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Automobile and Truck Fuel Economy (CAFE) and Greenhouse Gas Standards

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Summary

In recent years, as oil and gasoline prices have risen and concerns over greenhouse gas emissions and climate change have grown, there has been a resurgence of interest in the fuel economy and emissions of motor vehicles in the United States. Federal fuel economy and greenhouse gas standards have become a focal point for addressing these concerns. The debate over rising fuel efficiency and greenhouse gas standards for passenger vehicles and heavy trucks has been controversial. Proponents of higher fuel economy argue that new standards will create incentives for the development of new technologies that will help reduce oil consumption and limit greenhouse gas emissions. Critics argue that these standards will impose regulatory costs which will distort the market for new vehicles, and that other policy mechanisms would be more effective at reducing petroleum consumption and emissions (e.g., higher fuel taxes).

On August 28, 2012, the Obama Administration issued new passenger vehicle fuel economy and greenhouse gas standards for vehicle model years (MY) 2017-2025. The National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) expect that combined new passenger car and light truck Corporate Average Fuel Economy (CAFE) standards will rise to as much as 41.0 miles per gallon (mpg) in MY2021 and 49.7 mpg in MY2025, up from 34.1 mpg in MY2016. To the extent possible, new CAFE standards will be integrated with federal and state greenhouse gas (GHG) standards for automobiles, because fuel economy improvements are a key strategy for reducing vehicle emissions. If all of the GHG reductions were made through fuel economy improvements, the equivalent miles-per-gallon requirement would be 54.5 mpg in MY2025. However, other strategies will also be used (for example, improved vehicle air conditioners) to reduce GHG emissions to the actual GHG standard of 163 grams of carbon dioxide per mile.

The Administration expects that consumers' fuel savings from the new standards will more than offset the additional cost of the new technology for these vehicles, which could be thousands of dollars per vehicle. EPA and NHTSA expect that the new standards will save roughly 4 billion barrels of oil and 2 billion metric tons of greenhouse gases over the life of the vehicles covered under the proposal. Critics dispute some of the Administration's assumptions. They counter that the costs will be higher and could lead to a drop in new vehicle sales, as the higher vehicle costs may put new car financing out of reach for many consumers.

In a similar process to an earlier Obama Administration agreement that led to new fuel economy and greenhouse gas standards for MY2012-MY2016, the Administration has secured commitment letters from the state of California and from 13 automakers to support the MY2017-2025 rulemaking as well. There has been concern about a potential "patchwork" of different federal and state standards if EPA, NHTSA, and California were to establish different standards on fuel economy and GHG emissions. Two key parts of the agreement are that California will treat any vehicle meeting the new federal GHG standards as meeting California standards, and that the automakers agree to not challenge the new standards in court.

In August 2011, the Administration also tightened fuel economy and GHG emissions standards for MY2014-MY2018 medium- and heavy-duty trucks.

Contents

Introduction 1
Passenger Vehicle Standards for MY2017-MY2025 2
Different Statutes Govern Fuel Efficiency 3
Federal Authorities 3
State Regulations 4
Structure and Design of the CAFE/GHG System 5
Size-Based Standards 5
Benefits and Costs of the Rules 6
Compliance and Vehicle Cost Factors 7
Medium- and Heavy-Duty Truck Standards for MY2014-MY2018 9

Figures

Figure 1. Final Passenger Car CAFE Targets for MY2011 Through MY2016 6
Figure 2. EPA's Estimate of Cost to Automakers in MY2025 from Final Rule 8
Figure 3. EPA's Estimate of Per-Vehicle Cost Increase in MY2025 from the Final Rule 9

Tables

Table 1. MY2016-MY2025 Combined Passenger Car and Light Truck GHG and CAFE Standards 2

Contacts

Author Information 11

Introduction

Interest in the fuel efficiency of automobiles and trucks has waxed and waned over more than three decades as oil and gasoline prices have risen and fallen. However, in recent years, as oil prices have spiked to historic levels, and concerns over greenhouse gas emissions and climate change have grown, there has been a resurgence in interest in the fuel economy and emissions of motor vehicles in the United States. Proponents of higher vehicle fuel efficiency standards argue that they create incentives for the development of new technologies that will help reduce dependence on imported oil and better enable the United States to use scarce resources and limit greenhouse gas emissions—technologies that would not be developed in the absence of that "technology push." Critics argue that efficiency standards distort the market for new vehicles, compromising consumer choice, and that other policy mechanisms (e.g., higher fuel taxes) would be more effective at reducing petroleum consumption and emissions.

