regardless of the purpose of the law. Given that Congress had included some exceptions, but not that particular one, the government said that it would be inappropriate to read in or imply that exception.

In December 2002, NHTSA published a CAFE NPRM for MY 2005–2007 light trucks in which the agency addressed certain court filings by the State of California relating to CAFE preemption. The agency noted that California had:

> [I]n recent court filings, asserted that NHTSA has not treated the CAFE statute as preempting state efforts to engage in CAFE related regulation, stating that ''time and time again, NHTSA in setting CAFE standards has commented on the fuel economy effects of California's emissions regulations, and not once has it even suggested that these were preempted.'' See Appellants Opening Brief filed on behalf Michael P. Kenny in Central Valley Chrysler-Plymouth, Inc. *et. al.* v. Michael P. Kenny, No. 02–16395, at p. 33 (9th Cir. 2002). As a result, the State suggests that it may, consistent with federal law, issue regulations that relate to fuel economy.
>
> The State misses the point. The agency reviews emissions requirements to ensure that we do not establish a standard that is infeasible in light of other public policy considerations, including federal and state efforts to regulate emissions. Thus, we consider potential fuel economy losses due to more stringent emissions requirements when we determine maximum feasible fuel economy levels.
>
> This does not mean that a state may issue a regulation that relates to fuel economy and which addresses the same public policy concern as the CAFE statute. Our statute contains a broad preemption provision making clear the need for a uniform, federal system: ''When an average fuel economy standard prescribed under this chapter is in effect, a State or a political subdivision of a State may not adopt or enforce a law or regulation related to fuel economy standards or average fuel economy standards for automobiles covered by an average fuel economy standard under this chapter.'' 49 U.S.C. 32919(a).
>
> The fact that NHTSA had not expressly addressed this particular aspect of California's requirements should not have been interpreted as tacit acceptance. Indeed, the United States has taken the express position in the Kenny case that it has a substantial interest in enforcing the federal fuel economy standards and in ensuring that states adhere to the Congressional directive prohibiting them from adopting or enforcing any law or regulation related to fuel economy or average fuel economy standards.[199]

In its CAFE final rule for MY 2005–07 light trucks, NHTSA stated that its ''position with regard to the relationship between state laws and our federal fuel economy responsibility was set forth in the [December 2002] NPRM and has not changed. The EPCA statute contains a preemption provision intended to ensure a unified federal program to address motor vehicle fuel economy.''

In September 2003, the Environmental Protection Agency specifically discussed the relationship between CO_2 standards and fuel economy. In denying an October 1999 petition by the International Center for Technology Assessment (ICTA) asking the EPA to regulate CO_2 and other greenhouse gas emissions from motor vehicles under the Clean Air Act for the purpose of addressing global climate change, the EPA included a discussion of how regulating CO_2 emissions would cause ''[i]nterference with Fuel Economy Standards:''

> Even if GHGs were air pollutants generally subject to regulation under the CAA, Congress has not authorized the Agency to regulate CO_2 emissions from motor vehicles to the extent such standards would effectively regulate the fuel economy of passenger cars and light duty trucks. No technology currently exists or is under development that can capture and destroy or reduce emissions of CO_2, unlike other emissions from motor vehicle tailpipes. At present, the only practical way to reduce tailpipe emissions of CO_2 is to improve fuel economy. Congress has already created a detailed set of mandatory standards governing the fuel economy of cars and light duty trucks, and has authorized DOT—not EPA—to implement those standards. The only way for EPA to proceed with CO_2 emissions standards without upsetting this

[196] *Egelhoff*, at 147.

[197] *Gade* v. *National Solid Wastes Management Ass'n.*, 505 U.S. 88, 105 (1992).

[198] Id., at 106; see also *Morales*, at 386: ''petitioner advances the notion that only state laws specifically addressed to the airline industry are pre-empted, whereas the ADA imposes no constraints on laws of general applicability. Besides creating an utterly irrational loophole (there is little reason why state impairment of the federal scheme should be deemed acceptable so long as it is effected by the particularized application of a general statute), this notion similarly ignores the sweep of the 'relating to' language. We have consistently rejected this precise argument in our ERISA cases: '[A] state law may ''relate to'' a benefit plan, and thereby be pre-empted, even if the law is not specifically designed to affect such plans, or the effect is only indirect.' '' (Citations omitted.)

[199] Light Truck Average Fuel Economy Standards Model Years 2005–2007, 67 FR 77015, at 77025 (Proposal to establish standards December 16, 2002).

statutory scheme would be to set a standard less stringent than CAFE for cars and light duty trucks. But such an approach would be meaningless in terms of reducing GHG emissions from the U.S. motor vehicle fleet.[200]

EPA further explained this position in its brief filed in early 2005 in the Court of Appeals for the D.C. Circuit in *Commonwealth of Massachusetts* v. *EPA*, No. 03–1361, in which 12 states and a number of environmental groups filed a petition for review challenging EPA's denial of ICTA's petition:

Further reinforcing both the legal and policy rationales for the ICTA Petition Denial is the fact that at present, the only practical way of making a meaningful reduction in motor vehicle emissions of CO_2 (the most significant greenhouse gas) is by increasing fuel economy. See 68 FR at 52929. Consequently, even if EPA possessed CAA authority to regulate CO_2 for climate change purposes, any motor vehicle standard EPA might set under the Act that required meaningful reductions in CO_2 emissions would effectively require a corresponding increase in fuel economy. However, in the Energy Policy and Conservation Act (''EPCA''), 49 U.S.C. 32901–18, Congress established a detailed program for regulating the fuel economy of passenger cars and light trucks—the bulk of the motor vehicle fleet—and it authorized DOT, not EPA, to implement that program. EPA thus reasonably concluded that it would be inconsistent with EPCA for EPA to set CO_2 emission standards under the CAA that would effectively require significant increases in the fuel economy of vehicles subject to EPCA. 68 FR at 52929. In arguing that EPCA does not expressly abrogate EPA's authority under the CAA, see Pet. Br. at 38–43, Petitioners ignore those EPCA provisions that clearly signal Congress' intent that regulation of motor vehicle fuel economy be governed by EPCA alone.

NHTSA Has Concluded That Any Effort to Regulate Carbon Dioxide Emissions From Motor Vehicles Is Related to Average Fuel Economy Standards for Motor Vehicles Under 49 U.S.C. Chapter 329

1. Motor Vehicle Fuel Economy Is Directly Related to Emissions of Carbon Dioxide

Fossil fuels such as petroleum contain mostly hydrocarbons (compounds containing hydrogen and carbon). In the combustion process, these fuels are oxidized to produce heat. In perfect combustion, the oxygen (O_2) in the air combines with all of the carbon (C) in the fuel to form carbon dioxide (CO_2) and all of the hydrogen (H) in the fuel to form water (H_2O).

Most light trucks are powered by gasoline internal combustion engines. The combustion of gasoline produces CO_2 in amounts that can be readily calculated. Based on its content (carbon and hydrogen), as a matter of basic chemistry, the burning of a gallon of gasoline produces about 20 pounds of CO_2.[201] [202]

In practice, the combustion process is not 100 percent efficient and engines produce several types of emissions as combustion byproducts or as a result of incomplete combustion. In an internal combustion engine, these include nitrogen oxides (NO_X) (from nitrogen and oxygen in the atmosphere), carbon monoxide (CO) and hydrocarbons (HC), including methane. These emissions do not alter the fact that combustion of gasoline produces CO_2. Moreover, the amounts of CO_2 emitted per mile are far greater than the amounts of HC, CO, and NO_X, singly or combined.[203] [204]

CO_2 emissions are always and directly linked to fuel consumption because CO_2 is the ultimate end product of burning gasoline.[205] The more fuel a vehicle burns or consumes, the more CO_2 it emits.[206] Viewed another way, fuel economy is directly related to emissions of greenhouse gases such as CO_2.[207] Fuel consumption and CO_2 emissions from a vehicle are two ''indissociable'' parameters.[208]

2. The Most Significant Factor in Determining the Compliance of Motor Vehicles With NHTSA's Fuel Economy Standards Is Their Rate of Carbon Dioxide Emissions

A manufacturer's compliance with the federal average fuel economy standards is based on the collective fuel economies of its covered vehicles. For purposes of determining compliance with federal fuel economy standards, EPA and manufacturers measure the amount of CO_2, CO, and HC emitted from the vehicle. The regulations requiring this approach do so because of the scientific relationship between fuel consumption and carbon emissions.

As noted above, gasoline is comprised of carbon and hydrogen in the form of HC compounds. Carbon and hydrogen are basic elements that are not converted to other elements in either internal combustion engines or catalytic converters. As a component of the fuel, the carbon is conveyed to the engine, where combustion occurs. Thereafter, the carbon, largely in different compounds than in gasoline, is emitted through the tailpipe. Thus, if the carbon content of the fuel is known, the amount of fuel consumed by the engine can be determined by measuring tailpipe emissions of carbon-containing compounds.[209] Fully combusted carbon

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[200] Control of Emissions from New Highway Vehicles and Engines, 68 FR 52922, 52929 (denial of petition September 8, 2003).

[201] Most of that weight comes from the oxygen in the air. A carbon atom has an atomic weight of 12, and each oxygen atom has an atomic weight of 16, giving each single molecule of CO_2 an atomic weight of $12 + (16 \times 2)$ or 44. Therefore, to calculate the weight of the CO_2 produced from a gallon of gasoline, the weight of the carbon in the gasoline is multiplied by 44/12 or 3.7. Since gasoline is about 87% carbon and 13% hydrogen by weight, and since a gallon of gasoline weighs about 6.3 pounds, the carbon in a gallon of gasoline weighs (6.3 lbs. × .87) or 5.5 pounds. If the weight of the carbon (5.5 pounds) is then multiplied by 3.7, the answer is about 20 pounds. (Source: *http://www.fueleconomy.gov/feg/co2.shtml*. The website, *http://www.fueleconomy.gov*, is operated jointly by the Department of Energy and the Environmental Protection Agency.)

[202] In addition, CO_2 emissions can be determined from the carbon content of the fuel by using a carbon content coefficient that reflects the amount of carbon per unit of energy in each fuel. CO_2 emissions = energy consumption [*e.g.*, in Btu] × carbon content coefficient for the fuel × fraction of carbon oxidized [99% for petroleum] × 3.67 [conversion of carbon to carbon dioxide (44/12) based on molecular weights]. T.J. Blasing, G. Marland and C. Broniak, Estimates of Annual Fossil-Fuel CO_2 Emitted for Each State in the U.S.A. and the District of Columbia for Each Year from 1960 through 2001, at *http://cdiac.ornl.gov/trends/emis_mon/stateemis/emis_state.htm*. The carbon content coefficients for petroleum products have varied very little over time—less than one percent per year since 1990. *Id.* Reformulated gasoline introduced in the 1990s pursuant to the Clean Air Act Amendments of 1990 has a carbon emissions coefficient approximately one percent smaller than that of standard gasoline.

[203] U.S. EPA, Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks, EPA420–F–00–013, April 2000. Available on the Internet at *http://www.epa.gov/otaq/consumer/f00013.pdf*.

[204] Good, David, U.S. EPA, 2006 test-car-list-and analysis for DD 206.xls, February 2006. (unpublished analysis of 2006 test car list available at *http://www.epa.gov/otaq/tcldata.htm*).

[205] See also EPA's denial of petition to regulate CO_2 tailpipe emissions from motor vehicles, 68 FR 52922, 52931, September 8, 2003; *Center for Biological Diversity* (November 22, 2005, NHTSA 2005–22223–1382) (p. 2–3); RAND Europe, Preparation of Measures to Reduce CO_2 Emissions from N1 Vehicles, Final Report, at 4, prepared for the European Commission, 11th April 2003.

[206] ''Vehicles with lower fuel economy burn more fuel, creating more CO_2. Your vehicle creates about 20 pounds of CO_2 (170 cu. ft.) per gallon of gasoline it consumes. Therefore, you can reduce your contribution to global climate change by choosing a vehicle with higher fuel economy. By choosing a vehicle that achieves 25 miles per gallon rather than 20, you can prevent the release of about 17 (260 thousand cu. ft.) tons of greenhouse gases over the lifetime of your vehicle.'' Model Year 2006 Fuel Economy Guide, at 2, Department of Energy and Environmental Protection Agency, DOE/EE–0309.

[207] 68 FR 52922, 52931; Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2005—Executive Summary, EPA420–S–05–0001, July 2005, at *http://www.epa.gov/otaq/cert/mpg/fetrends/420s05001.htm*.

[208] P. Leduc, B. Dubar, A. Ranini and G. Monnier, Downsizing of Gasoline Engine: an Efficient Way to Reduce CO_2 Emissions, at 2, Institut Français du Pétrole, Division Techniques d'Applications Energétiques, 92852 Rueil-Malmaison Cedex—France).

[209] DOT FHWA, Perspectives on Fuel Consumption and Air Contaminant Emission Rates

Continued

takes the form of CO_2. Partially combusted carbon takes the form of CO or HC (generally unburned hydrocarbons). Therefore, fuel consumption may be determined by measuring tailpipe emissions of CO_2, CO, and HC.

As a result of incomplete combustion, CO and HC are emitted from a vehicle's engine. However, in the years since vehicle manufacturers were first required to meet federal fuel economy standards, the manufacturers have also been required under the Clean Air Act to meet increasingly stringent standards for emission of CO, HC, NO_X, and particulates.[210] They have been able to meet these standards because fuels have been reformulated to burn cleaner, and vehicle manufacturers have applied many significant technological advances to the engines and vehicles (e.g., multipoint fuel injection, closed-loop computer-controlled mixture control, and close-coupled 3-way exhaust catalysts). As a result, emissions of CO and HC have fallen dramatically. Moreover, the technologies that produce these reductions in air pollution do so by more completely converting CO and HC to CO_2 (and water).[211] Over the same time period, there has not been a corresponding decline in CO_2 emissions, which, as noted above, are the necessary result of gasoline consumption. CO and HC play an increasingly and extremely minor role in the measurement of fuel economy, such that fuel economy has become virtually synonymous with CO_2 emission rates.

