Securing America's Future Energy

Issue Brief

October 9, 2015

Estimated Oil Savings from EPA's Proposed Phase 2 Medium- and Heavy-Duty Vehicle and Engine Rule

Summary

- On June 19, 2015, the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) jointly published proposed standards to regulate greenhouse gas emissions and improve fuel efficiency for medium- and heavy-duty vehicles beginning in model year 2019 and ending with model year 2027. The agencies estimate that this Phase 2 of the program—which builds upon earlier Phase 1 standards adopted in 2011 for model year 2013 through 2018 vehicles—will conserve 1.8 billion barrels of oil over the lifetimes of the vehicles sold under the program.
- The U.S. transportation sector relies on oil for 92 percent of its total energy consumption. This dependence leaves the U.S. economy vulnerable to volatile price conditions and an unpredictable global oil market. Increasing vehicle fuel efficiency is one of the most effective tools for decreasing the oil intensity of the U.S. economy, and thereby enhancing economic and national security.
- Medium- and heavy-duty vehicles represent the fastest growing sector of U.S. transportation oil demand. Strengthening fuel economy standards for these vehicles is critical to reducing America's overall dependence on oil and improving our country's energy security.
- This report's analysis, commissioned by Securing America's Future Energy (SAFE), shows that achieving the improvements required by the Phase 2 rule is both technologically feasible and cost effective. It also shows that demand attributable to medium- and heavy-duty vehicles could decline by almost 0.5 million barrels per day (mbd) by 2030 (~13 percent) and 0.8 mbd (~20 percent) by 2040 due to the rule.
- However, improvements in vehicle fuel efficiency alone will not insulate the U.S. economy from the volatile oil price conditions typical of the global oil market. SAFE recommends several revisions to the proposed rule—including extending manufacturing incentives for alternative fuel vehicles into the medium- and heavy-duty sector and implementing advanced technology credits for natural gas vehicles in the sector, as well as reinstating them for technologies that qualify for the credit under Phase 1—that if adopted will help strengthen U.S. energy security by achieving even greater oil savings over the long term.

Importance of Medium- and Heavy-Duty Fuel Economy

Almost 40 percent of total U.S. primary energy demand is met by oil, giving it an economic significance unmatched by any other fuel.[1] The transportation sector accounts for more than 70 percent of total U.S. oil consumption of approximately 19 mbd.[2] This sector relies on oil for 92 percent of its total energy consumption and has no readily available substitutes.[3]

The price of oil is set in an unpredictable and increasingly volatile global oil market, meaning that the commodity's price is affected by events in oil-producing and oil-consuming countries around the world. The key consequence of this dynamic is that changes in oil supply or demand anywhere affect prices everywhere. In fact, U.S. gasoline prices more closely correlate with global crude streams than the U.S. crude oil benchmark, West Texas Intermediate (WTI). Because there are no readily available substitutes to oil in the U.S. transportation sector, the primary and near-term impact of changes in prices on the U.S. economy is through the amount of oil consumed, not the amount of oil produced or imported.

Between 2011 and 2014, the United States' reliance on oil led to an average economy-wide spend of almost $880 billion per year on petroleum products, equivalent to more than 5 percent of U.S. gross domestic product.[4] These high levels of spending—more than twice what they were in the early 2000s—strain the budgets of consumers, businesses, and governments alike.[5] Higher oil prices also added $1.2 trillion to the U.S. federal debt between 2002 and 2012, and every U.S. recession for the past 40 years has been preceded by, or coincided with, an oil price spike.[6]

Although oil prices, and thus U.S. spending on oil, are expected to be markedly lower in 2015—$54 per barrel compared to $99 per barrel in 2014 and approximately $595 billion compared to $850 billion in 2014, respectively—total U.S. spending on petroleum fuels exceeded a combined $3.5 trillion between 2011 and 2014.[7] Households are also expected to spend less on gasoline in 2015, at levels slightly below those last seen on an annual basis in both 2009 (during the Great Recession) and 2005.[8] Nevertheless, and despite rising domestic oil production, the United States still sends nearly $1 billion abroad each day to pay for oil, often to countries that are hostile to U.S. interests.[9]