The most recent federal legislation on fuel efficiency was the Energy Independence and Security Act of 2007 (EISA),[1] which requires the National Highway Traffic Safety Administration (NHTSA) to increase combined passenger car and light truck fuel economy standards to at least 35 miles per gallon (mpg) by 2020,[2] up from roughly 26.6 mpg in 2007.[3] Along with requiring higher passenger vehicle standards, EISA dramatically changed the structure of the passenger vehicle fuel economy program. It also directed DOT to study improvements in heavy-duty vehicles and, if feasible, issue standards for those vehicles as well.[4] In the same year, the Supreme Court found that the Environmental Protection Agency (EPA) has the authority to regulate vehicle greenhouse gas (GHG) emissions under the Clean Air Act.[5] These two actions at the federal level have significantly changed how motor vehicles are regulated at the federal level.

Fuel consumption and greenhouse gas (GHG) emissions from motor vehicles are closely linked. The vast majority of vehicle GHG emissions result from the burning of petroleum products, so reducing vehicle fuel consumption is the most direct means of reducing emissions. For these reasons, the Obama Administration has issued joint rules on vehicle fuel economy and GHG emissions for model year (MY) 2012-2016 passenger cars and light trucks,[6] MY2014-MY2018 medium- and heavy-duty trucks,[7] and MY2017-MY2025 passenger cars and light trucks.[8] The

[1] P.L. 110-140

[2] Thirty-five miles per gallon is a lower bound: the Administration is required to set standards at the "maximum feasible" fuel economy level for any model year.

[3] Previously, passenger car Corporate Average Fuel Economy (CAFE) standards had been established in 1975 by the Energy Policy and Conservation Act (EPCA, P.L. 94-163), and had not increased beyond that level after 1985. Before the enactment of EISA, DOT had very little authority to modify the passenger car standards. Light truck standards had been flat at 20.7 mpg through the mid-2000s until the Bush Administration used broader authority within EPCA to raise the light trucks standards.

[4] For more analysis, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*, by Fred Sissine.

[5] For more analysis, see CRS Report RS22665, *The Supreme Court's Climate Change Decision: Massachusetts v. EPA*, by Robert Meltz.

[6] Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA), "Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule," 75 *Federal Register* 25324-25728, May 7, 2010.

[7] EPA and NHTSA, "Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Final Rule," 76 *Federal Register* 57106-57513, September 15, 2011.

[8] The CAFE standards only apply through MY2021 because of stipulations in the fuel economy law. NHTSA will need to issue additional regulations for MY2022 onward, while EPA has the authority to set GHG standards for MY2025

Administration intends the passenger vehicle standards to be harmonized with standards issued by the state of California under the Clean Air Act.

Passenger Vehicle Standards for MY2017-MY2025

On August 28, 2012, the Obama Administration issued final rules to tighten passenger vehicle fuel economy and greenhouse gas (GHG) standards for MY2017-2025.[9] (See **Table 1**.) In a similar process to the landmark agreement that led to new fuel economy and greenhouse gas standards for MY2012-MY2016, the Administration has secured commitment letters from the state of California and from 13 automakers.[10] Many stakeholders were concerned about a potential "patchwork" of different federal and state standards if EPA, NHTSA, and California were to establish different standards at the intersection of fuel economy and GHG emissions. (See discussion below on "Different Statutes Govern Fuel Efficiency.") Two key parts of the agreement are that California will treat any vehicle meeting the new federal GHG standards as meeting California standards,[11] and that the automakers agree to not challenge the new standards in court.

The Administration expects that consumers' fuel savings from the new standards will more than offset the additional cost of the new technology for these vehicles, which could be thousands of dollars per vehicle. EPA and NHTSA expect that the new standards will save roughly 4 billion barrels of oil and 2 billion metric tons of greenhouse gases over the life of the vehicles covered under the new standards. Critics have challenged the Administration's assumptions, countering that the costs will be higher and could lead to a drop in new vehicle sales.

Table 1. MY2016-MY2025 Combined Passenger Car and Light Truck GHG and CAFE Standards

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
GHG Standard (grams/mile)[a]	250	243	232	222	213	199	190	180	171	163
GHG-Equivalent Fuel Economy (miles per gallon equivalent)[a]	35.5	36.6	38.3	40.0	41.7	44.7	46.8	49.4	52.0	54.5
Fuel Economy (CAFE) Standard (miles per gallon)[a]	34.1	35.4	36.5	37.7	38.9	41.0	43.0[b]	45.1[b]	47.4[b]	49.7[b]

Source: EPA and NHTSA, *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*, Prepublication Version, August 28, 2012.

a. Because of the complexity of the CAFE/GHG system, these numbers are based on projected sales of vehicles in different size classes. The standards are size-based, and the vehicle fleet encompasses large,

and beyond. EPA and NHTSA, *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*, Prepublication Version, August 28, 2012, http://www.epa.gov/oms/climate/documents/2017-2025-ghg-cafe-standards-frm.pdf.