The fuel economy of a particular vehicle is determined by a formula promulgated by EPA. That formula (an equation) calculates fuel economy based on carbonaceous emissions from the vehicle, taking into account the normalization of the fuel to a standardized test fuel. Under the formula, in determining fuel economy, all carbon emissions—i.e., the CO_2 emission rate, HC emission rate, and CO emission rate—are considered.

Significantly, as demonstrated by the example below, in determining fuel economy the role of CO_2 emissions greatly outweighs that of these other exhaust gases. This is reflected by the relative magnitudes of the CO_2 term and non-CO_2 terms in the equation. In other words, calculating fuel economy is largely a function of CO_2 emissions.

Under 40 CFR 600.113, fuel economy (mpg) is calculated using the following equation:

$$mpg = \frac{51,740,000 \times CWF \times SG}{(CWF \times HC + 0.429 \times CO + 0.273 \times CO_2) \times (0.6 \times SG \times NHV + 5,471)}$$

Where:

HC = hydrocarbon emission rate (grams per mile)
CO = carbon monoxide emission rate (grams per mile)
CO_2 = carbon dioxide emission rate (grams per mile)
CWF = carbon weight fraction of test fuel
NHV = net heating value (by mass) of test fuel
SG = specific gravity of test fuel

Under the regulation, separate measurements and calculations under the Federal Test Procedure (i.e., city cycle) and Federal Highway Fuel Economy Test Procedure (i.e., highway cycle) are required, with the resultant city (mpg_c) and highway (mpg_h) fuel economy values being harmonically averaged using weights of 0.55 and 0.45, respectively.[212]

Determining the characteristics of a test fuel and inserting them into the above equation is a preliminary step toward assessing the relative importance of CO_2 emissions in determining compliance with the fuel economy standards.

For this purpose, we will use the characteristics of a test fuel set forth in the sample calculation in Appendix II to 40 CFR part 600:

CWF = 0.868
NHV = 18,478 Btu per pound
SG = 0.745

These values are within about 8 percent of other values in the record (given relatively minor variations, particularly in heating value, in gasolines) and are reasonable for the purposes of this assessment, although very precise data would be collected for a test for compliance with the rule.[213]

Substituting these values into EPA's general equation for fuel economy shown above yields

$$mpg = \frac{51,740,000 \times 0.868 \times 0.745}{(0.868 \times HC + 0.429 \times CO + 0.273 \times CO_2) \times (0.6 \times 0.745 \times 18,478 + 5,471)}$$

which algebraically reduces to the following:

$$mpg = \frac{2,437}{(0.868 \times HC + 0.429 \times CO + 0.273 \times CO_2)}$$

by Highway Vehicles. *http:// www.tfhrc.gov/structur/pdf/01100.pdf.*

[210] As explained below in the final section of the discussion of preemption, NHTSA does not believe that regulation of these emissions is preempted by EPCA since it is the agency's judgment that such regulation only tangentially affects fuel economy.

[211] Because carbon dioxide is, like water, an ultimate byproduct of combustion, it cannot be further converted on the vehicle to some other compound through any practical means.

[212] 40 CFR 600.206–93.

[213] See, e.g., Fuel economy impact of reformulated gasoline (energy (NHV) of fuel, at *http://www.epa.gov/otaq/rfgecon.htm;* Motor Gasolines Technical Review, at *http:// www.chevron.com/products/prodserv/fuels/ bulletin/motorgas/;* Carbon Coefficients, at *http:// www.eia.doe.gov/oiaf/1605/87-92rpt/appa.html;* and Specific Gravity—Liquids, at *http:// www.engineeringtoolbox.com/specific-gravity-liquids-d_336.html.*

Based on EPA data [214] averaged across all MY 2006 truck test data available at *http://www.epa.gov/otaq/tcldata.htm* (which does not include production data), model year 2006 light trucks have the following city cycle emission rates as determined by testing by the Federal Test Procedure:

HC = 0.042 g/mi
CO = 0.056 g/mi
CO_2 = 471 g/mi

Substituting these values and the fuel characteristics noted above into the algebraically reduced equation shown above,

$$mpg_c = \frac{2{,}421}{\left(\underbrace{0.868 \times 0.042}_{HC\ term} + \underbrace{0.429 \times 0.56}_{CO\ term} + \underbrace{0.273 \times 471}_{CO_2\ term}\right)}$$

which produces the following city fuel economy in miles per gallon:

$$mpg_c = \frac{2{,}421}{(0.037 + 0.240 + 128.583)} = \frac{2{,}421}{\left(\underbrace{0.277}_{non-CO_2\ term} + \underbrace{128.583}_{CO_2\ term}\right)} = 18.8$$

The average model year 2006 light truck emission rates on the highway cycle were as follows: [215]

HC = 0.011 g/mi
CO = 0.17 g/mi
CO_2 = 316 g/mi

which, using the formula above, yields the following highway fuel economy in miles per gallon:

$$mpg_h = \frac{2{,}421}{\left(\underbrace{0.868 \times 0.011}_{HC\ term} + \underbrace{0.429 \times 0.17}_{CO\ term} + \underbrace{0.273 \times 316}_{CO_2\ term}\right)} = \frac{2{,}421}{\left(\underbrace{0.082}_{non-CO_2\ term} + \underbrace{86.268}_{CO_2\ term}\right)} = 28.0$$

For both the city and highway calculations, the controlling independent variable is the large number (term) in the denominator, given that the numerator is a fixed number. That number is the CO_2 term (86.268). The other numbers (denominated the HC term and the CO term) are not significant. More particularly, for the 2006 model year light trucks, the typical city and highway CO_2 terms for light trucks are more than four hundred and one thousand, respectively, times the magnitude of the corresponding non-CO_2 terms. NHTSA has concluded that this proportion will not change, especially in light of its conclusion that emission limitations on the other types of emissions are permissible under EPCA.

As shown above, in the measurement and calculation of a given vehicle model's fuel economy for purposes of federal fuel economy standards, the role of CO_2 is controlling and far greater than the combined role of the other two relevant exhaust gases (CO and HC). A manufacturer's compliance with the applicable CAFE standard is determined by averaging model-specific fuel economy values. This demonstrates that compliance with federal fuel economy standards is based primarily on CO_2 emission rates of covered vehicles.[216]

3. NHTSA Has Concluded That a Reduction of CO_2 Emissions From Motor Vehicles Is Possible Only Through the Incorporation of the same Technologies That Would Be Employed To Increase Fuel Economy

The technologies that would be employed to reduce CO_2 emissions are, in all relevant ways, the same technologies as underlie NHTSA's judgment about the appropriate CAFE standards for light trucks, as explained below.[217]

The CAFE standards promulgated by NHTSA are performance standards. As such, they do not require the employment of any particular technology. But the standards are the maximum feasible average fuel economy level that NHTSA decides the manufacturers can achieve in a particular year. [218] They are based on various technologies. Those technologies are addressed in the NHTSA CAFE rulemaking record. In large measure, they are summarized in Table 3–2 of the 2002 National Academy of Sciences (NAS) CAFE study, which is reproduced below in Tables 18 and 19 (numbered as Tables 3–2 and 3–3, respectively, in the NAS study).

[214] Good, David, op. cit.

[215] Ibid.

[216] The vast majority of vehicles covered by NHTSA's light truck CAFE standard are powered by gasoline fueled engines. Hybrids are expected to comprise from 1.7 to 2.9 percent of the fleet of new vehicles, while diesels are expected to comprise from 0 to 2.6 percent. These non-gasoline fueled vehicles will have a minor effect on the average fuel economy of the overall fleet of new vehicles.

[217] The agency has not identified any technologies, let alone realistic ones, that could be added to vehicle exhaust pipes to reduce CO_2 emissions. Above and beyond the application of the technologies addressed in this discussion of preemption, to meet CO_2 standards, in theory the manufacturer could make the vehicle much smaller or substantially reduce the size of its engine, depending on the stringency of the CO_2 regulation. P. Leduc et al., op cit. see fn above; see also, *http://www4.nationalacademies.org/news.nsf/isbn/0309076013?OpenDocument*

[218] See 49 U.S.C. 32902(a).

Table 18: Fuel Consumption Technology Matrix – SUVs and Minivans (Table 3-2 NAS report)

Baseline (small SUV): overhead cams, 4-valve, fixed timing, roller finger follower. Baseline (others): 2-valve, fixed timing, roller finger follower.	Fuel Consumption Improvement (%)	Retail Price Equivalent (RPE) ($) Low	High	Small SUV 1	2	3	Mid SUV 1	2	3	Large SUV 1	2	3	Minivan 1	2	3
Production-intent engine technology															
Engine friction reduction	1-5	35	140	x	x	x	x	x	x	x	x	x	x	x	x
Low-friction lubricants	1	8	11	x	x	x	x	x	x	x	x	x	x	x	x
Multivalve, overhead camshaft (2-V vs. 4-V)	2-5	105	140				x	x	x	x	x	x	x	x	x
Variable valve timing	2-3	35	140	x	x	x	x	x	x	x	x	x	x	x	x
Variable valve lift and timing	1-2	70	210		x	x		x	x		x	x		x	x
Cylinder deactivation	3-6	112	252				x	x		x	x			x	
Engine accessory improvement	1-2	84	112	x	x	x	x	x	x	x	x	x	x	x	x
Engine supercharging and downsizing	5-7	350	560			x			x			x			x
Production-intent transmission technology															
Five-speed automatic transmission	2-3	70	154	x			x	x		x	x	x	x	x	x
Continuously variable transmission	4-8	140	350		x	x			x						
Automatic transmission w/aggressive shift logic	1-3	0	70	x			x			x	x		x		
Six-speed automatic transmission	1-2	140	280					x			x	x		x	x
Production-intent vehicle technology															
Aero drag reduction	1-2	0	140		x	x		x	x		x	x		x	x
Improved rolling resistance	1-1.5	14	56	x	x	x	x	x	x	x	x	x	x	x	x
Safety technology															
Safety weight increase	–3 to –4	0	0	x	x	x	x	x	x	x	x	x	x	x	x
Emerging engine technology															
Intake valve throttling	3-6	210	420		x			x			x			x	
Camless valve actuation	5-10	280	560			x			x			x			x
Variable compression ratio	2-6	210	490			x			x			x			x
Emerging transmission technology															
Automatic shift/manual transmission (AST/AMT)	3-5	70	280					x				x		x	x
Advanced CVTs—allows higher torque	0-2	350	840						x						
Emerging vehicle technology															
42-V electrical systems	1-2	70	280		x	x		x	x		x	x		x	x
Integrated starter/generator (idle off–restart)	4-7	210	350		x	x		x	x		x	x		x	x
Electric power steering	1.5-2.5	105	150			x		x	x		x	x		x	x
Vehicle weight reduction (5%)	3-4	210	350						x			x			

NOTE: An *x* means the technology is applicable to the particular vehicle. Safety weight added (EPA baseline + 3.5%) to initial average mileage/consumption values.

Baseline: 2-valve, fixed timing, roller finger follower.	Fuel Consumption Improvement (%)	Retail Price Equivalent (RPE) ($)		Small Pickup			Large Pickup		
		Low	High	1	2	3	1	2	3
Production-intent engine technology									
Engine friction reduction	1-5	35	140	x	x	x	x	x	x
Low-friction lubricants	1	8	11	x	x	x	x	x	x
Multivalve, overhead camshaft (2-V vs. 4-V)	2-5	105	140	x	x	x	x	x	x
Variable valve timing	2-3	35	140		x	x	x	x	x
Variable valve lift and timing	1-2	70	210		x	x		x	x
Cylinder deactivation	3-6	112	252	x	x			x	
Engine accessory improvement	1-2	84	112	x	x	x	x	x	x
Engine supercharging and downsizing	5-7	350	560			x		x	x
Production-intent transmission technology									
Five-speed automatic transmission	2-3	70	154	x	x		x	x	x
Continuously variable transmission	4-8	140	350			x			
Automatic transmission w/aggressive shift logic	1-3	0	70	x			x	x	
Six-speed automatic transmission	1-2	140	280		x			x	x
Production-intent vehicle technology									
Aero drag reduction	1-2	0	140		x	x		x	x
Improved rolling resistance	1-1.5	14	56	x	x	x	x	x	x
Safety technology									
5% safety weight increase	–3 to –4	0	0	x	x	x	x	x	x
Emerging engine technology									
Intake valve throttling	3-6	210	420		x			x	
Camless valve actuation	5-10	280	560			x			x
Variable compression ratio	2-6	210	490			x			x
Emerging transmission technology									
Automatic shift/manual transmission (AST/AMT)	3-5	70	280		x				x
Advanced CVTs	0-2	350	840			x			
Emerging vehicle technology									
42-V electrical systems	1-2	70	280		x	x		x	x
Integrated starter/generator (idle off–restart)	4-7	210	350		x	x		x	x
Electric power steering	1.5-2.5	105	150		x	x		x	x
Vehicle weight reduction (5%)	3-4	210	350						

NOTE: An *x* means the technology is applicable to the particular vehicle. Safety weight added (EPA baseline + 3.5%) to initial average mileage/consumption values.

Table 19: Fuel Consumption Technology Matrix – Pickup Trucks (Table 3-3 NAS report)

If a state regulation required manufacturers to reduce CO_2 emissions from motor vehicles, the state regulation would be predicated on the manufacturers' employment of the same technologies they would employ to meet federal fuel economy standards. As an example, for discussion purposes, we will consider a California regulation. In 2005, CARB adopted amendments to its regulations that it referred to as "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light Duty Trucks and Medium Duty Vehicles."[219] In support of its regulations, CARB released a report that listed more than 20 technologies that manufacturers could be applied in order to achieve compliance with its CO_2-based standards.[220] The technologies identified in the State's report with respect to large trucks are identified in the second column of the table reproduced below from its report, which employs acronyms that are explained below.