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[1] EPA, NHTSA, *"Cutting Carbon Pollution, Improving Fuel Efficiency, Saving Money, and Supporting Innovation for Trucks,"* June 2015, at 2.
[2] EIA, Annual Energy Outlook (AEO) 2015.
[3] Id.
[4] SAFE analysis based on data from BEA.
[5] SAFE analysis based on data from BEA and EIA.
[6] SAFE, *Oil and the Debt*, October 2013, at 1; and SAFE analysis based on data from BEA, EIA, and the National Bureau of Economic Research.
[7] SAFE analysis based on data from EIA.
[8] SAFE analysis based on data from BLS, Census Bureau, and EIA.
[9] SAFE analysis based on data from EIA (2014 data).

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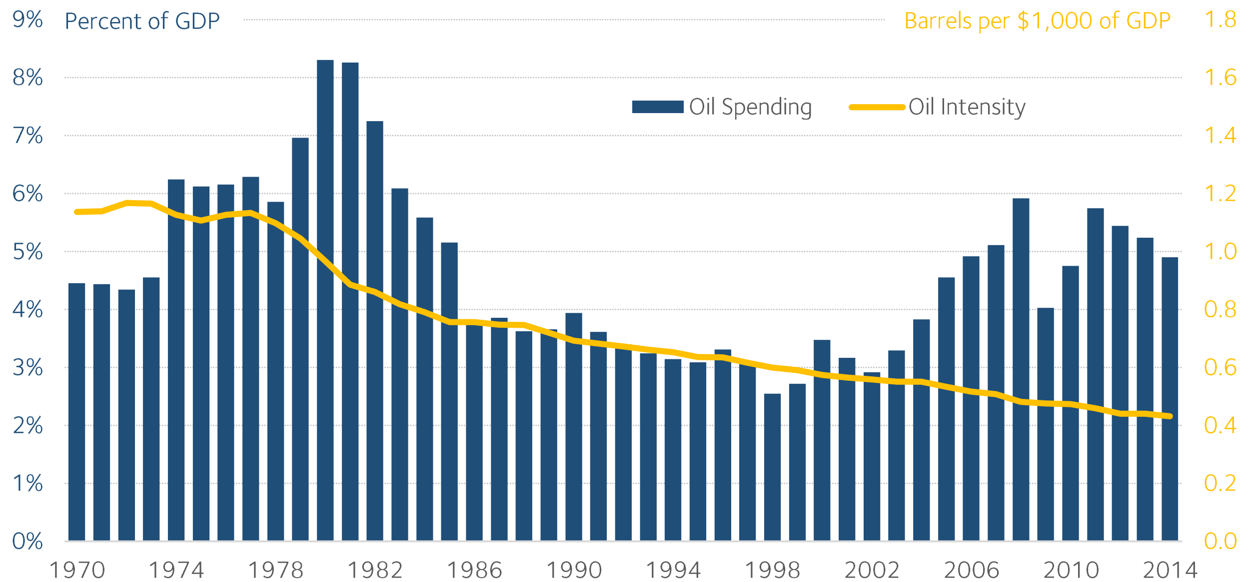
FIGURE 1 • U.S. SPENDING ON OIL AS A SHARE OF GDP AND OIL INTENSITY



Source: SAFE analysis based on data from U.S. EIA and Bureau of Economic Analysis

The extreme economic importance of oil to the United States creates adverse national security challenges. Notably, more than 50 percent of daily oil supplies transit through seven major chokepoints in often unstable regions, particularly the Middle East.[10] The U.S. military is placed in harm's way to protect these maritime supply routes and vulnerable energy infrastructure across the globe. U.S. oil dependence also weakens the country's ability to address foreign policy challenges, including Iran. Efforts to enact effective sanctions on Iran's oil industry as far back as 2005 were undermined by the impact such sanctions would have on global oil prices.