[9] Ibid.

[10] Environmental Protection Agency, *EPA and NHTSA, in Coordination with California, Announce Plans to Propose Greenhouse Gas and Fuel Economy Standards for Passenger Cars and Light Trucks*, EPA-420-F-11-027, Washington, DC, July 2011, http://www.epa.gov/otaq/climate/420f11027.pdf.

[11] Technically, California's standards are more stringent than the federal standards. However, applying the federal standards to the California fleet would lead to fleet average levels in California in line with the state standards.

medium, and small cars and light trucks. Thus if the sales mix is different from projections the achieved CAFE and GHG levels would be different. For example, the CAFE numbers are based on NHTSA's projection using the MY2008 fleet as the baseline. A newer projection, based on the MY2010 fleet, leads to somewhat lower numbers (roughly 0.3—0.6 mpg lower for MY2017-2020 and roughly 0.7-1.0 mpg lower for MY2021 onward).

b. Projected. NHTSA only has authority to set CAFE standards in five-year increments. Thus, only rules through MY2021 have been finalized. For MY2022 onward NHTSA must issue a new rule, which has not been proposed as of September 2012.

Different Statutes Govern Fuel Efficiency

Federal Authorities

Federal authorities to regulate vehicle fuel economy and GHGs arise from very different statutes. The Energy Policy and Conservation Act of 1975 (EPCA)[12] requires NHTSA to set Corporate Average Fuel Economy (CAFE) standards for passenger cars and light trucks. Amendments in EISA direct NHTSA to tighten passenger vehicle CAFE standards and set efficiency standards for medium- and heavy-duty trucks as well. EPCA does not provide statutory authority to regulate GHG.

Vehicle GHG standards are administered by EPA through its authority under the Clean Air Act and subsequent amendments[13]—authority affirmed by the previously mentioned Supreme Court decision. These two statutes differ in several ways, including:

- the authority they grant the agencies;
- the lead-time required to implement regulations;
- the time span of those regulations;
- standards for vehicle testing;
- requirements for cost-benefit analysis; and
- provisions for fines or penalties.

Thus, although the agencies have acted to integrate the standards, there are key differences between the standards. Most notably, the "miles-per-gallon" targets under the rules that have received the most attention in the new (MY2017 and later) rule are not, in fact, the CAFE standards. The oft-cited "standard" of 54.5 mpg in MY2025 for the rule is a proxy for the actual GHG standard of 163 grams per mile (g/mi) of carbon dioxide (CO_2) equivalent. As the vast majority of vehicle GHG emissions come from fuel combustion, the primary means for achieving the standards will be through fuel economy increases. The 54.5 mpg "standard" assumes that all of the reductions in GHG emissions come from fuel savings. In actuality, some of the most cost-effective emissions reductions come through other means not reflected in the CAFE test, such as improvements in vehicle air conditioning systems.[14] If finalized, the expected CAFE standard for MY2025 is lower, 49.7 mpg, although that number is still significantly higher than current standards or what is required for MY2016.[15]

[12] P.L. 94-163

[13] 42 U.S.C. 7521 *et seq.*

[14] Although CO_2 is the primary GHG, other gases, such as methane (CH_4) and fluorinated gases (e.g., air conditioner refrigerants), also act as greenhouse gases.

[15] Similarly under the MY2012-MY2016 rule, the oft-cited "standard" of 35.5 mpg is a translation of the GHG standard

Another key difference between EPA and NHTSA's authority is that NHTSA is limited by statute and may only issue rules covering five model years or fewer. Thus, while the final GHG rule extends through MY2025, the CAFE rule only extends through MY2021. For MY2022 and later, NHTSA has published "conditional standards," but will need to complete a separate rulemaking for those years, a process that had not been started as of September 2012. Because of this difference, and because of the long time frame for the GHG rule, the agencies plan a "comprehensive mid-term evaluation" to assess the progress of the program, revisit cost-benefit analyses, and propose new CAFE standards. The inclusion of the mid-term evaluation was a key demand made by the automakers in the commitment letters they signed in support of the proposal.[16] As noted in the BMW Group's letter:

> BMW Group believes that the robust and comprehensive mid-term evaluation described by EPA and NHTSA in the July 2011 Supplemental Notice of Intent is critical, given BMW Group's view of the uncertainty associated with the model years 2022-2025 standards. Although BMW Group may not have full knowledge about the evolution and cost of technologies necessary to meet these standards, particularly in 2022-2025, the mid-term evaluation provides a basis for BMW Group's support for adoption of standards for model years that far into the future.[17]

Nearly identical language is contained in the other automakers' letters, including letters from the Detroit 3.