[219] See *http://www.arb.ca.gov/regact/grnhsgas/grnhsgas.htm.* The regulations are codified at Title 13 of the California Code of Regulations (CCR). See 13 CCR § 1961.1 (2006).

[220] California Environmental Protection Agency, Air Resources Board, Regulations To Control Greenhouse Gas Emissions From Motor Vehicles, Initial Statement of Reasons.

TABLE 20.—CARB "TECHNOLOGY PACKAGES" TO REDUCE CO_2 EMISSIONS FROM A LARGE TRUCK [221]

Light truck	Combined technology packages	CO_2 (g/mi)	Potential CO_2 reduction from 2002 baseline (percent)	Retail price equivalent 2002	Potential CO_2 reduction from 2009 baseline (percent)	Retail price equivalent 2009
Near	CCP, A6, (2009 baseline)	484	−5.5	$126	0	0%
Term 2009–2012	DVVL, DCP, A6	442	−13.6	549	−8.6	$423
	CCP, DeAct, A6	433	−15.4	480	−10.5	354
	DCP, DeAct, A6	430	−15.9	845	−11.0	931
	DeAct, DVVL, CCP, A6, EHPS, ImpAlt	418	−18.4	789	−13.6	663
	DeAct, DVVL, CCP, AMT, EHPS, ImpAlt	396	−22.6	677	−18.1	551
Mid Term 2013–2015	CCP, DeAct, GDI–S, AMT, EHPS, ImpAlt	416	−18.6	827	−13.9	701
	DeAct, DVVL, CCP, A6, ISG, EHPS, eACC	378	−26.2	1885	−21.9	1759
	ehCVA, GDI–S, AMT, EHPS, ImpAlt	381	−25.5	1621	−21.2	1495
Long Term 2015–	GDI–L, AMT, EHPS, ImpAlt	354	−24.4	1460	−20.0	1334
	Mod HEV	372	−44.5	2630	−41.3	2504
	dHCCI, AMT, ISG, EPS, eACC	362	−29.3	2705	−25.2	2579
	GDI–L, AMT, ISG, EPS, ImpAlt	354	−30.7	2537	−26.7	2411
	HSDI, AdvHEV	244	−52.2	8363	−49.5	8237
	AdvHEV	241	−52.5	5311	−49.8	5185

The acronyms in the table above refer to the following technologies: [222]

A5: 5-speed automatic transmission
A6: 6-speed automatic transmission
AdvHEV: Advanced hybrid
AMT: Automatic Manual Transmission
CCP: Coupled cam phasing
CVVL: Continuous variable valve lift
DCP: Dual cam phasing
DeAct: Cylinder deactivation
dHCCI: Diesel homogeneous charge compression ignition
DVVL:Discrete variable valve lift
eACC: Improved electric accessories
ehCVA: Electrohydraulic camless valve actuation
EHPS: Electrohydraulic power steering
EPS: Electric power steering
GDI–S: Stoichiometric gasoline direct injection
GDI–L: Lean-burn gasoline direct injection
HSDI: High-speed (diesel) direct injection
ImpAlt: Improved efficiency alternator
ISG: Integrated starter-generator systems
ModHEV: Moderate hybrid
Turbo: Turbocharging

As is evident from a comparison of the excerpt from the NAS report above with the excerpt from the CARB statement of reasons above, nearly all of the technologies relied upon by CARB are technologies that NHTSA largely relies on in formulating the federal average fuel economy standards. Thus, vehicle manufacturers would have to install many of the same types of technologies under the NHTSA CAFE rule and under the CARB greenhouse gas rule.

California's Regulation of Greenhouse Gas/Carbon Dioxide Equivalent Emissions From Motor Vehicles Is Related to Average Fuel Economy Standards for Motor Vehicles Under 49 U.S.C. Chapter 329 and Therefore Preempted

California's GHG regulations include new requirements on greenhouse gas emissions from motor vehicles including model year 2009 and subsequent model year light duty trucks (LDT) and medium duty passenger vehicles (MDPV). The CARB greenhouse gas rules include two sets of standards for motor vehicles. One set applies to all passenger cars and to LDTs with a loaded vehicle weight (LVW) up to 3750 pounds. The other set applies to LDTs with a loaded vehicle weight of greater than 3750 pounds and to MDPVs with a gross vehicle weight of less than 10,000 pounds.

NHTSA's CAFE rulemaking covers MY 2008–2011 light trucks. It also includes MY 2011 MDPVs. Thus, the CARB regulations cover vehicles covered by NHTSA's rulemaking.

As noted above, CARB's regulations govern the emission of greenhouse gases from passenger cars, light duty trucks and medium duty passenger vehicles. Greenhouse gases (GHG) is defined to "mean[] the following gases: CO_2, methane, nitrous oxide, and hydrofluorocarbons." [223]

CARB's GHG regulation states that the fleet average greenhouse gas exhaust emission values from passenger cars, light-duty trucks and medium-duty passenger vehicles that are produced and delivered for sale in California shall not exceed specified values.[224] Table 21 provides the following requirements for Fleet Average Greenhouse Gas Exhaust Emissions, specified in terms of grams per mile CO_2—equivalent:

TABLE 21.—CARB FLEET AVERAGE GREENHOUSE GAS EXHAUST EMISSION REQUIREMENTS

[In grams/mi CO_2-equivalent]

Model year	LDTs 0–3750 lbs LVW and passenger cars	LDTs 3751 LVW–8500 GVW and MDPVs
2009	323	439
2010	301	420
2011	267	390

[221] California Environmental Protection Agency, Air Resources Board, Regulations To Control Greenhouse Gas Emissions From Motor Vehicles Initial Statement of Reasons (CARB ISOR) at 68.

[222] The acronyms appear in the CARB ISOR report at 205–06.

[223] 13 CCR §§ 1961.1(d), (e)(4)

[224] 13 CCR § 1961.1(a)(1)(A).

TABLE 21.—CARB FLEET AVERAGE GREENHOUSE GAS EXHAUST EMISSION REQUIREMENTS—Continued

[In grams/mi CO_2-equivalent]

Model year	LDTs 0–3750 lbs LVW and passenger cars	LDTs 3751 LVW–8500 GVW and MDPVs
2012	233	361
2013	227	355
2014	222	350
2015	213	341
2016+	205	332

As explained in CARB's ''Final Statement of Reasons'' for its vehicular GHG regulations, the following emission sources are covered:

Vehicle climate change emissions comprise four main elements (1) CO_2, CH_4, and N_2O emissions resulting directly from the operation of the vehicle, (2) CO_2 emissions resulting from operating the air conditioning system (indirect AC emissions), (3) refrigerant emissions from the air conditioning system due to either leakage, losses during recharging, sudden releases due to accidents, or release from scrappage of the vehicle at the end of life (direct AC emissions), and (4) upstream emissions associated with the production of the fuel used by the vehicle. The climate change emission standard incorporates all of these elements.[225]

For vehicles certified on conventional fuels (*e.g.*, gasoline), CARB's regulation does not encompass upstream emissions (*i.e.*, emissions associated with the production and transportation of the fuel used by the vehicle).[226]

More particularly, under the CARB regulation, for each GHG vehicle test group, a manufacturer shall calculate both a ''city'' grams per mile average of CO_2 equivalent value and a ''highway'' grams per mile average of CO_2 equivalent value.[227] The use of CO_2 equivalence is an approximation that CARB used to place the gases included in CARB's definition of greenhouse gas on the same scale so that they could be added together. CARB based this on a statement of global warming potential:[228]

TABLE 22.—GWP VALUES FROM CARB INITIAL STATEMENT OF REASONS, P. 48

Greenhouse gas compound	Global warming potential
Carbon Dioxide	1
Methane	23
Nitrous Oxide	296
HFC 134a	1300
HFC 152a	120

Under the CARB GHG regulation, the basic calculation of a given vehicle model's GHG emission rate is as follows:[229]

CO_2 equivalent value = $CO_2 + 296 \times N_2O + 23 \times CH_4$ − A/C Direct Emissions Allowances − A/C Indirect Emissions Allowances.

This calculation may be expressed as follows:

$$GHG = \underbrace{CO_2}_{CO_2\ term} + \underbrace{(296 \times N_2O) + (23 \times CH_4)}_{non\text{-}CO_2\ term} - \underbrace{(\Delta AC_{direct} + \Delta AC_{indirect})}_{AC\ term}$$

Where:

GHG = CO_2-equivalent greenhouse gas emission rate (per FTP and highway tests)

CO_2 = tailpipe carbon dioxide emission rate

N_2O = tailpipe nitrous oxide emission rate

CH_4 = tailpipe methane emission rate

ΔAC_{direct} = credit for reducing direct emissions from air conditioning system (refrigerant emissions from the air conditioning system)

$\Delta AC_{indirect}$ = credit for reducing indirect emissions from air conditioning system use CO_2 emissions resulting from operating the air conditioning system,

As detailed in its ''Initial Statement of Reasons,'' CARB estimates demonstrated that of the total covered GHG emissions, vehicle tailpipe CO_2 emissions would be a much larger component than CO_2-equivalent baseline emission rates for all the other components combined. The following table shows CARB's estimates of the baseline emission rate for each covered GHG component[230] (column 2) along with the NHTSA's arithmetic calculation of corresponding shares of baseline emissions reported by CARB (column 3).

TABLE 23.—CARB ESTIMATES OF BASELINE GREENHOUSE GAS EMISSION RATES

GHG emissions component	Rate (CO_2-equiv. g/mi)	Calculated share (percent total)
CO_2 emissions resulting directly from the operation of the vehicle	291–512	92–95
CH_4 emissions resulting directly from the operation of the vehicle	0.1	0.02–0.03
N_2O emissions resulting directly from the operation of the vehicle	1.8	0.3–0.6

[225] California Environmental Protection Agency, Air Resources Board, Regulations To Control Greenhouse Gas Emissions From Motor Vehicles, Final Statement Of Reasons (FSOR), at 7–8.

[226] CARB, FSOR at 8.

[227] 13 CCR 1961.1(a)(1)(B)1.a.

[228] The global warming potential is a relative index used to compare the climate impact of an emitted greenhouse gas, relative to an equal amount of carbon dioxide.

[229] Ibid.

[230] CARB ISOR at 48, 59, 70–72, 75 and 79.

TABLE 23.—CARB ESTIMATES OF BASELINE GREENHOUSE GAS EMISSION RATES—Continued

GHG emissions component	Rate (CO_2-equiv. g/mi)	Calculated share (percent total)
CO_2 emissions resulting from operating the air conditioning system	13.5–19.0	4
Refrigerant emissions from the air conditioning system	8.5	2–3

As is evident from the above table, CO_2 emissions resulting directly from the operation of the vehicle account for more than ninety two percent of the emissions potentially covered by CARB's vehicular GHG regulation.[231] This demonstrates that CO_2 emissions from the operation of the vehicle are the predominant factor under CARB's greenhouse gas regulation.

This is corroborated by data in the record. As discussed above, a reasonably representative MY2006 light truck emits 471 g/mi and 316 g/mi of CO_2 on the city and highway test cycles respectively. Like federal fuel economy standards, CARB's GHG regulation weights these cycles at 55% and 45% respectively,[232] such that representative CO_2 value would be 401 gr/mile for a MY 2006 light truck. According to CARB's ''Initial Statement of Reasons'',[233] a typical baseline vehicle emits 0.005 grams per mile of CH_4. Under the regulation, manufacturers may use a default value of 0.006 grams per mile for N_2O in lieu of actually measuring emissions of that gas.[234] Also according to the regulation, manufacturers could be granted as much as 9 and 11 grams per mile in direct and indirect emissions allowances, respectively, for improvements to air conditioners.[235]

Therefore, the CO_2-equivalent GHG emission rate for a typical light truck granted the maximum credit for air conditioner improvements might be computed as follows:

$$GHG = \underbrace{401}_{CO_2\ term} + \underbrace{(296 \times 0.006) + (23 \times 0.005)}_{non-CO_2\ term} - \underbrace{(9+11)}_{AC\ term}$$

which reduces, with rounding, to:

$$GHG = \underbrace{401}_{CO_2\ term} + \underbrace{2}_{non-CO_2\ term} - \underbrace{20}_{AC\ term}$$

Therefore, for a typical light truck, the term representing CO_2 emissions that are also subject to regulation under federal CAFE standards (in the above equation, the term labeled ''CO_2 term'') would have a magnitude about 200 times that of the term representing its other emissions (''non-CO_2 term'' in the above), and about 20 times that of the term account for improvements to its air conditioning system (''AC term'' in the above). Consistent with CARB's estimate, discussed above, that tailpipe CO_2 emissions dominate total GHG emissions considered by CARB, this calculation indicates that CO_2 emissions account for on the order of 95 per cent $(1 - 22/(401 + 2 + 20) = 0.95)$ of the emissions that enter into the calculation of total GHG emissions under CARB's regulation.

Alternatively, using the MY2011 values of CARB's standards for total GHG emissions—267 and 390 grams per mile for lighter and heavier vehicles, respectively, corresponding CO_2 emissions resulting directly from vehicle operation would be 285 and 408 grams per mile, respectively:

$$267 = \underbrace{CO_2}_{CO_2\ term} + \underbrace{2}_{non-CO_2\ term} - \underbrace{20}_{AC\ term}$$

$$390 = \underbrace{CO_2}_{CO_2\ term} + \underbrace{2}_{non-CO_2\ term} - \underbrace{20}_{AC\ term}$$

Solving these two equations for CO_2 yields values of 285 and 408 grams per mile, respectively. At these rates, CO_2 accounts for either 93% $(1 - 22/(285 + 2 + 20) = 0.93)$ or 95% $(1 - 22/(408 + 2 + 20) = 0.95)$ of the emissions that enter into the calculation of total GHG emissions under CARB's regulation.