Uncertain events around the world also contribute to volatility in global oil markets and oil prices. For example, conflict in Yemen has affected oil prices despite Yemen's minimal oil production capacity, in part due to the country's strategic location adjacent to the Bab el-Mandeb strait and shared border with Saudi Arabia. Moreover, Russia's incursions into Ukraine and subsequent international sanctions, the emergence and expansion of the Islamic State of Iraq and the Levant (ISIL) in Northern Iraq and Syria, and other developments increase concerns over the security and stability of global oil supplies.

The global oil market is also frequently subject to unpredictable—and sometimes anti-competitive—behavior from oil-producing countries that supply it, most notably from members of the Organization of the Petroleum Exporting Countries (OPEC). For example, the organization's November 2014 decision not to reduce output despite a growing imbalance between global oil demand and supply contributed to a more than 50 percent decline in oil prices between the summer of 2014 and January 2015, resulting in levels of oil price volatility not observed since 2009, among other impacts.[11]

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[10] See, e.g., EIA, World Oil Transit Chokepoints, November 10, 2014, at 2.
[11] SAFE analysis based on data from EIA.

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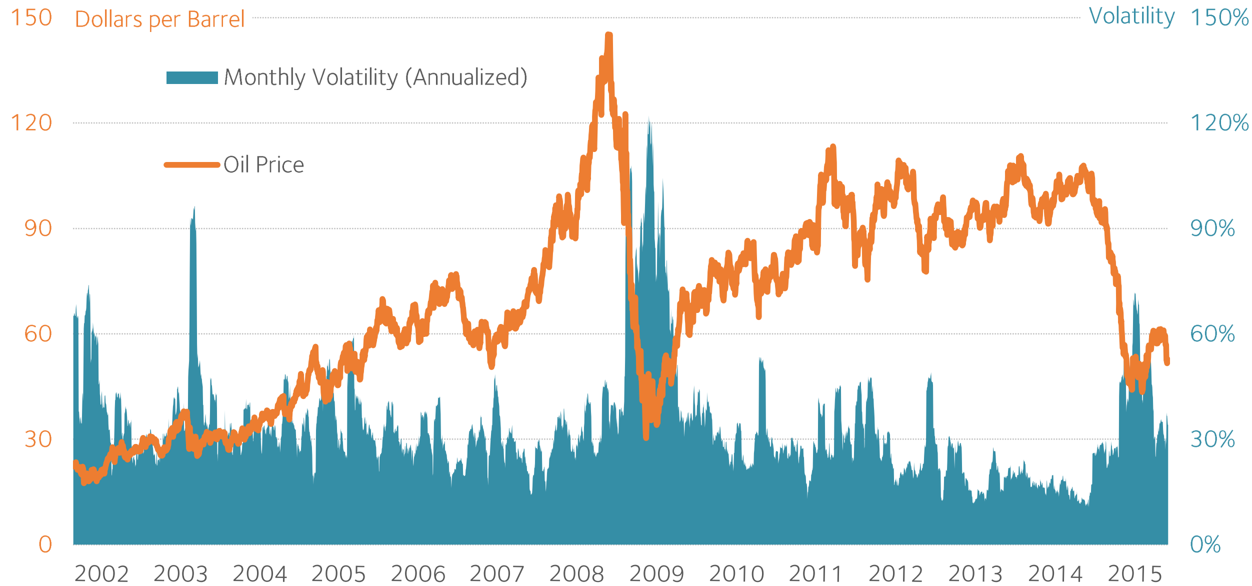
FIGURE 2 • OIL PRICE AND ESTIMATED OIL PRICE VOLATILITY



Source: SAFE analysis based on data from U.S. EIA

Medium- and heavy-duty vehicles represent a sizable portion of U.S. transportation-related oil demand. In total, commercial trucks accounted for 2.8 mbd of U.S. oil consumption in 2013, more than 20 percent of transportation-related oil consumption, a share second only to light-duty vehicles.[12] Class 7-8 heavy-duty trucks accounted for more than 70 percent of the oil consumed by trucks.[13]