State Regulations

EPCA explicitly preempts states from setting their own fuel economy standards. Under the Clean Air Act, states are also generally preempted from setting their own vehicle emissions standards with one key exception: California may establish its own vehicle emissions standards if EPA determines that the standards are necessary and if they are at least as stringent as any federal standards. For California to set new emissions standards, the state must first secure a waiver by EPA from the Clean Air Act preemption (§209). Once a waiver is granted to California, other states may adopt the California standards.[18] This exception from state preemption was originally enacted because California had particularly troublesome pollution problems and had state vehicle emissions standards before there were federal standards.

Two key provisions of the agreement between the Administration, the automakers, and California are that EPA will grant California the waiver for MY2017-MY2025,[19] and that California will

(250 g/mi). The actual CAFE standard for MY2016 is approximately 34.1 mpg. This is supported by the agencies' Joint Notice in May of 2009: "If the automotive industry were to achieve this CO_2 level all through fuel economy improvements, this would equate to achieving a fleet average level of 35.5 mpg. However, it is expected that most companies would also apply some air conditioning improvements to reduce GHG emissions. This would not translate into fuel economy improvements, so on average we expect the fuel economy improvements to be somewhat below the 35.5 mpg value."

[16] The 13 automakers to sign commitment letters were BMW, Chrysler, Ford, General Motors, Honda, Hyundai, Jaguar and Land Rover, Kia, Mazda, Mitsubishi, Nissan, Toyota, and Volvo. Commitment letters were also signed by the California Air Resources Board and the Association of Global Automakers, which represents several foreign auto manufacturers. See http://www.epa.gov/otaq/climate/regulations.htm.

[17] Letter from Norbert Reithofer, Chairman of the Board of Management, BMW Group, to The Honorable Ray Lahood, Secretary of Transportation and The Honorable Lisa Jackson, Environmental Protection Agency Administrator, July 27, 2011, http://www.epa.gov/otaq/climate/letters/bmw-commitment-ltr.pdf.

[18] In the past, about a dozen other states have adopted the California standards.

[19] EPA had previously granted California a waiver for MY2012-MY2016.

accept vehicles complying with the federal greenhouse standards as meeting the California standards.[20]

Structure and Design of the CAFE/GHG System

Size-Based Standards

In addition to requiring NHTSA to increase CAFE standards to at least 35 mpg by 2020, EISA also made major changes to NHTSA's authority to establish the structure and rules for the CAFE program. Before EISA, passenger car standards were based on a "straight-line" average of 27.5 mpg. In general, for each model year, every automaker needed to achieve a sales-weighted average of 27.5 mpg for all of its cars, regardless of vehicle attributes, or face penalties.[21] Because smaller and lighter vehicles typically consume less fuel, the CAFE program thus provided an incentive for automakers to downsize their vehicles. Larger vehicles tend to offer greater passenger protection in accidents, however. Larger vehicles also tend to be heavier, so a fuel economy program structure that does not factor vehicle size into the setting of CAFE standards could promote the use of smaller, less safe vehicles. A corollary and further criticism of the program was that it favored producers of smaller vehicles that would tend to have higher fuel economy, generally non-U.S. manufacturers.

Whereas the inflexible *passenger car* CAFE system was set in statute, that same statute provided NHTSA with much broader authority to set CAFE standards for other vehicle classes, such as light trucks. Under an MY2011 rule for light trucks finalized by the Bush Administration, for the first time, fuel economy targets varied with vehicle size, with smaller vehicles expected to achieve higher fuel economy than larger vehicles. Under the new system, each vehicle is assigned a fuel economy "target" based on its footprint, which is the product of a vehicle's track width (the horizontal distance between the tires) and its wheelbase (the distance from the front to the rear axles). The sales-weighted average of the targets for a manufacturer's fleet is the CAFE average that the manufacturer must achieve in a given model year. In this way, no *specific* vehicle is required to meet a *specific* fuel economy, and the average fuel economy required will vary from manufacturer to manufacturer.