Just as in the case of compliance with federal fuel economy standards, compliance with CARB's regulation is largely a function of tailpipe CO_2 emissions.[236] The same emissions provide the primary basis for determining compliance with federal fuel economy standards. In addition, CARB's own analysis anticipates that manufacturers would comply with its GHG regulation primarily by applying technologies that increase fuel economy.

With only one exception—improvements to air conditioning systems—those technologies would have a parallel impact on fuel economy as measured for purposes of determining compliance with federal fuel economy standards.[237] For purposes of determining compliance with federal CAFE standards, testing is run with the air conditioning turned off. Thus, the federal CAFE rules do not ''credit'' improved air conditioning efficiency or reduced losses from air conditioners. CARB has included reductions in emissions associated with air conditioning (direct and indirect) in its GHG regulation, so the technologies it relies upon are in this one limited respect broader than those NHTSA relies on. However, those technologies are nevertheless fuel economy technologies in that they reduce CO_2 emissions by reducing the load on a vehicle's engine and in turn reduce fuel consumption. Further, air conditioning improvements are not the predominant factor in reducing CO_2-equivalent

[231] A CARB memorandum recognizes that CO_2 emissions are by far the largest amount of emissions produced by motor vehicles. *http://www.arb.ca.gov/msei/on-road/downloads/pubs/co2final.pdf.*

[232] 13 CCR 1961.1.

[233] ISOR at 48.

[234] 13 CCR § 1961.1(a)(1)(B)1.a.

[235] California Code of Regulations, Title 13, § 1961.1(a)(1)(B)(1)(b) allows a direct emissions allowance of up to 9 grams per mile. Section 1961.1(a)(1)(B)(1)(c) allows an indirect emissions allowance of up to 11 grams per mile.

[236] This conclusion follows even if the CO_2 emission rates in the examples are changed considerably, in line with the baseline estimates in CARB's ISOR.

[237] As demonstrated above, the CARB regulation would have the substantially the same effect as the Federal fuel economy regulation in terms of many of the technologies that manufacturers likely would have to install to meet the requirements. In addition to covered large trucks, addressed above, CARB's ISOR addressed the technologies that likely would be installed in small trucks and minivans. (ISOR, pp. 66–7). In general, those technologies are the same as in the NAS report referred to above.

emissions under the CARB regulation.[238]

CARB's vehicle greenhouse gas regulation is, therefore, clearly related to fuel economy standards [239] and thus subject to the preemption provision in EPCA.

NHTSA Has Also Concluded That Regulation of Carbon Dioxide Emissions From Motor Vehicles Conflicts With and Is Impliedly Preempted Under 49 U.S.C. Chapter 329

Pre-emption principles also provide that if a state law or regulation stands as an obstacle to the accomplishment and execution of the full purposes and objectives of Congress in enacting a statute, that law or regulation may be preempted.[240] The presence of an express preemption provision in a statute neither precludes nor limits the ordinary working of conflict pre-emption principles, particularly in the absence of a saving clause.[241] Therefore, NHTSA has concluded that these principles are also fully operative under EPCA, in addition to its express preemption provision.

NHTSA has concluded that the State GHG standard, to the extent that it regulates tailpipe CO_2 emissions, would frustrate the objectives of Congress in establishing the CAFE program and conflict with the efforts of NHTSA to implement the program in a manner consistent with the commands of EPCA. Congress had a variety of interrelated objectives in enacting EPCA and has charged NHTSA with balancing and achieving them. Among them was improving motor vehicle fuel economy. To achieve that objective, Congress did not simply mandate the issuance of fuel economy standards set at whatever level NHTSA deemed appropriate. Nor did it simply say that levels must be set consistent with the criteria it specified in Section 32902(f). It went considerably further, mandating the setting of standards at the maximum feasible level.

Other congressional objectives underlying EPCA include avoiding serious adverse economic effects on manufacturers and maintaining a reasonable amount of consumer choice among a broad variety of vehicles. Congress was explicitly concerned that the CAFE program be carefully drafted so as to require levels of average fuel economy that do not have the effect of either ''imposing impossible burdens or unduly limiting consumer choice as to capacity and performance of motor vehicles.'' [242] These concerns are equally applicable to the manner in which that program is implemented.

To guide the agency toward the selection of standards meeting these competing objectives, Congress specified four factors that NHTSA must consider in determining which level is the maximum feasible level of average fuel economy and thus the level at which each standard must be set. These are technological feasibility, economic practicability, the effect of other Government standards on fuel economy, and the need of the Nation to conserve energy.[243] In addition, the agency had traditionally considered the safety consequences in selecting the level of future CAFE standards.

Congress expected the agency to balance these factors in a fashion that ensures the standards are neither too low, nor too high. The Conference Report for EPCA states that the fuel economy standards were to be the product of balancing the benefits of higher fuel economy levels against the difficulties individual manufacturers would face in achieving those levels:

> Such determination should take industry-wide considerations into account. For example, a determination of maximum feasible average fuel economy should not be keyed to the single manufacturer which might have the most difficulty achieving a given level of average fuel economy. Rather, the Secretary must weigh the benefits to the nation of a higher average fuel economy standard against the difficulties of individual automobile manufacturers. Such difficulties, however, should be given appropriate weight in setting the standard in light of the small number of domestic automobile manufacturers that currently exist, and the possible implications for the national economy and for reduced competition association [sic] with a severe strain on any manufacturer. However, it should also be noted that provision has been made for granting relief from penalties under Section 508(b) in situations where competition will suffer significantly if penalties are imposed.[244]

NHTSA has concluded that were a State to establish a fuel economy standard or de facto fuel economy standard, e.g., a CO_2 emission standard, it would not choose one that has the effect of requiring lower levels of average fuel economy than the CAFE standards applicable under EPCA or even one requiring the same level of average fuel economy. Given that the only practical way to reduce tailpipe emissions of CO_2 is to improve fuel economy, such a State standard would be meaningless since it would not reduce CO_2 emissions to an extent greater than the CAFE standards.[245] Instead, a State would establish a standard that has the effect of requiring a higher level of average fuel economy.

Setting standards that are more stringent than the fuel economy standards promulgated under EPCA would upset the efforts of NHTSA to balance and achieve Congress's competing goals. Setting a standard too high, above the level judged by NHTSA to be consistent with the statutory consideration after careful consideration of these issues in a rulemaking proceeding, would negate the agency's analysis and decisionmaking. NHTSA makes its judgments only after considering extensive technical

[238] Based on its own analysis of warming-potential weighted emissions, CARB estimates that upgrading to a low-leak HFC–152a air conditioning system or a CO_2 system would reduce GHG emissions by ''approximately 8.5 or 9 CO_2-equivalent grams per mile, respectively.'' (ISOR, p. 72). CARB further states that ''upgrading to a VDC with external controls, air recirculation, and HFC–152a as the refrigerant, the estimated indirect emission reduction is 7 CO_2-equivalent grams per mile for a small car, 8 CO_2-equivalent grams per mile for a large car, and 9.8 CO_2-equivalent grams per mile for minivans, small trucks, and large trucks.'' (ISOR, p. 75). According to the regulation, combined direct and indirect emissions allowances for air conditioners could total as much as CO_2-equivalent 20 grams per mile. California Code of Regulations, Title 13, section 1961.1(a)(1)(B)(1)(b) allows a direct emissions allowance of up to 9 grams per mile. Section 1961.1(a)(1)(B)(1)(c) allows an indirect emissions allowance of up to 11 grams per mile.

[239] A CARB memorandum recognizes that CO_2 emissions are related to fuel economy. It points out that CO_2 emissions can be modeled to estimate fuel economy. It also noted in the context of CO_2 that emission rates for vehicles from a certain period (MY 1990—MY 1997) were assumed to be the same as the preceding model year (1989) because CAFE standards did not change dramatically after the initial model year (MY 1989). *http://www.arb.ca.gov/msei/on-road/downloads/pubs/co2final.pdf* (this document apparently was prepared in the late 1990s, based on its reference to the EMFAC7G model, which was approved by EPA on April 16, 1998.) Similarly, a National Academies Press (NAP) release on Automotive Fuel Economy, recognized the relationship between automotive fuel economy and CO_2 emission rates: ''Fuel economy improvements in new light-duty vehicles will reduce carbon dioxide emissions per mile because less fuel will be consumed per vehicle mile driven.'' *http://www.nap.edu/openbook/0309045304/html/7html.* (NAP was created by the National Academies to publish the reports issued by the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council.) See also NAP report at *http://www.nap.edu/books/0309076013/html/7.html.* In addition, CARB recognized that the GHG (CO_2-equivalent emission standards are related to fuel economy in another way. CARB recognized that the standards would result in savings in reduced operating costs. Those lower costs are based on lower costs for fuel based on improved fuel efficiency. (ISOR, p. 196; FSOR, pp. 166, 168).

[240] *Spriestma* v. *Mercury Marine,* 537 U.S. 51, 64–5 (2002).

[241] *Geier* v. *Honda,* 529 U.S. 861, 869 (2000).

[242] H. Rep. No. 94–340, 87 (1975).

[243] 49 U.S.C. 32902(f).

[244] S. Rep. No. 94–516, 154–155 (1975).

[245] This is also EPA's conclusion. See 68 FR 52922, 52929.

information such as detailed product information submitted by the vehicle manufacturers and NAS' report on the future of the CAFE program and conducting analyses of potential impacts on employment and safety.

As noted above, manufacturers confronted with requirements for the reduction of tailpipe CO_2 emissions would look at the same pool of technology used to reduce fuel consumption. NHTSA concludes that it is disruptive to the orderly implementation of the CAFE program, and to NHTSA's reasonable balancing of competing concerns, to have two different governmental entities assessing the need to conserve energy, technological feasibility, economic practicability, employment, vehicle safety and other concerns, and making inconsistent judgments made about how quickly and how much of that single pool of technology could and should be required to be installed consistent with those concerns. EPCA does not specify how to weight each concern; thus, NHTSA determines the appropriate weighting based on the circumstances in each CAFE standard rulemaking. More important, ignoring the judgments made by NHTSA at the direction of Congress could result in setting standards at levels higher than NHTSA can legally justify under EPCA, increasing the risk of the harms that that body sought to avoid, e.g., serious adverse economic consequences for motor vehicle manufacturers and unduly limited choices for consumers.

Through EPCA, Congress committed the reasonable accommodation of these conflicting policies and concerns to NHTSA.[246] ''Congress did not prescribe a precise formula by which NHTSA should determine the maximally-feasible fuel economy standard, but instead gave it broad guidelines within which to exercise its discretion.'' [247] A state's adoption and enforcement of a CO_2 standard for motor vehicles would infringe on NHTSA's discretion to establish CAFE standards consistent with Congress' guidance and threaten the goals that Congress directed NHTSA to achieve. The process of achieving those goals involves great expertise and care. The fuel economy standards delegated to NHTSA are to be the product of balancing the benefits of higher fuel economy levels against the difficulties individual manufacturers would face in achieving those levels.[248]

As EPA observed in its notice denying the petition to regulate motor vehicle CO_2 emissions, its issuance of standards for those emissions would ''abrogate EPCA's regime,'' [249] rendering NHTSA's careful balancing of consideration a nullity. This is equally true for State standards for those emissions.

There appear to be two misconceptions that have clouded proper analysis of these implied preemption issues. One is that since the term ''average fuel economy standard'' is defined in EPCA as meaning ''a performance standard specifying a *minimum* level of average fuel economy applicable to a manufacturer in a model year'' [250] (emphasis added), there can be no conflict or incompatibility between CO_2 standards and CAFE standards. Indeed, it has been suggested that in defining this term in this fashion, Congress endorsed the setting of other standards having the effect of regulating fuel economy.[251] NHTSA does not interpret the statute in this manner, because EPCA requires that CAFE standards be set at the maximum feasible level, consistent with the agency's assessment of impacts on the nation, consumers and industry.

An interpretation that allowed more stringent State fuel economy standards would nullify the statutory limits that Congress placed in EPCA on the level of CAFE standards, and the efforts of NHTSA in its CAFE rulemaking to observe those limits. Congress expressly listed four analytical, decision guiding factors in EPCA because fuel economy was not the only value that Congress sought to protect and promote in the mandating the setting of CAFE standards. Congress did not want improved fuel economy to come at the price of adverse effects on sales, jobs, and consumer choice. Further, in choosing the level of future CAFE standards, NHTSA has traditionally considered the potential impact on safety.

In selecting the maximum feasible level, NHTSA strives to set the standards as high as it can without causing significant adverse consequences for the manufacturers or consumers. Since NHTSA should not, as a matter of sound public policy, and in fact may not as a matter of law, set standards above the level it determines to be the maximum feasible level, EPCA should not be interpreted as permitting the States to do so. Indeed, NHTSA has concluded that, under EPCA, States may not set actual or de facto fuel economy standards at any level.

Second, as noted above, regulating fuel economy and regulating CO_2 emissions are inextricably linked, given current and foreseeable automotive technology. There are not two different pools of technology, one for reducing tailpipe CO_2 emissions, and the other for improving fuel economy. Thus, there is nothing to be gained by setting both tailpipe CO_2 standards and CAFE standards.

If the technology does not improve fuel economy, it does not reduce tailpipe CO_2 emissions. The technologies listed in Part 5 of CARB's Initial Statement of Reasons for its GHG standard for reducing tailpipe CO_2 emissions reduce those emissions by improving fuel economy.

This dichotomy of perception or characterization about fuel economy and CO_2 emissions does not appear to exist in other countries. According to the International Energy Agency:

> The existing approaches for achieving CO_2 reduction through fuel economy improvement in new cars vary considerably, with both regulatory approaches (China, Japan, US, CA) and voluntary approaches (EU). Some systems include financial incentives as well (Japanese tax credit for hybrids, U.S. gas guzzler tax, various EU member country differential taxation schemes based on fuel economy, such as in the UK and Denmark).[252]

Further, in Europe, the studies conducted for the European Commission in support of efforts to provide public information on fuel economy and CO_2 emissions to induce consumers to purchase vehicles with lower CO_2 emissions uniformly reflect the view that fuel economy and CO_2 emissions are directly related.[253]

[246] 901 F.2d 107, 120–21.