In noticeable contrast to the light-duty vehicle segment, energy and oil use by medium- and heavy-duty vehicles is forecast to rise, not fall, over the next 25 years from 2.8 mbd today to approximately 3.4 mbd in 2040. This rise in demand is attributable to an increase in the number of medium- and heavy-duty vehicles on U.S. roads (and corresponding increase in total vehicle miles driven), plus only very gradual improvements in vehicle fuel economy. Without the Phase 2 rule, the U.S. Department of Energy forecasts that the average fuel economy of diesel-powered heavy-duty vehicles will increase by 17 percent over the next 25 years, from 6.15 miles per gallon (mpg) to 7.21 mpg.[14]

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[12] U.S. DOE, ORNL, Transportation Data Energy Book, Edition 33.
[13] Id.
[14] SAFE analysis based on data from EIA, Annual Energy Outlook (AEO) 2015.

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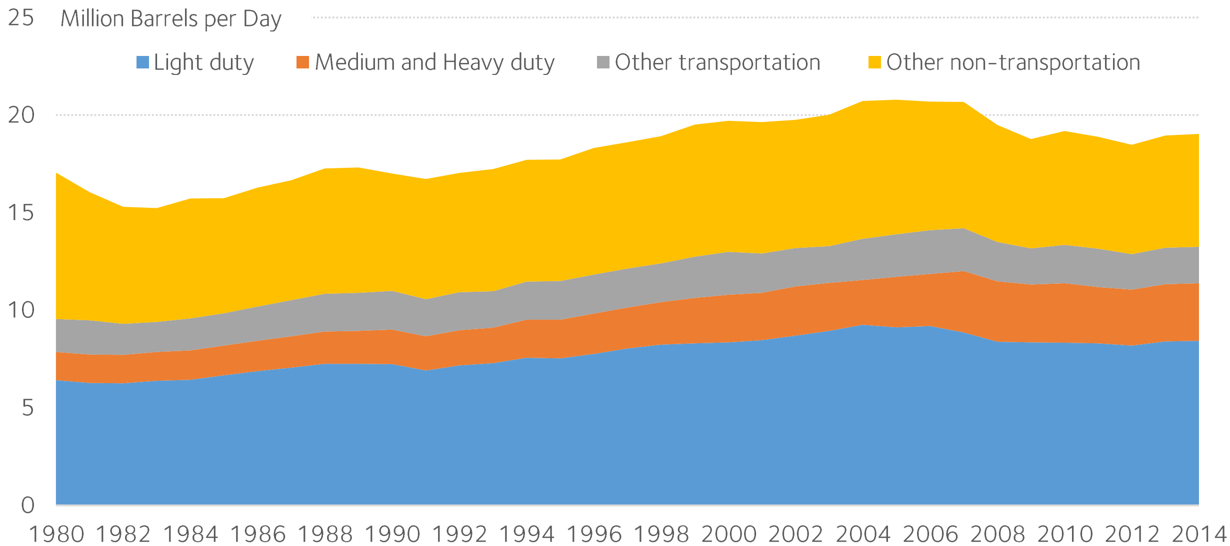
FIGURE 3 • U.S. TRANSPORTATION OIL DEMAND



Note: Allocation of total 2013 and 2014 demand is estimated.
Source: SAFE analysis based on data from EIA

Regulatory Background

In December 2007, Congress passed—and President George W. Bush signed into law—the Energy Independence and Security Act of 2007 (EISA). In addition to requiring the first significant improvements in light-duty vehicle fuel economy since 1975, EISA also mandated the first nationwide efficiency standards for medium- and heavy-duty vehicles in U.S. history. The law required the Secretary of Transportation—through the National Highway Traffic Safety Administration (NHTSA)—to consult with the Secretary of Energy and Administrator of the Environmental Protection Agency (EPA) to conduct a rulemaking that would implement fuel economy standards for commercial trucks. The law specified several key components, among them that the standards should be designed to:

1. Achieve the maximum feasible improvement.
2. Adopt and implement appropriate test methods, measurement metrics, fuel economy standards, and compliance and enforcement protocols that are cost effective and technologically feasible.
3. Provide no less than four full model years of regulatory lead time and three full model years of regulatory stability.[15]

The statutory authority for regulation contained in EISA remains the underlying authority for NHTSA to establish fuel economy standards for medium- and heavy-duty trucks today. However, in 2007, the Supreme Court also ruled in *Massachusetts v. EPA* that the EPA had the authority to regulate tailpipe emissions of carbon dioxide (CO_2) as a pollutant under the Clean Air Act.[16] Upon entering office in 2009, President Barack Obama instructed the EPA to proceed in establishing tailpipe emissions standards for light-duty vehicles for model years 2012 through 2016, and to ensure that such

[15] 49 U.S.C. § 32902, Average Fuel Economy Standards.
[16] Massachusetts v. Environmental Protection Agency 549 U.S. 497.

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standards were harmonized to the maximum extent practicable with NHTSA fuel economy standards.[17] In May 2010, the President extended the directive to the agencies to regulate light-duty vehicles in model years 2017 to 2025 and medium- and heavy-duty trucks in model years 2014 to 2018.[18]

Phase 1 Medium- and Heavy-Duty Truck Rule

In August 2011, EPA and NHTSA finalized the heavy-duty national program, featuring complementary efficiency and greenhouse gas standards for all commercial trucks with a gross vehicle weight (GVW) in excess of 8,500 lbs.[19] The rule identified three distinct regulatory categories of vehicles: (1) combination tractors (semi-trailer trucks); (2) heavy-duty pick-up trucks and vans; and (3) vocational trucks. The standards for tractors in Phase 1 excluded trailers; however, the agencies indicated their intention to regulate trailers in future rulemaking.

Given the historic nature of the truck standards, the substantial diversity of truck types and duty cycles included in the rulemaking, and the disaggregated nature of the trucking industry, the Phase 1 standards required only modest improvements in fuel efficiency. The rule was intended to "get something on the books," and the regulators clearly signaled their intent to pursue additional phases that required more stringent standards.[20] Standards for combination tractors, which consume about two-thirds of all fuel used in medium- and heavy-duty vehicles, required efficiency improvements of up to 20 percent between model years 2014 and 2018; those for heavy-duty pick-ups and vans required up to 15 percent improvements, and those for vocational vehicles required up to 10 percent improvements.[21] In total, the Phase 1 standards will save approximately 0.4 mbd of fuel in 2030 and 0.5 mbd in 2040 versus a no-standards baseline.[22] The agencies project Phase 1 fuel efficiency improvements to result in $42 billion in savings over the lifetimes of vehicles, after accounting for compliance related technology costs.[23]

The Phase 1 standards included requirements for both engines and complete vehicles. This was consistent with historical precedent for testing engines to meet emissions standards for conventional pollutants, such as particulate matter and oxides of sulfur and nitrogen. Given that the trucking industry is not vertically integrated, separate engine testing has historically provided the most consistent approach for evaluating and controlling performance with respect to such pollutants. This is particularly true given the vast range of duty-cycles for which an individual engine can be deployed, especially within vocational trucks. It is simply impractical to reliably test complete trucks across the entire range of duty cycles; therefore, the engine is tested across a range of duty cycles. However, unlike conventional pollutants, there are technologies that can be applied to engines and vehicles independently to improve vehicle efficiency. Establishing minimum engine efficiency standards ensures that both engine and vehicle manufacturers will contribute to overall program goals.