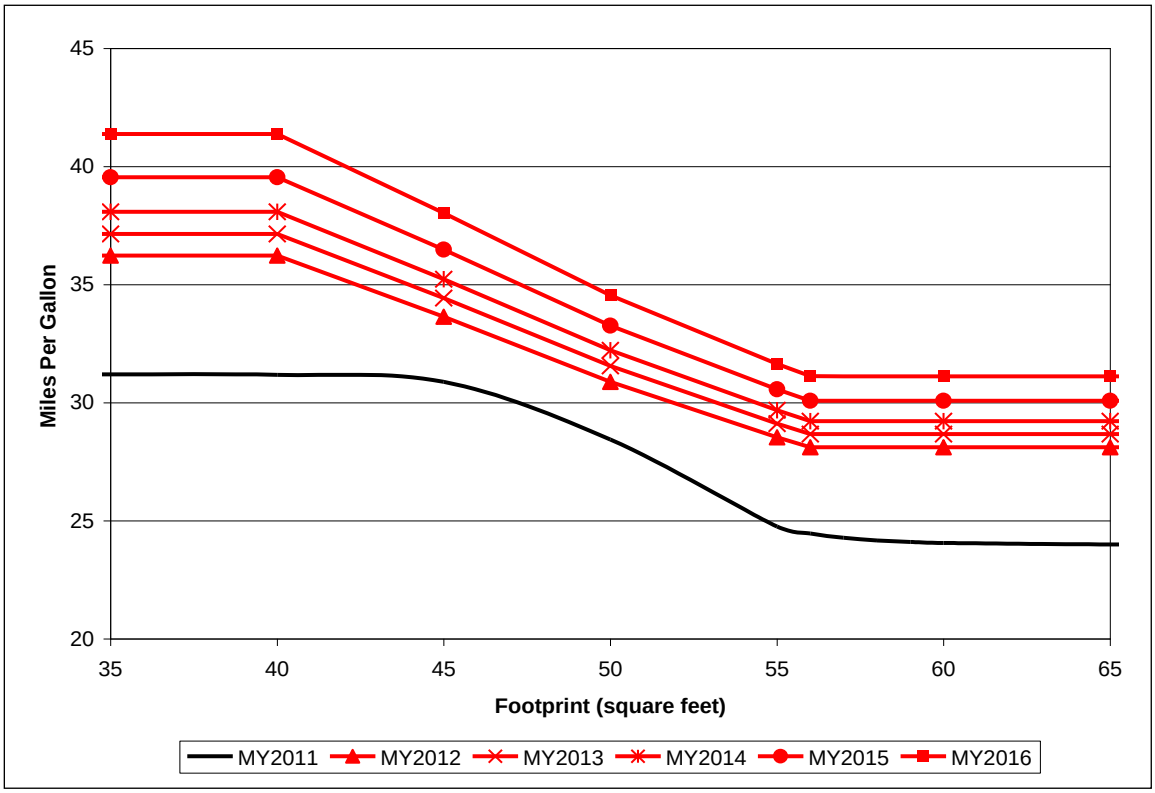
In amending the CAFE program through EISA, Congress required NHTSA to set new standards "based on 1 or more vehicle attributes related to fuel economy … in the form of a mathematical function."[22] For each model year, NHTSA establishes these functions separately for cars and light trucks based on size (**Figure 1**). In harmonizing the CAFE and GHG standards, EPA adopted NHTSA's size-based curves. For each model year EPA has also established similar compliance functions. The size-based standards make for a much more complicated regulatory system than the previous one, but arguably provide less incentive to comply with the regulations by simply making vehicles smaller.

[20] For a more detailed discussion of the California standards, and the waiver petition, see CRS Report R40506, *Cars, Trucks, and Climate: EPA Regulation of Greenhouse Gases from Mobile Sources*, by James E. McCarthy and Brent D. Yacobucci, and CRS Report R41103, *Federal Agency Actions Following the Supreme Court's Climate Change Decision in Massachusetts v. EPA: A Chronology*, by Robert Meltz.

[21] "In general," because some flexibilities apply to the system, including the ability for automakers to bank excess credits from prior years, borrow expected credits from future years, and generate credits from the sale of alternative fuel vehicles.

[22] 49 U.S.C. 32902(b)(3)(A)

Figure 1. Final Passenger Car CAFE Targets for MY2011 Through MY2016



Source: CRS analysis of: National Highway Traffic Safety Administration, "Average Fuel Economy Standards Passenger Cars and Light Trucks Model Year 2011; Final Rule," 74 *Federal Register* 14407, March 30, 2009; and Environmental Protection Agency and National Highway Traffic Safety Administration, "Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule," April 1, 2010.

Benefits and Costs of the Rules

EPA estimates that the GHG rules will raise the average price of a new MY2025 vehicle by roughly $1,800 compared to MY2016,[23] but that annual fuel savings lead to a payback period of just over three years:

> Fuel savings for consumers are expected to more than offset the higher vehicle costs. The typical driver will save a total of $5,700 to $7,400 (7 percent and 3 percent discount rate, respectively) in fuel costs over the lifetime of a MY 2025 vehicle and, even after accounting for the higher vehicle cost, consumers will save a net $3,400 to $5,000 (7 percent and 3 percent discount rate, respectively) over the vehicle's lifetime. This estimate assumes a gasoline price of $3.87 per gallon in 2025 with small increases most years over the vehicle's lifetime. Further, the payback period for a consumer purchasing a 2025 light-duty vehicle with cash would be, on average, 3.4 years at a 7 percent discount rate or 3.2 years at a 3 percent discount rate, while consumers who buy with a 5-year loan would save more each month on fuel than the increased amount they will spend on the higher monthly loan payment, beginning in the first month of ownership. [EPA footnotes omitted][24]

[23] For the MY2016 rule, EPA and NHTSA estimated a cost increase of roughly $950 above MY2011.