[247] 901 F.2d 107, 120–21.

[248] 793 F.2d 1322, 1338.

[249] Id.

[250] 49 U.S.C. 32901(a)(6).

[251] This suggestion cannot be reconciled with Congress' decision to include an express preemption provision in EPCA. 49 U.S.C. 32919(a).

[252] FUELING THE FUTURE: Workshop on Automobile CO_2 Reduction and Fuel Economy Improvement Policies, WORKSHOP REPORT, 13 October, 2004, Shanghai, China, *http://www.iea.org/textbase/work/2004/shanghai/UNEP_IEA.PDF.*

[253] RAND Europe, at 4; D. Elst, N. Gense, I.J. Riemersma, H.C. van de Burgwal, Z. Samaras, G. Frontaras, I. Skinner, D. Haines, M. Fergusson, and P. ten Brink, Measuring and preparing reduction measures for CO_2-emissions from N1 vehicles-final report the European Commission, Directorate-General for Environment, at 90, TNO TPD, (part of the Netherlands Organisation for Applied Scientific Research TNO), in partnership with Aristotle University of Thessaloniki and Institute for European Environmental Policy, Contract no. B4–3040/2003/364181/MAR/C1, December 2004 (observing that '' * * * reduction of CO_2 is equivalent to fuel economy improvement * * * ''); and A. Gartner, Study on the effectiveness of Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO_2 emissions in respect of the marketing of new passenger cars, Final report to the European Commission, Directorate-General for Environment, Contract No.: 07010401/2004/377013/MAR/C1, at

Similarly, in 2001, one of the leading U.S. environmental groups participating in this rulemaking issued a report that identified a vehicle's fuel consumption rate as the single vehicle design factor determining the amount of a vehicle's CO_2 emissions:

The CO_2 emitted by a motor vehicle is the product of three factors: the amount of driving, the vehicle's fuel consumption rate and the carbon intensity of the fuel consumed. The fuel consumption rate (*e.g.*, the number of gallons needed to drive 100 miles) is the inverse of fuel economy (miles per gallon, or mpg).[254]

Later, in the same report, it was observed in a footnote (#26) that "it is actual CAFE that determines fuel consumption and CO_2 emissions." [255]

EPCA's Provision Specifying Factors To Be Considered in Setting Average Fuel Economy Standards Does Not Limit Preemption Under 49 U.S.C. Chapter 329

EPCA does not include any exception to its preemption provision that would cover State GHG and CO_2 standards. Nevertheless, some commenters opposing preemption suggested that Section 32902(f), which lists the factors that NHTSA must consider in determining the level at which to set fuel economy standards, prevents preemption by requiring consideration, by NHTSA, of the effect of other Government standards, including emissions standards, on fuel economy.

EPCA's decisionmaking factor provision is neither a saving clause nor a waiver provision. Nor does NHTSA interpret it as saving state emissions standards that effectively regulate fuel economy from preemption. The agency interprets that provision only to direct NHTSA to consider those State standards that can otherwise be validly adopted and enforced under State and Federal law.

The decisionmaking factors provision does reflect an expectation by Congress that some state emissions standards would not be preempted under the express preemption provision. However, as an initial matter, NHTSA does not read the provision to imply a savings clause. This is particularly so given that Congress has considered and provided a different saving clause, *i.e.*, the one for a State law or regulation on disclosure of fuel economy or fuel operating costs for an automobile.

Moreover, even if EPCA did contain the saving clause desired by those commenters, NHTSA would not give it effect here, as doing so "would upset the careful regulatory scheme established by federal law." [256]

First, and most important in this context, such a reading would upset the carefully calibrated CAFE regulatory program under which NHTSA is with setting CAFE standards at the maximum feasible level, taking care neither to set them too high nor too low. Because of the need to conserve energy, Congress did not simply mandate the setting of appropriate fuel economy standards. Instead, it mandated the setting of maximum feasible ones. At the same time, Congress was aware that setting overly stringent standards would excessively reduce consumer choice about vehicle design and performance and threaten adverse economic consequences. As noted by EPA in its Federal Register document denying ICTA's petition to regulate CO_2 emissions from motor vehicles, the setting of standards for CO_2 tailpipe emissions would displace NHTSA and upset EPCA's regulatory regime for CAFE.

Second, the requirement to consider these decisionmaking factors must be reconciled with the express preemption provision. NHTSA has concluded that reading the express preemption provision in the manner suggested by commenters opposing preemption would irrationally limit that provision and leave NHTSA's role in administering the CAFE program open to a substantial risk of abrogation. By the same token, in NHTSA's view, it is equally important that the "relates to" language in the express preemption provision should not be given so broad a reading that even State emissions standards having only an incidental effect on fuel economy standards are deemed to be preempted by it.

NHTSA has concluded that these two extreme readings, with their unacceptable impacts on EPCA and on the Clean Air Act, including its waiving preemption provision, can be avoided under a carefully calibrated interpretation of EPCA's express preemption provision that harmonizes the two acts to the extent possible.

NHTSA does not interpret EPCA's express preemption provision as preempting State emissions standards that only incidentally or tangentially affect fuel economy. These standards include, for example, given current and foreseeable technology, the existing emissions standards for CO, HC, NO_X, and particulates. They also include the limits on sulfur emissions that become effective in 2007. NHTSA considers such standards under the decisionmaking factors provision of EPCA since, under applicable law, they can be adopted and enforced and therefore can have an effect on fuel economy.

However, two groups of State emissions standards do not qualify under NHTSA's interpretation of the decisionmaking factors provision, and therefore would not be considered. One is State standards that cannot be adopted and enforced because there has been no waiver for California under the preemption waiver provision of the Clean Air Act. The other is the State emissions standards that are expressly or impliedly preempted under EPCA, regardless of whether or not they have received such a waiver. Preempted standards include, for example:

(1) A fuel economy standard; and

(2) A law or regulation that has essentially all of the effects of a fuel economy standard, but is not labeled as one (example: State tailpipe CO_2 standard).

This reading of EPCA's express preemption provision allows that provision to function in a consistent way, without irrational limitation, to protect the national CAFE program from interference by any State standard effectively regulating fuel economy. It also simultaneously maximizes the ability of EPCA and the Clean Air Act to achieve their respective purposes.

NHTSA's judgment is that the agency should distinguish between motor vehicle emission standards for emissions other than CO_2 (*e.g.*, HC, CO, NO_X and PM) and motor vehicle emission standards for CO_2. Those other emissions are not directly and inextricably linked to fuel economy. NHTSA's current view is that standards for emissions other than CO_2 merely affect the level of CAFE that is achievable and thus only incidentally affect fuel economy standards. Accordingly, we believe that regulation of these emissions is not rulemaking inconsistent with the operation of preemption principles under EPCA.

HC, CO, and PM all result from incomplete combustion. Therefore, the first step toward controlling emissions of these pollutants involves improving

45 and 70, Allgemeine Deutsche Automobil-Club ADAC e.V., March 2005 (observing " * * * that most consumers are not aware of the correlation of fuel consumption and CO_2 emissions of passenger cars * * * " and that " * * * the CO_2 emissions (g/km) can be calculated from fuel consumption * * * ").

[254] J. DeCicco and A. Feng, Automakers' Corporate Carbon Burden, Reframing Public Policy on Automobiles, Oil and Climate, at 7–8, Environmental Defense, 2001. The article explained that carbon intensity is how much CO_2 is emitted per unit of fuel consumed. For gasoline, this amounts to 19.4 pounds per gallon. Id. at 8.

[255] Ibid, at 22–23.

[256] *Geier* v. *American Honda Motor Co.*, 529 U.S. 861, 869 (2000). (Citations omitted.)

the combustion process. Doing so increases the production and emission of carbon dioxide. All three pollutants can also be substantially eliminated from tailpipe emissions by placing catalytic converters between the engine and the tailpipe. Catalytic converters reduce emissions of these pollutants through oxidation, which also increases the production and emission of carbon dioxide. PM emissions can also be controlled using PM traps, which temporarily trap and store PM. PM traps periodically regenerate by oxidizing away the stored PM. Doing so increases the production and emission of carbon dioxide.

NO_X results from the oxidation of nitrogen at the high peak temperatures that occur in an efficiently-operating engine. The exposure of nitrogen to peak temperatures can be reduced by increasing turbulence in the combustion chamber, changing ignition and/or injection timing, and recirculating some exhaust gases through the engine. Increased turbulence and changes to ignition and/or injection timing tend to increase the production and emission of carbon dioxide. Catalytic converters can substantially eliminate NO_X from the exhaust stream. However, doing so requires chemical reduction—oxidation in reverse. Modern catalytic converters perform both reduction and oxidation, reducing NO_X to oxidize HC and CO, and further oxidizing HC and CO with oxygen available in the exhaust stream. These processes increase the production and emission of carbon dioxide.

Gasoline vehicles also emit HC through the evaporation of fuel. These emissions are controlled using canisters that temporarily store evaporated fuel. Periodically, these canisters are purged, releasing the stored fuel vapors to the engine to be combusted. Compared to simply releasing evaporative emissions to the atmosphere, these processes increase the formation and emission of carbon dioxide.

To summarize, the processes used to control HC, CO, NO_X, and PM emissions increase the formation and emission of carbon dioxide. Because carbon dioxide is, like water, an ultimate byproduct of combustion, it cannot be further converted on the vehicle to some other compound through any practical means. Plants use sunlight to convert carbon dioxide and water to biomass (and oxygen) through photosynthesis, but vehicles produce far too much exhaust to be consumed by plants that could conceivably be sustained by the amount of sunlight to which vehicles are exposed. Even if enough sunlight were available, biomass would be produced at a rate requiring impractically frequent removal from the vehicle. Theoretically, on-board scrubbers could be used separate carbon dioxide from the exhaust stream. Chemical processes for removing carbon dioxide are currently used in underwater rebreathers and space applications (*e.g.*, the international space station), and are contemplated for stationary applications (*e.g.*, electric utilities). (See, *e.g.*, *http://www.nas.nasa.gov/About/Education/SpaceSettlement/teacher/course/co2.html*, *http://www.frogdiver.com*, and *http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/5a5.pdf*.) However, for a variety of reasons (*e.g.*, size, cost, energy demands, use of dangerous reactants such as calcium hydroxide), these processes would not be even remotely practical for motor vehicles.

Even if a practical process to separate carbon dioxide from the exhaust stream were available, the carbon dioxide would, to prevent its release, need to be compressed or solidified for temporary onboard storage, and frequently removed for disposal (*e.g.*, in underground facilities). For example if fifteen gallons of gasoline are added at each refueling of a vehicle, about 290 pounds of carbon dioxide (or, without any separation of the carbon dioxide, about 1,400 pounds of exhaust gases) would be produced through the combustion of that fuel. (This example assumes gasoline with a density of 6 pounds per gallon and a carbon content (by mass) of 87%. Each pound of carbon dioxide contains 0.273 pounds of elemental carbon. The combustion of 1 pound of gasoline requires about 14.7 pounds of air.) At these rates of production, no practical means of onboard storage and periodic removal are foreseeable.

For these reasons, a CO_2 emissions standard stands apart from those other emissions standards. NHTSA has concluded that such a standard functions as a fuel economy standard, given the direct relationship between a vehicle's fuel economy and the amount of CO_2 it emits. In contrast, no such relationship exists between a vehicle's fuel economy and the emissions currently regulated by EPA.

Interpreting EPCA's preemption provision as preempting only those State regulations that directly regulate or have the effect of directly regulating fuel economy gives, to the extent possible, maximum effect both to EPCA and to the preemption waiver provision in the Clean Air Act. This is necessary and appropriate, especially considering the importance of the goals of the Clean Air Act and the attention paid by Congress in drafting EPCA to the relationship of the CAFE program to the Clean Air Act. EPCA's express preemption provision cannot be interpreted as preempting all State laws relating to a fuel economy standard, no matter how tangential the relationship. Such an interpretation would largely, if not wholly, negate the Clean Air Act's preemption waiver provision and leave few, if any, emission standards to be considered by NHTSA under EPCA's decisionmaking factor provision. Our approach to reconciling EPCA and the Clean Air Act appropriately distinguishes between emissions other than CO_2 and CO_2. The Clean Air Act authorizes the States to regulate emissions other than CO_2, but not CO_2 itself, because of the nature of combustion and the availability of different technologies for regulating those other emissions.

Our approach also avoids interpreting EPCA's express preemption provision so narrowly as to produce the absurd and destructive result of preempting State fuel economy standards, but not State standards that are fuel economy standards in effect, but not in name. Giving EPCA this degree of primacy is particularly appropriate given the regulatory authority in this statute is quite narrow and specific: fuel economy standards, and their functional equivalents, CO_2 standards and GHG standards, to the extent that the latter regulate CO_2 emissions.

XV. Rulemaking Analyses and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

Executive Order 12866, ''Regulatory Planning and Review'' (58 FR 51735, October 4, 1993), provides for making determinations whether a regulatory action is ''significant'' and therefore subject to OMB review and to the requirements of the Executive Order. The Order defines a ''significant regulatory action'' as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or Tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the

President's priorities, or the principles set forth in the Executive Order.

The rulemaking adopted in this document is economically significant. Accordingly, OMB reviewed it under Executive Order 12866. The rule is also significant within the meaning of the Department of Transportation's Regulatory Policies and Procedures.

We estimate that the total benefits under the Unreformed CAFE standards for MYs 2008–2010 and the Reformed CAFE standard for MY 2011 will be approximately $7,554 million at a 7 percent discount rate and at fuel prices (based on EIA long-term projections) ranging from $1.96 to $2.39 per gallon: $577 million for MY 2008, $1,876 million for MY 2009, $2,109 million for MY 2010, and $2,992 million for MY 2011. We estimate that the total costs under those standards, as compared to the MY 2007 standard of 22.2 mpg, will be a total of $6,440 million: $536 million for MY 2008, $1,621 million for MY 2009, $1,752 million for MY 2010, and $2,531 million for MY 2011.