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[17] The White House, Presidential Memorandum – EPA Waiver, *State of California Request for Waiver Under 42 U.S.C. 7543(b), the Clean Air Act*, January 26, 2009.
[18] EPA, NHTSA, *Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles*, August 2011.
[19] EPA, NHTSA, *EPA and NHTSA Adopt First-Ever Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium- and Heavy-Duty Vehicles*, August 2011.
[20] Id., at 4.
[21] Id., at 5.
[22] SAFE-commissioned analysis of Phase 1 fuel savings.
[23] EPA, NHTSA, *EPA and NHTSA Adopt First-Ever Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium- and Heavy-Duty Vehicles*, August 2011, at 2.

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The Phase 1 standards were generally supported by a broad spectrum of engine and truck makers, fleets, and public agencies. In large part, this was because the industry was pleased to secure the implementation of a single national standard for regulating vehicle efficiency. The California Air Resources Board had signaled its intent to proceed with its own rulemaking if EPA and NHTSA failed to act, and the possibility of a complex regulatory landscape with differing requirements at the state and national level was considered a major threat to the industry's operations.

SAFE's Role in Developing Past Fuel Economy Standards

For more than a decade, SAFE has supported strengthening vehicle fuel economy standards because they reduce the oil intensity of the U.S. economy and enhance the nation's economic and national security. In its 2006 report, entitled *Recommendations to the Nation on Reducing U.S. Oil Dependence*,[24] SAFE, under the auspices of its Energy Security Leadership Council (ESLC), recommends that increased fuel economy standards serve as the centerpiece of a series of policies.

Interest in fuel economy standards intensified during 2007—as oil prices continued to rise—and culminated in the passage of EISA which required significant increases in fuel economy standards for the first time in a generation. To a significant extent, EISA incorporated SAFE's recommendations.

SAFE has supported subsequent strengthening of both light-duty and heavy-duty fuel economy standards since 2007. In June 2011, for example, in a report entitled *Oil Savings from the Proposed 2017-2025 Fuel Economy Standards*, SAFE presented the potential oil savings from different standards (based on the four different stringency levels identified in EPA and NHTSA's regulatory Notice of Intent to establish fuel economy standards for those model years) and identified a selection of other issues for the agencies to address as part of the rulemaking process.

Phase 2 Proposed Rule

In February 2014, President Obama directed NHTSA and the EPA to proceed with Phase 2 rulemaking that would extend fuel economy standards for medium- and heavy-duty vehicles beyond model year 2018 and "well into the next decade."[25] When announcing the directive, the president also set a timeline: The proposed rule should be released in June 2015 and finalized in 2016.

The proposed rule was published in June and requires an average fuel consumption reduction of 22 percent by model year 2027 for new vehicles relative to vehicles meeting the most stringent Phase 1 standards.[26] The rule calculates the increase in efficiency by analyzing the engine—as done under Phase 1 of the rule—plus several other components of the powertrain, as suggested and agreed upon by industry leaders such as Cummins, Volvo, and others. The Phase 2 rule, mostly following the Phase 1 structure, has 46 different regulatory categories, encompassing engine, truck, tractor, and trailer categories (trailers were not included in the Phase 1 standards).[27] There are 10 categories for tractors, 18 for vocational vehicles, 2 for commercial pickups and vans, 10 for trailers, and 6 for engines.

[24] Securing America's Future Energy, *Recommendations to the Nation on Reducing U.S. Oil Dependence*, 2006.
[25] The White House, "Improving the Fuel Efficiency of American Trucks," February 2014.
[26] SAFE-commissioned analysis based on data from EPA and NHTSA.
[27] ICCT, "5 Numbers You Need to Know About the Proposed U.S. Truck Efficiency Rule," June 19, 2015.

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While the vast number of regulatory categories may limit compliance flexibility, the EPA and NHTSA estimate that the proposed Phase 2 program will save about 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program.[28] The agencies also estimate that payback periods for new vehicle owners would be favorable. Under the proposed guidelines, a long-haul truck in 2027 would recoup the extra cost of new technology in less than two years through fuel savings.[29] The payback periods for pick-ups and vans are estimated at three years, and those for vocational vehicles at six years.[30] The agencies also estimate the proposed standards would result in approximately $230 billion in net benefits over the lifetime of the vehicles sold in the regulatory timeframe, while costing the affected industry approximately $25 billion over the same period.[31] Assuming that all savings and costs from shipping goods are passed through to consumers, they estimate the average household could save $150 per year by 2030 and $275 per year by 2040.