[24] EPA and NHTSA, *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*, Prepublication Version, August 28, 2012, p. 40.

Whether or not the Obama Administration has understated the costs, as some have asserted,[25] EPA and NHTSA argue that the benefits of the program will far outweigh the costs. For example, EPA estimates the total costs of the program to automakers and vehicle buyers at roughly $148 billion to $156 billion, while the benefits are roughly $510 billion to $639 billion over the life of the vehicles covered by the rule, depending on various factors, especially the discount rate.[26] The vast majority (roughly 80%) of these benefits are expected to come through fuel savings, and thus reduced expenditures on fuel.[27]

Compliance and Vehicle Cost Factors

The costs of compliance will be different for each manufacturer, depending on the vehicles they produce. Under the size-based standards, an advantage of one automaker over another is not based on the automaker's overall fuel economy, but on the rated fuel economy relative to the size of the vehicle. For example, an automaker with smaller vehicles may not be compliant with the standards while an automaker with larger vehicles may be, even if the smaller vehicles actually have higher fuel economy. Compliance, and thus costs, are based on how each vehicle performs relative to the CAFE and GHG "curves" shown in **Figure 1**. In its regulatory impact analysis of its MY2017-MY2025 rule, EPA estimated total sales and per-vehicle costs for each automaker in MY2025. Although some results were expected—for example, larger automakers face higher total costs simply due to the volume of vehicles they produce (**Figure 2**), some results were surprising. For example, some automakers are projected to fare well under the car standards relative to other automakers, but poorly under the light truck standards, or vice versa (**Figure 3**).[28]

[25] For example, the Center for Automotive Research has criticized EPA and NHTSA for underestimating the real-world cost of new technology for its MY2017-MY2025 proposal. Center for Automotive Research, *CAR's Reply to the ICCT's "Comments on the Center for Automotive Research (CAR) June 2011 Report 'The U.S. Automotive Market and Industry in 2025,'"* July 18, 2011.

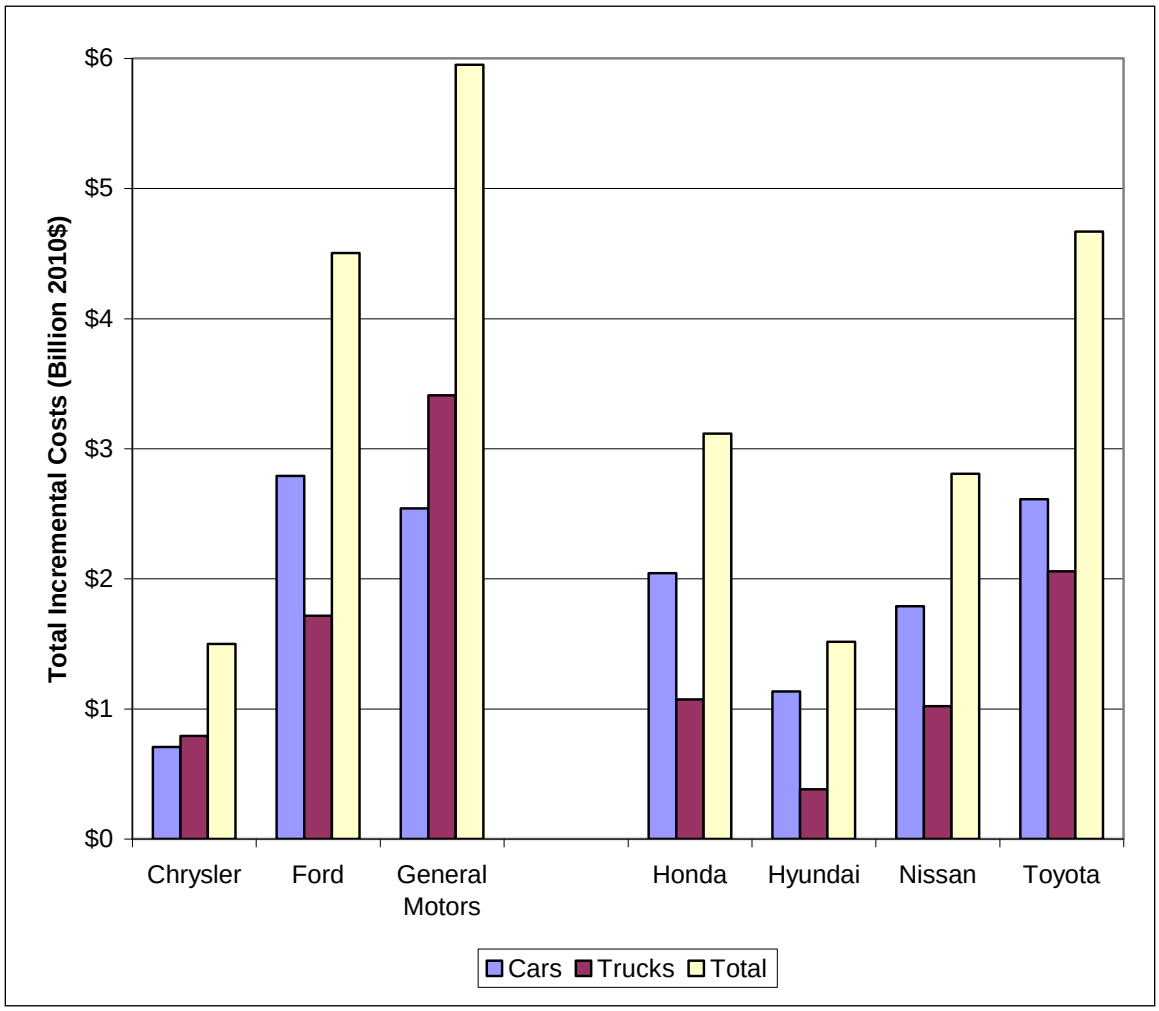
[26] Net benefits (benefits minus costs) are estimated at between $356 billion and $483 billion. EPA and NHTSA, *2017 and Later*…, Prepublication Version, pp. 14-15.