Under the Reformed CAFE standards for MYs 2008–2011, as compared to the MY 2007 standard of 22.2 mpg, we estimate the total benefits under the Reformed CAFE system for MYs 2008–2011 at $8,125 million: $782 million for MY 2008, $2,015 million for MY 2009, $2,336 million for MY 2010, and $2,992 million for MY 2011. We estimate the total costs to be similar to the total costs under the Unreformed CAFE system, $6,711 million: $553 million for MY 2008, $1,724 million for MY 2009, $1,903 million for MY 2010, and $2,531 million for MY 2011.

Because the final rule is significant under both the Department of Transportation's procedures and OMB's guidelines, the agency has prepared a Final Regulatory Impact Analysis and placed it in the docket and on the agency's Web site.

B. National Environmental Policy Act

Consistent with the requirements of the National Environmental Policy Act (NEPA),[257] the regulations of the Council on Environmental Quality,[258] and relevant DOT regulations and orders,[259] the agency has prepared a final Environmental Assessment (EA) of this action and concludes that this rulemaking action will not have a significant effect on the quality of the human environment. Both the final EA and a Finding of No Significant Impact (FONSI) have been placed in the docket.

In comments on the draft EA, the Attorneys General and the Center for Biological Diversity challenged the adequacy of the environmental analysis performed by the agency. These commenters stated that the agency is required to prepare an EIS.

The agency disagrees that an EIS was required. Although not required to do so under NEPA, the agency first published a draft EA for comment, and carefully reviewed all comments.[260] Appropriate adjustments have been made in the final EA.

Based on the analysis in the final EA, which led to a determination that this rulemaking action will not have a significant effect on the quality of the human environment, the agency determined that it was not required to prepare an Environmental Impact Statement (EIS). The function of an EA is to present and analyze various alternatives so that an agency can consider the environmental concerns related to a particular action and other possible actions ''while reserving agency resources to prepare full EISs for appropriate cases.'' *Sierra Club* v. *DOT*, 753 F.2d 120, 126 (D.C. Cir. 1985). An EIS is required only when an agency has first determined that a major federal action will ''significantly affect [] the quality of the human environment.'' 42 U.S.C. 4332(2)(C). *See also Sierra Club*, 753 F.2d at 126, *Town of Cave Creek, Arizona* v. *FAA*, 325 F.3d 320, 327 (D.C. Cir. 2003) and *Fund for Animals* v. *Thomas*, 127 F.3d 80, 83 (D.C. Cir. 1997). This limitation reflects the courts' awareness of the time and expense involved in the preparation of an EIS. *See River Road Alliance* v. *Corps of Engineers of the United States Army*, 764 F.2d 445, 449 (7th Cir. 1985) (the decision to prepare an EIS is based on ''whether the time and expense of preparing an environmental impact statement are commensurate with the likely benefits from a more searching evaluation than an environmental assessment provides'') and *Metropolitan Edison Co.* v. *People Against Nuclear Energy*, 460 U.S. at 766, 776 (1983) (noting scarcity of time and resources in limiting the scope of NEPA review). The agency conducted a careful inquiry and assessed the potential environmental impacts of a variety of alternatives including the action adopted in this final rule. With respect to each alternative, the agency determined that projected impacts would be very small and generally constitute improvements compared to the baseline for this rulemaking.[261]

The Attorneys General and the Center for Biological Diversity stated that the agency did not consider a reasonable number of alternatives, and therefore did not take the requisite ''hard look'' when analyzing environmental impacts.[262] In particular, they asserted that Reformed CAFE creates incentives for manufacturers to build larger vehicles, ''which will jeopardize air quality and the climate'' and that NHTSA did not ''consider the environmental impact of its choices or the possibility of making other choices.''

In determining the impacts of this rulemaking, the agency analyzed a reasonable number of alternative actions, as required under NEPA. As the Supreme Court has recognized, an agency is required to examine only reasonable alternatives, not those that might result in the worst-case scenario and that are unlikely to occur. *See Robertson* v. *Methow Valley Citizens Council*, 490 U.S. 332, 354–55 (1989).

The agency recognizes that numerous alternatives exist, including alternatives with more stringent fuel economy requirements.[263] However, the agency did not analyze these alternatives in the final EA because we determined from our analytical model that they would not be consistent with the statutory criteria of EPCA. We note that the agency is required to set fuel economy standards at the ''maximum feasible'' levels achievable by manufacturers in the applicable model years, taking into consideration four statutory factors: Technological feasibility; economic practicability; the impact of other Federal standards on fuel economy; and the need of the nation to conserve

[257] 42 U.S.C. 4321 *et seq.*

[258] 40 CFR part 1500.

[259] 49 CFR part 520, DOT Order 5610.1C, and NHTSA Order 560–1.

[260] None of the commenters provided specific data to indicate that impacts from the proposed rule, final rule, or considered alternatives, would be significant.

[261] See Section 4 Environmental Consequences, in the final EA, which has been placed in the docket for this rulemaking.

[262] The term ''hard look'' refers to whether the agency fully evaluated, rather than cursorily examined, a particular issue. *See Marsh* v. *Oregon Natural Resources Council*, 490 U.S. 360, 374 (1989). Elements of a hard look include whether an agency demonstrated that ''it had responded to significant points made during the public comment period, had examined all relevant factors, and had considered significant alternatives to the course of action ultimately chosen.'' Merrick B. Garland, Deregulation and Judicial Review, 98 Harv. L. Rev. 505, 526 (1985). *See also Home Box Office* v. *FCC*, 567 F.2d 9, 35 (D.C. Cir.) (requiring agencies to consider all relevant factors and demonstrate a ''rational connection between the facts found and the choice made'') (citing *Burlington Truck Lines* v. *United States*, 311 U.S. 156, 168 (1962)), *cert. denied*, 434 U.S. 829 (1977).

[263] Commenters suggested that the agency consider more stringent standards, but provided no substantive data to support the general assertion that unspecified, but more stringent, standards be adopted.

energy. EPCA does not permit the agency to establish fuel economy standards at any chosen level, but instead requires NHTSA to balance these factors when setting an appropriate standard. For example, a fuel economy standard ''with harsh economic consequences for the auto industry * * * would represent an unreasonable balancing of EPCA's policies.'' *Center for Auto Safety* v. *NHTSA*, 793 F.2d 1322, 1340 (D.C. Cir. 1986).

The evaluated alternatives represent standards set under the traditional Unreformed CAFE process and under the marginal cost-benefit analysis previously described. These alternatives analyzed by the agency, which are described in greater detail in the final EA (see EA pp. 8–15), represent options that were reasonable, given the agency's authority under EPCA. All of these options were projected to result primarily in small emission reductions. We evaluated the selected alternatives against a reasonable baseline and we have evaluated the estimated cumulative impacts resulting from the alternative ultimately adopted in the final rule.[264] The alternative adopted today reflects the technological capabilities of the industry within the applicable time frame and does not result in harsh economic consequences for the industry. After carefully considering the statutory criteria, the agency has determined that the standards adopted today represent the ''maximum feasible'' levels achievable by manufacturers.[265]

Further, we considered, but did not evaluate, an alternative that would incorporate a backstop or ratcheting mechanism. There are several reasons for not including such a mechanism within the context of the Reformed CAFE system that we are adopting today. The suggestion that NHTSA must incorporate a backstop does not consider the fact, noted above several times, that CAFE does not command that NHTSA, in administering the CAFE program, either to ignore or seek to preclude mix shifts and design changes made due to consumer demand. NHTSA has traditionally considered consumer demand in setting new CAFE standards and likewise has considered it as necessary and appropriate in amending existing standards. The proponents of a backstop did not consider that the proposed Reformed CAFE system minimized the incentive for manufacturers to upsize vehicles. The Reformed system adopted in this final rule reduces that incentive even more. Further, manufacturers are limited in their ability to increase vehicle size by consumer demand and by other market forces, such as potential fuel prices. Adoption of a backstop would also undermine the benefits of attribute-based standards for some manufacturers and perpetuate the shortcomings of the Unreformed system.

The Attorneys General also expressed concern about the potential for vehicle upsizing and stated that the agency should analyze the impact on fuel savings that would occur if manufacturers enlarged their vehicles, making them subject to a less stringent requirement. As explained above, the agency chose footprint as the vehicle metric on which to base the standard because it would be difficult for manufacturers to make short term adjustments solely in response to the fuel economy levels. We based our analysis on manufacturer product plans, which reflect vehicle designs through MY 2011. As also explained above, footprint is closely tied to a vehicle's platform, which manufacturers typically rely upon without change for a multi-year product cycle.

The Center for Biological Diversity argued that the agency did not properly analyze the cumulative impacts of the light truck rule relative to greenhouse gas emissions and global warming. The commenter asserts that past, present and future actions must be adequately catalogued and considered, including a list and description of ''sources of United States [greenhouse gas] emissions by category and percent of the total to place the [greenhouse gas] emissions into perspective.'' The Center for Biological Diversity also stated that the agency needs a full understanding of how its proposed action impacts the overall ability of the U.S. to reduce its greenhouse gas emissions.

In the final EA, the agency has provided a discussion of the greenhouse gas emissions in the U.S. transportation sector, as well as in the U.S. generally, based on available data (see EA pp. 21, 31). Although the commenters urge the agency to promulgate a standard that results in larger reductions in CO_2 emissions, such a course of action would not be consistent with the EPCA constraints discussed earlier. The extent of NHTSA's analysis is dictated by the goals and requirements of EPCA. *Metropolitan Edison Co.*, 460 U.S. at 776 (noting that ''[t]he scope of the agency's inquiries must remain manageable if NEPA's goal of 'ensur[ing] a fully informed and well considered decision' * * * is to be accomplished.'') (citations omitted). The agency considered the impacts to greenhouse gas emissions from fuel economy standards set according to the statutory directive of EPCA. Moreover, as illustrated in the final EA, all of the analyzed alternatives were projected to reduce CO_2 emissions (see EA p. 30).

The commenters also contend that the agency has not taken into account changed circumstances that have occurred since the last EIS was completed. In addition to citing the passage of time since the agency last prepared an EIS for the CAFE program, commenters said that higher gas prices, heightened concerns about foreign oil dependence, climate changes, and advances in hybrid technologies constitute ''changed circumstances'' that dictate a full evaluation of environmental impacts in an EIS.

While we appreciate that changes have occurred since the last EIS was performed, we note that there must be sufficient information to show that this action will affect the quality of the human environment ''in a significant manner or to a significant extent not already considered'' to require an EIS. Further, as explained in the FRIA, higher gasoline prices were factored into the model relied on by the agency (see FRIA p. VIII–26). The incorporation of hybrid technology is addressed elsewhere in this notice and in the FRIA (see FRIA p. V–12). Consideration of the nation's dependence on foreign oil raises policy questions that lie outside the scope of NEPA. We address that matter elsewhere in this notice.

The setting of the MY 2005–2007 light truck standards in April 2003 (68 FR 16868) was the agency's first effort to set CAFE standards since the lifting of prior

[264] While a baseline typically represents the impact that would occur if an agency took no action (*i.e.*, if NHTSA did not establish standards at all for MYs 2008–2011), 49 U.S.C. § 32902(a) precludes this possibility by affirmatively requiring the Secretary of Transportation to prescribe, by rule, average fuel economy standards for light trucks—in other words, the agency must promulgate some standard to apply to light trucks. For these purposes, we chose to use the MY 2007 (22.2 mpg) standard as the baseline to assess the impacts of the various alternatives.

[265] Separately, NRDC provided several scenarios purportedly demonstrating the impact of upsizing on fleet-wide fuel economy. While the agency does not agree that the scenarios presented by NRDC are probable, we note that the fleet-wide fuel economy estimates for each one remains within the range of alternatives considered in the Environmental Assessment. That is, under NRDC's analysis, the fleet-wide fuel economy was not lower than the No Action Alternative evaluated in the final EA. Additionally, as discussed in the final EA, the range of impacts from the considered alternatives is very narrow and minimal. The projections for each of the alternatives examined by the agency indicated that none of them would result in a significant impact. An agency is only required to examine reasonable alternatives, not those that might result in the worst-case scenario and that are unlikely to occur. *See Robertson* v. *Methow Valley Citizens Council*, 490 U.S. 332, 354–55 (1989).

Congressional restrictions (other than the ministerial setting of standards at already prescribed levels during the intervening years). Based on the EA for that action,[266] the agency concluded that no significant environmental impact would result from the rule. As explained in the MY 2005–2007 EA, we believe that adopting that approach in that rulemaking action is consistent with our prior evaluations assessing the impacts of changes to CAFE.

The final EA in the current action also considered the effects of the different alternatives on nonattainment areas as well as on those areas that could be at risk of nonattainment status (see EA p. 31). The agency determined that the changes projected from the various alternatives that were considered would not increase the risk of any geographic areas incurring nonattainment status. As the projections in the final EA show, the levels of criteria pollutants are expected to decrease, with the exception of CO, and the projected increases in CO are not sufficient to result in an increase in nonattainment areas (see EA p. 30).

NRDC and the Center for Biological Diversity stated that the agency did not consider the impacts of the regulation on human health and endangered species. The final EA addresses human health issues. The final EA demonstrates that the changes in the emissions of criteria pollutants are not projected to result in any additional violations of the primary air standards, which are set at levels intended to protect against adverse effects on human health (see EA p. 31).