Analysis commissioned by SAFE finds that achieving the improvements required by the Phase 2 rule are both technologically feasible and cost effective.[32] Subsequent analysis of the potential fuel savings finds that demand attributable to medium and heavy-duty vehicles could decline by almost 0.5 mbd by 2030 (~13 percent) and by nearly 0.8 mbd (~20 percent) by 2040 due to the rule.[33] As a result, total onroad fuel use could decline by 4.5 percent by 2030 and 7.5 percent by 2040, respectively.[34]

[28] EPA, DOT, Federal Register, 80 (133), *Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles— Phase 2.*
[29] EPA, NHTSA, "*EPA and NHTSA Propose Standards to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium- and Heavy-Duty Vehicles for Model Year 2018 and Beyond*," June 2015, at 2.
[30] EPA, NHTSA, "EPA and NHTSA Propose Greenhouse Gas and Fuel Efficiency Standards for Medium- and Heavy-Duty Trucks: By the Numbers," June 2015, at 2-3.
[31] EPA, NHTSA, "Cutting Carbon Pollution, Improving Fuel Efficiency, Saving Money, and Supporting Innovation for Trucks," June 2015, at 2.
[32] ICCT, *Cost effectiveness of advanced efficiency technologies for long-haul tractor-trailers in the 2020-2030 timeframe*, April 2015.
[33] SAFE-commissioned analysis based on data from EPA and NHTSA.
[34] Id.