[27] Ibid. p. 83.

[28] For example, Honda has higher costs for passenger cars than GM, but lower costs for light trucks. Similarly, Nissan fares better than Hyundai on cars but worse on trucks.

Figure 2. EPA's Estimate of Cost to Automakers in MY2025 from Final Rule

Relative to MY2016 Standards

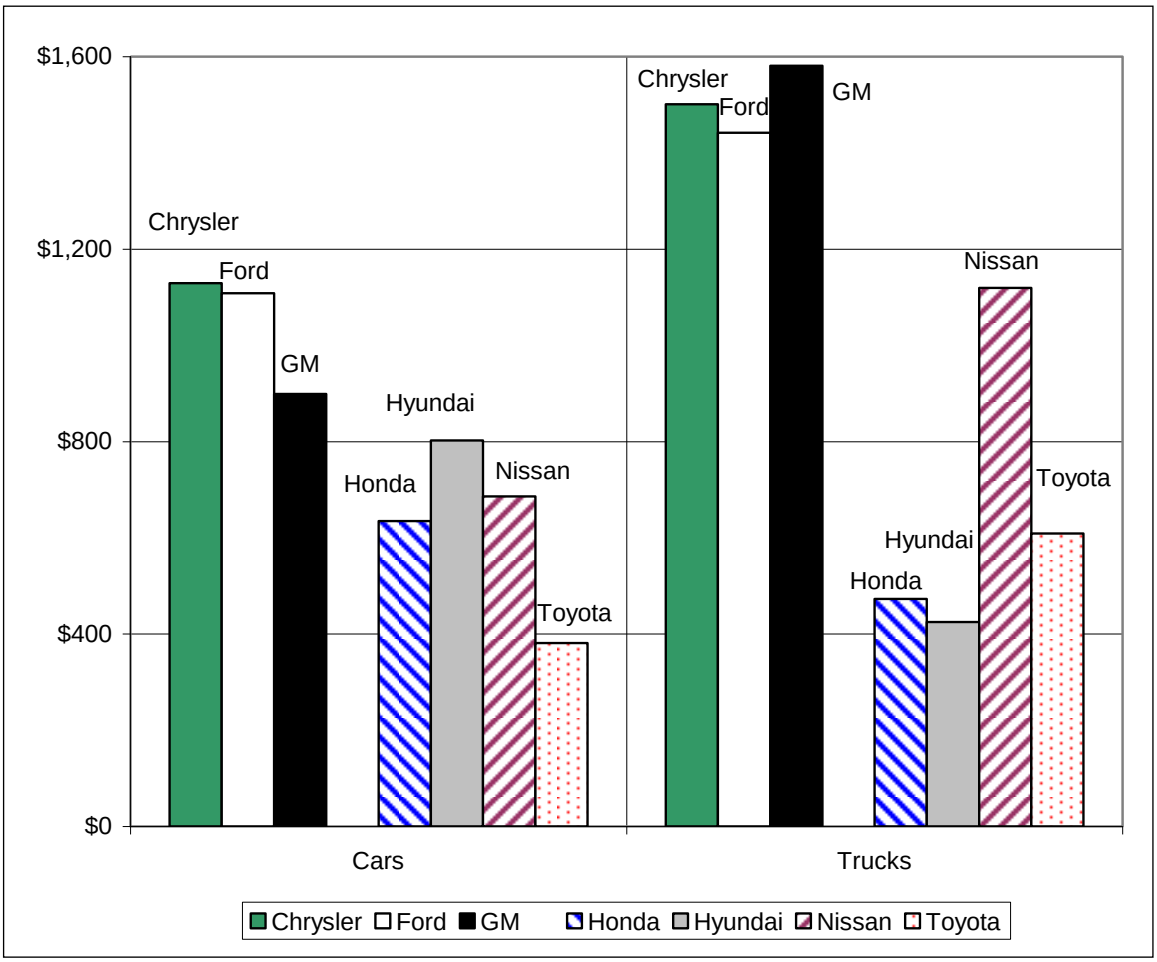


Source: CRS Analysis of EPA, *Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*, August 2012.

Note: These are estimated incremental costs above MY2016 multiplied by projected sales in MY2025. Total costs would be the sum of similar estimates for each model year between MY2021 and MY2025.

Figure 3. EPA's Estimate of Per-Vehicle Cost Increase in MY2025 from the Final Rule

2010 Dollars



Source: EPA, *Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*, August 2012.

Medium- and Heavy-Duty Truck Standards for MY2014-MY2018

In addition to requiring an increase in light-duty vehicle CAFE standards, EISA[29] also required NHTSA to study the potential for fuel efficiency gains, and, if feasible, implement fuel efficiency standards for medium- and heavy-duty trucks and engines. After the completion of studies by the National Academy of Sciences and NHTSA, EPA and NHTSA proposed a joint rulemaking for MY2014-MY2018.[30] On August 9, 2011, the agencies announced final rules. [31]

[29] §102(b)

[30] Environmental Protection Agency and National Highway Traffic Safety Administration, "Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: Proposed Rules," 75 *Federal Register* 74152, November 30, 2010.

[31] Environmental Protection Agency and National Highway Traffic Safety Administration, "Greenhouse Gas Emissions

Because of the inherent differences between commercial and passenger vehicles, the standards are based on multiple attributes, including the weight class, physical size, and the presence of a sleeping area in the driver's cab. Further, because the same heavy-duty engine may be used in various vehicles, and similar vehicles are often configured in different ways, the standards are based on fuel consumption and greenhouse gas emissions per tons of payload miles,[32] as opposed to the miles-per-gallon standards for passenger vehicles.