With regard to endangered species, the commenters expressed concern about the potential impact of increased greenhouse gas emissions and global warming on various species and their habitat. We first note that the Endangered Species Act does not require review in every instance that could have an impact on a particular endangered or threatened species, however remote. 16 U.S.C. 1531 *et seq.* Rather, review is triggered in instances where it is likely that such an impact will occur. *See Babbitt* v. *Sweet Home Chapter of Communities for a Great Oregon,* 515 U.S. 687, 703 (1995). As noted in the final EA, the agency projected that the final rule would produce, compared to U.S. emissions of CO_2, a small decrease in emissions of CO_2, the primary component of greenhouse gas emissions, under the selected alternative (see EA p. 32). Accordingly, the agency determined that the action we are adopting today will not have a significant impact on the environment.

In addition to commenting on the EA, the Center for Biological Diversity asserted that the Global Change Research Act (GCRA) requires the agency to rely on specific research in our analysis. The agency disagrees. The GCRA calls for the publication of a study on the effects of global climate changes every four years and to make these research findings available to agencies to use. It does not mandate, however, that Federal agencies rely on the research report. Instead, the statute only imposes a requirement that the report be made available to agencies. See 15 U.S.C. 2938 (ensuring that research findings are made available for use by Federal agencies in formulating policies addressing human-induced and natural processes of global change).

C. Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996), whenever an agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions). The Small Business Administration's regulations at 13 CFR part 121 define a small business, in part, as a business entity ''which operates primarily within the United States.'' (13 CFR 121.105(a)). No regulatory flexibility analysis is required if the head of an agency certifies the rule will not have a significant economic impact on a substantial number of small entities.

I certify that the final rule will not have a significant economic impact on a substantial number of small entities. The following is the agency's statement providing the factual basis for the certification (5 U.S.C. 605(b)).

The final rule directly affects fourteen single stage light truck manufacturers. According to the Small Business Administration's small business size standards (see 5 CFR 121.201), a single stage light truck manufacturer (NAICS code 336112, Light Truck and Utility Vehicle Manufacturing) must have 1,000 or fewer employees to qualify as a small business. None of the affected single stage light truck manufacturers are small businesses under this definition. All of the manufacturers of light trucks have thousands of employees. Given that none of the businesses directly affected are small business for purposes of the Regulatory Flexibility Act, a regulatory flexibility analysis was not prepared.

D. Executive Order 13132 Federalism

Executive Order 13132 requires NHTSA to develop an accountable process to ensure ''meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.'' The Order defines the term ''Policies that have federalism implications'' to include regulations that have ''substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.'' Under the Order, NHTSA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or NHTSA consults with State and local officials early in the process of developing the proposed regulation. The agency has complied with Order's requirements.

The issue of preemption of State emissions standard under EPCA is not a new one; there is an ongoing dialogue regarding the preemptive impact of CAFE standards whose beginning pre-dates this rulemaking. This dialogue has involved a variety of parties (i.e., the States, the federal government and the public) and has taken place through a variety of means, including rulemaking. This issue was explored in the litigation over the California ZEV regulations in 2002 (in which the federal government filed an amicus brief) and addressed at great length in California's 2004–2005 rulemaking proceeding on its GHG regulation.[267] NHTSA first addressed the issue in its rulemaking on CAFE standards for MY 2005–2007 light trucks.

In the current rulemaking proceeding, we sought again to engage the public in a discussion of the relationship between CAFE standards and State CO_2 standards and the applicability of EPCA's preemption provision to the latter. In response to our discussion of preemption in the August 2005 NPRM, the agency received communications from a variety of States and their representative organizations.

States objected generally to the preemption discussion in the NPRM. CARB, New Jersey Department of Environmental Protection, New York

[266] See Docket NHTSA–2002–11419–18360 (Final Environmental Assessment for MY 2005–2007 Light Truck CAFE Standards).

[267] FSOR, pp. 358–68.

Department of Environmental Conservation, STAPPA/ALAPCO, NESCAUM, and the Attorneys General (California et al.) each stated that the preemption discussion was irrelevant or beyond the scope of the light truck CAFE rulemaking. These commenters requested that the agency not address this issue in the final rule. The Connecticut Department of Environmental Protection, Pennsylvania Department of Environmental Protection, and STAPPA/ALAPCO made similar requests. These commenters also asserted that the issue of preemption should be left to the courts.

The Attorneys General (California et al.) stated that Executive Order 13132 directs the agency to be ''deferential to States when taking action that affects the policymaking discretion of the States and should act only with the greatest caution where State or local governments have identified uncertainties regarding the constitutional or statutory authority of the national government.''

We have carefully considered these comments, as well as closely examined our authority and obligations under EPCA and that statute's express preemption provision. For those rulemaking actions undertaken at an agency's discretion, Section 3(a) of Executive Order 13132 instructs agencies to closely examine their statutory authority supporting any action that would limit the policymaking discretion of the States and assess the necessity for such action. This is not such a rulemaking action. NHTSA has no discretion not to issue the CAFE standards established by this final rule. EPCA mandates that the ''Secretary of Transportation * * * prescribe by regulation average fuel economy standards'' for light trucks (49 U.S.C. 32902). Given that a State CO_2 regulation is the functional equivalent of a CAFE standard, there is no way that NHTSA can tailor a fuel economy standard for light trucks so as to avoid preemption. Further, EPCA itself precludes a State from adopting or enforcing a law or regulation related to fuel economy (49 U.S.C. 32919(a)).

For these reasons and those stated at greater length in the section above on preemption, we have not adopted the views presented by the States. Nevertheless, the agency continues to examine these issues and welcomes continued input.

E. Executive Order 12988 (Civil Justice Reform)

Pursuant to Executive Order 12988, ''Civil Justice Reform'' (61 FR 4729, February 7, 1996), the agency has considered whether this rulemaking will have any retroactive effect. This final rule does not have any retroactive effect.

F. Unfunded Mandates Reform Act

Section 202 of the Unfunded Mandates Reform Act of 1995 (UMRA) requires Federal agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of more than $100 million in any one year (adjusted for inflation with base year of 1995 to $115 million for 2003). All cost estimates in the FRIA are in 2003 economics. Before promulgating a rule for which a written statement is needed, NHTSA is generally required by section 205 of the UMRA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows NHTSA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the agency publishes with the final rule an explanation why that alternative was not adopted.

This final rule will not result in the expenditure by State, local, or tribal governments, in the aggregate, of more than $115 million annually, but it will result in the expenditure of that magnitude by vehicle manufacturers and/or their suppliers. In promulgating this proposal, NHTSA considered whether average fuel economy standards lower and higher than those proposed would be appropriate. NHTSA is statutorily required to set standards at the maximum feasible level achievable by manufacturers and has tentatively concluded that the proposed standards are the maximum feasible standards for the light truck fleet for MYs 2008–2011 in light of the statutory considerations.

G. Paperwork Reduction Act

Under the procedures established by the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*), a person is not required to respond to a collection of information by a Federal agency unless the collection displays a valid OMB control number. For the transition period reporting requirements, and the additional pre-model year reporting requirements, NHTSA is submitting to OMB a request for approval of the following collection of information.

In compliance with the Paperwork Reduction Act, this notice announces that the Information Collection Request (ICR) abstracted below has been forwarded to the Office of Management and Budget (OMB) for review and comment. The ICR describes the nature of the information collections and their expected burden. This is a request for an amendment of an existing collection.

Agency: National Highway Traffic Safety Administration (NHTSA).

Title: 49 CFR Part 537, Automotive Fuel Economy Reports (F.E.) Reports

Type of Request: Amended collection.

OMB Clearance Number: 2127–0019.

Form Number: This collection of information will not use any standard forms.

Requested Expiration Date of Approval: Three years from the date of approval.

Summary of the Collection of Information: So that NHTSA can ensure that light truck manufacturers are complying with the CAFE requirements, NHTSA would require light truck manufacturers to provide information on their election of a compliance option during model years 2008–2010, and provide light truck footprint data beginning model year 2008.

NHTSA established a transition period during MYs 2008–2010 during which manufacturers may opt to comply with light truck fuel economy standards established under the Reformed CAFE system. For each year of the transition period, manufacturers must, within 45 days after the end of the model year, provide to NHTSA information identifying the light truck CAFE system with which the manufacturer chooses to comply. The choice is irrevocable.

Further, the Reformed CAFE system relies on vehicle footprint to determine a manufacturer's required average fuel economy level. Beginning in MY 2008, the agency would need to collect data on vehicle footprint to determine manufacturers' compliance with the Reformed CAFE system and to evaluate the new system.

Description of the Need for the Information and Proposed Use of the Information: NHTSA need this information to ensure that vehicle manufacturers are complying with the light truck CAFE program and to evaluate the Reformed CAFE system.

Description of the Likely Respondents (Including Estimated Number, and Proposed Frequency of Response to the Collection of Information): NHTSA estimates that 14 light truck manufacturers will be impacted by this amendment. The manufacturers are makers of light trucks have gross vehicle weight ratings of 4,536 kg (10,000 pounds) or less. For each pre-model report currently required under 49 CFR 537.7, the manufacturer will provide data on vehicle footprint. Further, during MYs 2008–2010, the manufacturers will provide, in addition to its identity, a statement as to which light truck CAFE standard with which it has chosen to comply, 49 CFR 533.5(f) or 49 CFR 533.5(g).

During the transition period, each manufacturer will provide 1 additional report per year for three years, for a total of 3 additional reports over 3 years.

Estimate of the Total Annual Reporting and Recordkeeping Burden Resulting from the Collection of Information: NHTSA estimates that each manufacturer will incur an additional 10 burden hours per year. This estimate is based on the fact that data collection will involve only computer tabulation. Further, this is consistent with the range of burden hours suggested by the Alliance in its comments. Thus, as a result of this final rule each manufacturer will incur an additional burden of ten hours or a total on industry of an additional 140 hours a year (assuming there are 14 manufacturers).

NHTSA estimates that the recordkeeping burden resulting from the collection of information will be 0 hours because the information will be retained on each manufacturer's existing computer systems for each manufacturer's internal administrative purposes.

NHTSA estimates that the total annual cost burden will be 0 dollars. There would be no capital or start-up costs as a result of this collection. Manufacturers can collect and tabulate the information by using existing equipment. Thus, there would be no additional costs to respondents or recordkeepers.

Comments are invited on:

• Whether the collection of information is necessary for the proper performance of the functions of the Department, including whether the information will have practical utility.

• Whether the Department's estimate for the burden of the information collection is accurate.

• Ways to minimize the burden of the collection of information on respondents, including the use of automated collection techniques or other forms of information technology.

A comment to OMB is most effective if OMB receives it within 30 days of publication.

Send comments to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW., Washington, DC 20503, Attention NHTSA Desk Officer. PRA comments are due within 30 days following the publication of this document in the **Federal Register**.

The agency recognizes that the amendment to the existing collection of information contained in today's final rule may be subject to revision in response to public comments and the OMB review. For additional information contact: Ken Katz, Lead Engineer, Fuel Economy Division, Office of International Policy, Fuel Economy, and Consumer Programs, National Highway Traffic Safety Administration, 400 Seventh St., SW., Washington, DC 20590. Mr. Katz can also be contacted at: telephone number (202) 366–0846, facsimile (202) 493–2290, electronic mail *kkatz@nhtsa.dot.gov.*

H. Regulation Identifier Number (RIN)

The Department of Transportation assigns a regulation identifier number (RIN) to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. You may use the RIN contained in the heading at the beginning of this document to find this action in the Unified Agenda.

I. Executive Order 13045

Executive Order 13045 (62 FR 19885, April 23, 1997) applies to any rule that: (1) Is determined to be economically significant as defined under E.O. 12866, and (2) concerns an environmental, health or safety risk that NHTSA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, we must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by us.

This rule does not have a disproportionate effect on children. The primary effect of this rule is to conserve energy resources by setting fuel economy standards for light trucks.

J. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act (NTTAA) requires NHTSA to evaluate and use existing voluntary consensus standards in its regulatory activities unless doing so would be inconsistent with applicable law (e.g., the statutory provisions regarding NHTSA's vehicle safety authority) or otherwise impractical.

Voluntary consensus standards are technical standards developed or adopted by voluntary consensus standards bodies. Technical standards are defined by the NTTAA as ''performance-based or design-specific technical specification and related management systems practices.'' They pertain to ''products and processes, such as size, strength, or technical performance of a product, process or material.''

In meeting the requirement of the NTTAA, we are required to consult with voluntary, private sector, consensus standards bodies. Examples of organizations generally regarded as voluntary consensus standards bodies include the American Society for Testing and Materials (ASTM), the Society of Automotive Engineers (SAE), and the American National Standards Institute (ANSI). If NHTSA does not use available and potentially applicable voluntary consensus standards, we are required by the Act to provide Congress, through OMB, an explanation of the reasons for not using such standards.

The final rule incorporates a function based on light truck footprint (average track width X wheelbase). For the purpose of this calculation, the agency based these measurements on those by the automotive industry. Determination of wheelbase is consistent with L101-wheelbase, defined in SAE J1100 SEP2005, Motor vehicle dimensions. The agency adopted a definition of track width consistent with SAE J1100 W101 SEP2005.

There are no voluntary consensus standards on fuel economy performance.

K. Executive Order 13211

Executive Order 13211 (66 FR 28355, May 18, 2001) applies to any rule that: (1) Is determined to be economically significant as defined under E.O. 12866, and is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action. If the regulatory action meets either criterion, we must evaluate the adverse energy effects of the planned rule and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by us.

The final rule establishes light truck fuel economy standards that will reduce the consumption of petroleum and will not have any adverse energy effects. Accordingly, this rulemaking action is not designated as a significant energy action.

L. Department of Energy Review

In accordance with 49 U.S.C. 32902(j), we submitted this rule to the Department of Energy for review. That Department did not make any comments that we have not addressed.

M. Privacy Act

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov.*

Regulatory Text

List of Subjects in 49 CFR Parts 523, 533, and 537

Fuel economy and Reporting and recordkeeping requirements.

■ In consideration of the foregoing, 49 CFR Chapter V is amended as follows:

PART 523—VEHICLE CLASSIFICATION

■ 1. The authority citation for part 523 continues to read as follows:

Authority: 49 U.S.C. 32902; delegation of authority at 49 CFR 1.50.

■ 2. Section 523.2 is amended by adding a definition of ''footprint'' and ''medium duty passenger vehicle'' to read as follows:

§ 523.2 Definitions.

* * * * *

Footprint means the product, in square feet rounded to the nearest tenth, of multiplying a vehicle's average track width (rounded to the nearest tenth) by its wheelbase (rounded to the nearest tenth). For purposes of this definition, track width is the lateral distance between the centerlines of the tires at ground when the tires are mounted on rims with zero offset. For purposes of this definition, wheelbase is the longitudinal distance between front and rear wheel centerlines. In case of multiple rear axles, wheelbase is measured to the midpoint of the centerlines of the wheels on the rearmost axle.

* * * * *

Medium duty passenger vehicle means a vehicle which would satisfy the criteria in § 523.5 (relating to light trucks) but for its gross vehicle weight rating or its curb weight, which is rated at more than 8,500 lbs GVWR or has a vehicle curb weight of more than 6,000 pounds or has a basic vehicle frontal area in excess of 45 square feet, and which is designed primarily to transport passengers, but does not include a vehicle that:

(1) Is an ''incomplete truck'' as defined in this subpart; or

(2) Has a seating capacity of more than 12 persons; or

(3)Is designed for more than 9 persons in seating rearward of the driver's seat; or

(4) Is equipped with an open cargo area (for example, a pick-up truck box or bed) of 72.0 inches in interior length or more. A covered box not readily accessible from the passenger compartment will be considered an open cargo area for purposes of this definition.

* * * * *

■ 3. Section 523.3(b) is amended by adding (b)(3) to read as follows:

§ 523.3 Automobile.

* * * * *

(b) * * *

(3) Vehicles that are defined as medium duty passenger vehicles, and which are manufactured during the 2011 model year or thereafter.

■ 4. Section 523.5(a)(5) is revised to read as follows:

§ 523.5 Light Truck.

(a) * * *

(5) Permit expanded use of the automobile for cargo-carrying purposes or other nonpassenger-carrying purposes through:

(i) For light trucks manufactured prior to model year 2012, the removal of seats by means installed for that purpose by the automobile's manufacturer or with simple tools, such as screwdrivers and wrenches, so as to create a flat, floor level, surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior; or

(ii) For light trucks manufactured in model year 2008 and beyond, for vehicles equipped with at least 3 rows of designated seating positions as standard equipment, permit expanded use of the automobile for cargo-carrying purposes or other nonpassenger-carrying purposes through the removal or stowing of foldable or pivoting seats so as to create a flat-leveled cargo surface extending from the forwardmost point of installation of those seats to the rear of the automobile's interior.''.

* * * * *

PART 533—LIGHT TRUCK FUEL ECONOMY STANDARDS

■ 5. The authority citation for part 533 continues to read as follows:

Authority: 49 U.S.C. 32902; delegation of authority at 49 CFR 1.50.

■ 6. Part 533.5 is amended by:

■ A. In paragraph (a) by revising Table IV and adding Figure I and Table V; and

■ B. Adding paragraphs (g) and (h).

The revisions and additions read as follows:

§ 533.5 Requirements.

(a) * * *

TABLE IV

Model year	Standard
2001	20.7
2002	20.7
2003	20.7
2004	20.7
2005	21.0
2006	21.6
2007	22.2
2008	22.5
2009	23.1
2010	23.5

$$Required\_Fuel\_Economy\_Level = \frac{N}{\sum_i \frac{N_i}{T_i}}$$

Where:

N is the total number (sum) of light trucks produced by a manufacturer,

N_i is the number (sum) of the i^{th} model light truck produced by the manufacturer, and

T_i is fuel economy target of the i^{th} model light truck, which is determined according to the following formula, rounded to the nearest hundredth:

$$T = \frac{1}{\frac{1}{a} + \left(\frac{1}{b} - \frac{1}{a}\right)\frac{e^{(x-c)/d}}{1+e^{(x-c)/d}}}$$

Where:

Parameters a, b, c, and d are defined in § 533.3 Table V;

e = 2.718; and

x = footprint (in square feet, rounded to the nearest tenth) of the vehicle model

TABLE V.—PARAMETERS FOR THE REFORMED CAFE FUEL ECONOMY TARGETS

Model year	Parameters			
	a	b	c	d
2008	28.56	19.99	49.30	5.58
2009	30.07	20.87	48.00	5.81
2010	29.96	21.20	48.49	5.50
2011	30.42	21.79	47.74	4.65

* * * * *

(g) For model years 2008–2010, at a manufacturer's option, a manufacturer's light truck fleet may comply with the fuel economy level calculated according to Figure I and the appropriate values in Table V, with said option being irrevocably chosen for that model year and reported as specified in § 537.8.

(h) For model year 2011, a manufacturer's light truck fleet shall comply with the fuel economy level, calculated according to Figure I and the appropriate values in Table V.

■ 7. Part 533 is amended by adding Appendix A to read as follows:

Appendix A—Example of Calculating Compliance Under § 533.5 Paragraph (g)

Assume a hypothetical manufacturer (Manufacturer X) produces a fleet of light trucks in MY 2008 as follows:

Model	Fuel economy	Volume	Footprint (ft²)
A	27.0	1,000	42
B	25.6	1,500	44
C	25.4	1,000	46
D	22.1	2,000	50
E	22.4	3,000	55
F	20.2	1,000	66

Note to Appendix A Table 1. Manufacturer X's required corporate average fuel economy level under § 533.5(g) would be calculated by first determining the fuel economy targets applicable to each vehicle as illustrated in Appendix A Figure 1.

Appendix A Figure 1

Model	Footprint (ft²)	MY 2008 fuel economy target (mpg)
A	42	26.2
B	44	25.5
C	46	24.8
D	50	23.3
E	55	21.7
F	66	20.3

Note to Appendix A Figure 1. Accordingly, vehicle models A, B, C, D, E, and F would be compared to fuel economy values of 26.2, 25.5, 24.8, 23.3, 21.7, and 20.3 mpg, respectively. With the appropriate fuel economy targets calculated, Manufacturer X's required fuel economy would be calculated as illustrated in Appendix A Figure 2.

Appendix A Figure 2

Manufacturer's Light Truck Production for Applicable Model Year

$$\frac{\text{Model A Volume}}{\text{Model A Target}} + \frac{\text{Model B Volume}}{\text{Model B Target}} + \frac{\text{Model C Volume}}{\text{Model C Target}} + \frac{\text{Model D Volume}}{\text{Model D Target}} + \frac{\text{Model E Volume}}{\text{Model E Target}} + \frac{\text{Model F Volume}}{\text{Model F Target}}$$

$$= \frac{1{,}000}{26.2} + \frac{1{,}500}{25.5} + \frac{1{,}000}{24.8} + \frac{2{,}000}{23.3} + \frac{3{,}000}{21.7} + \frac{1{,}000}{20.3}$$

$$= 23.1 \text{ mpg}$$

Note to Appendix A Figure 2. Manufacturer X's required fuel economy level is 23.1 mpg. Its actual fuel economy level would be calculated as illustrated in Appendix A Figure 3.

Appendix A Figure 3

Manufacturer's Light Truck Production for Applicable Model Year

$$\frac{\text{Model A Volume}}{\text{Model A Fuel Econ.}}+\frac{\text{Model B Volume}}{\text{Model B Fuel Econ.}}+\frac{\text{Model C Volume}}{\text{Model C Fuel Econ.}}+\frac{\text{Model D Volume}}{\text{Model D Fuel Econ.}}+\frac{\text{Model E Volume}}{\text{Model E Fuel Econ.}}+\frac{\text{Model F Volume}}{\text{Model F Fuel Econ.}}$$

$$= \frac{9{,}500}{\frac{1{,}000}{27.0}+\frac{1{,}500}{25.6}+\frac{1{,}000}{25.4}+\frac{2{,}000}{22.1}+\frac{3{,}000}{22.4}+\frac{1{,}000}{20.2}}$$

$$= 23.2 \text{ mpg}$$

Note to Appendix A Figure 3. Since the actual average fuel economy of Manufacturer X's fleet is 23.2 mpg, as compared to its required fuel economy level of 23.1 mpg, Manufacturer X complies with the Reformed CAFE standard for MY 2008 as set forth in § 533.7(g).

PART 537—AUTOMOTIVE FUEL ECONOMY REPORTS

■ 8. The authority citation for part 537 reads as follows:

Authority: 49 U.S.C. 32907; 49 CFR 1.50.

■ 9. Section 537.7 is amended by revising paragraphs (c)(4)(xvi) through (xxi) to read as follows:

§ 537.7 Pre-model year and mid-model year reports.

* * * * *

(c) *Model type and configuration fuel economy and technical information* * * *

(4) * * *

(xvi)(A) In the case of passenger automobiles:

(*1*) Interior volume index, determined in accordance with subpart D of 40 CFR part 600, and

(*2*) Body style;

(B) In the case of light trucks:

(*1*) Passenger-carrying volume,

(*2*) Cargo-carrying volume;

(*3*) Beginning model year 2008, track width as defined in 49 CFR 523.2,

(*4*) Beginning model year 2008, wheelbase as defined in 49 CFR 523.2, and

(*5*) Beginning model year 2008, footprint as defined in 49 CFR 523.2

(xvii) Performance of the function described in § 523.5(a)(5) of this chapter (indicate yes or no);

(xviii) Existence of temporary living quarters (indicate yes or no);

(xix) Frontal area;

(xx) Road load power at 50 miles per hour, if determined by the manufacturer for purposes other than compliance with this part to differ from the road load setting prescribed in 40 CFR 86.177–11(d);

(xxi) Optional equipment that the manufacturer is required under 40 CFR parts 86 and 600 to have actually installed on the vehicle configuration, or the weight of which must be included in the curb weight computation for the vehicle configuration, for fuel economy testing purposes.

* * * * *

■ 10. Section 537.8 is amended by adding paragraph (e) to read as follows:

§ 537.8 Supplementary reports.

* * * * *

(e) *Reporting compliance option in model years 2008–2010.* For model years 2008, 2009, and 2010, each manufacturer of light trucks, as that term is defined in 49 CFR 523.5, shall submit a report, not later than 45 days following the end of the model year, indicating whether the manufacturer is opting to comply with 49 CFR 533.5(f) or 49 CFR 533.5(g).

Note: The following Appendices will not appear in the Code of Federal Regulations

Appendix A—Comparison of Engineering Constraints Employed by the NPRM and the Final Rule Analyses

Technology	Engineering constraint		Reason for change
	NPRM	Final	
Low-Friction Lubricants	Do not apply if engine oil is 5W30 or better.	Do not apply if engine oil is better than 5W30.	Availability of lower friction (*e.g.*, 0W) oils.
Variable Valve Timing (VVT)	Do not apply to engines with displacement greater than 4.7 *l.*	Do not apply to OHV engines	OHV engines more likely to use cylinder deactivation.
Variable Valve Lift and Timing (VVLT).	Do not apply to engines with displacement greater than 3.0 *l.*	Do not apply to engines that do not already have VVT.	Next logical step from VVT.

Technology	Engineering constraint		Reason for change
	NPRM	Final	
Cylinder Deactivation	Do not apply to engines with VVT, VVLT, and/or fewer than 6 cylinders.	As a general rule, do not apply to engines with VVT, VVLT, multivalve OHC, and/or fewer than 6 cylinders.	Multivalve OHC engines more likely to use VVT or VVLT.
Continuously Variable Transmission.	Do not apply to frame vehicles or 4WD SUVs.	Apply only to FWD unibody vehicles.	Less likely to mistakenly apply CVT to some RWD SUVs.
Front Axle Disconnect	Apply only to 4WD vehicles	Apply only to 4WD vehicles with cylinder count greater than six.	Expected to be more applicable to large vehicles.
Electric Power Steering	No universal constraints	For vehicles with curb weights over 4,000 pounds, do not apply unless 42-Volt systems are already present.	Higher power demands for large vehicle steering.
Integrated Starter-Generator	No universal constraints	Start application with the largest vehicles, which have lower fuel economy, prior to applying to smaller, more fuel efficient vehicles.	Mild hybridization expected to be more suitable for large vehicles due to packaging issues and fuel savings potential.
Weight Reduction	Do not apply to vehicles with curb weights below 3,900 pounds.	Do not apply to vehicles with curb weights below 5,000 pounds.	Correction to placement of safety threshold.

Appendix B—Changes to Technology "Phase-In Constraints" Employed by the Volpe Model

Technology	NPRM (percent)	Final (percent)
Low Friction Lubricants	50	25
Improved Rolling Resistance	50	25
Low Drag Brakes	50	17
Engine Friction Reduction	33	17
Front Axle Disconnect (for 4WD)	5	17
Cylinder Deactivation	25	17
Multi-Valve, Overhead Camshaft	33	17
Variable Valve Timing	33	17
Electric Power Steering	33	17
Engine Accessory Improvement	33	25
5-Speed Automatic Transmission	33	17
6-Speed Automatic Transmission	25	17
Automatic Transmission w/Aggressive Shift Logic	33	17
Continuously Variable Transmission (CVT)	33	17
Automatic Shift Manual Transmission (AST/AMT)	10	17
Aero Drag Reduction	33	17
Variable Valve Lift & Timing	25	17
Spark Ignited Direct Injection (SIDI)	3	3
Engine Supercharging & Downsizing	25	17
42 Volt Electrical Systems	33	17
Integrated Starter/Generator	33	5
Intake Valve Throttling	25	17
Camless Valve Actuation	25	10
Variable Compression Ratio	25	10
Advanced CVT	25	17
Dieselization	3	3
Material Substitution	20	17
Midrange Hybrid Vehicle	3	3

Issued: March 28, 2006.

Jacqueline Glassman,

Deputy Administrator.

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