EPA and NHTSA estimate that the rules will raise the average cost of new heavy-duty MY2018 combination tractors (i.e., the tractor portion of a tractor-trailer) by about $6,200. For heavy-duty pickup trucks and vans, the agencies estimate the average increased MY2018 cost at around $1,000, and around $400 for vocational vehicles (a wide range of vehicles including utility trucks, refuse trucks, and dump trucks).[33] Depending on the vehicle and the annual number of miles traveled, the agencies estimate that the increased costs would be made up within a few years in fuel savings resulting from the rules.[34]

The agencies estimate that the rules will save 530 million barrels of oil and 270 million metric tons of greenhouse gases over the life of the vehicles sold in MY2014-MY2018. They estimate total program costs of $8.1 billion (present value), offset by $50 billion in fuel savings and $7.3 billion in other net benefits (e.g., reduced emissions of greenhouse gases and other pollutants, more miles driven from lower fuel costs, minus the increased congestion and fatalities from that increase in miles), for a net benefit estimate of $49 billion over the life of the vehicles covered by the rules.[35] Some critics have questioned the Administration's methodology in determining costs and benefits. They argue that the net benefits could be considerably lower than EPA and NHTSA have projected.[36]

Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Final Rule," 76 *Federal Register* 57106-57513, September 15, 2011.

[32] I.e., tons of payload times the number of miles traveled, also referred to as "ton-miles." As noted by EPA and NHTSA, the ton-mile is the "key measure of freight movement." Ibid., p. 57115.

[33] Ibid., p. 57127.

[34] Ibid., p. 57347.

[35] The agencies used a 3% discount rate to calculate present value, and made other assumptions (e.g., projected fuel prices from the Energy Information Administration's *Annual Energy Outlook 2011*). Changing any of these assumptions will affect the projected costs and benefits. For example, using a 7% discount rate, the agencies estimate that net benefits decrease to $33 billion (future benefits are reduced, while program costs, accrued in the early years, are less sensitive to the discount rate). Ibid., Table I-5.

[36] For example, see Winston Harrington and Alan Krupnick, *Improving Fuel Economy in Heavy-Duty Vehicles*, Resources for the Future, Issue Brief 12-01, Washington, DC, March 2012, p. 11, http://www.rff.org/RFF/Documents/RFF-IB-12-01.pdf.

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