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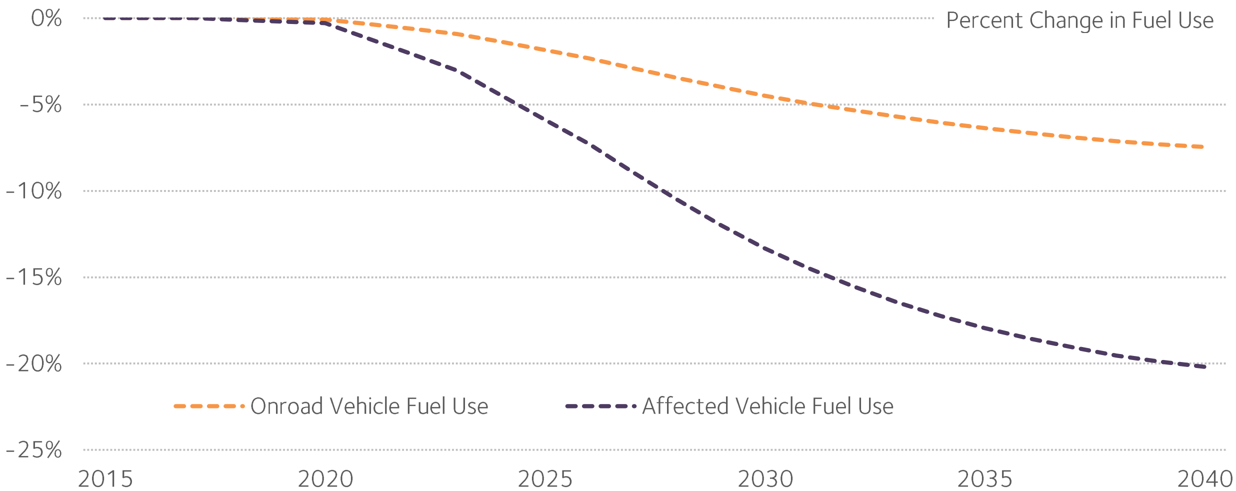
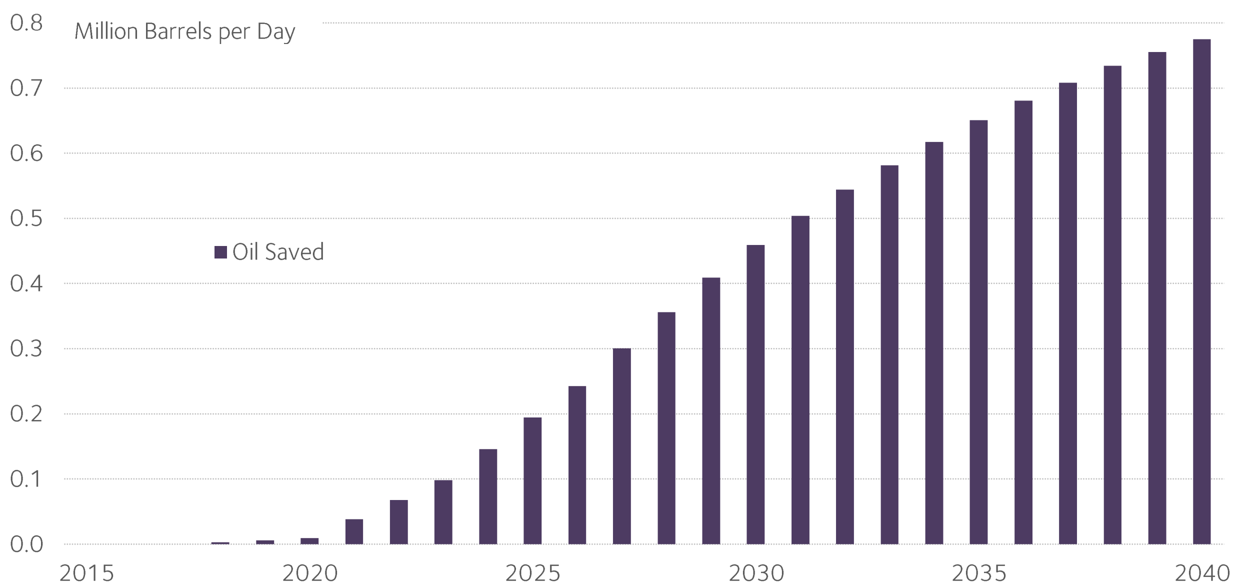
FIGURE 4 • PROJECTED CHANGE IN FUEL CONSUMPTION[35]



Note: Affected vehicles are the medium- and heavy duty-vehicles subject to the Phase 2 rulemaking. Onroad vehicles include both affected vehicles and other independently regulated onroad vehicles such as light-duty passenger vehicles, light-duty trucks, and motorcycles.
Source: Meszler Engineering Services and SAFE

FIGURE 5 • ESTIMATED FUEL SAVINGS FROM EPA AND NHTSA PHASE 2 RULE



Source: Meszler Engineering Services and SAFE

[35] Note: Although the complete initial set of Phase 2 standards (as proposed) does not take effect until model year 2021, there are a set of CO_2 standards and associated voluntary fuel consumption standards for box trailers that take effect in model year 2018. The fuel consumption impacts are calculated assuming compliance beginning in model year 2018 as manufacturers will have to achieve commensurate (and mandatory) CO_2 reductions beginning at that time.

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Recommendations

Before finalizing the Phase 2 fuel efficiency and greenhouse gas emissions standards, there are several issues SAFE believes that EPA and NHTSA must address to enhance their immediate effectiveness with regard to strengthening U.S. energy security through reductions in medium- and heavy-duty oil use. The suggested revisions would also eliminate the differential treatment of medium- and heavy-duty vehicle manufacturers relative to their light-duty counterparts, resulting in a more seamless integrated policy for motor vehicle greenhouse gas and fuel economy regulation.

Specifically, SAFE recommends that the agencies equilibrate the treatment of non-petroleum fuels across the light- and heavy-duty sectors by: (1) extending 49 USC §32905 manufacturing incentives into the medium- and heavy-duty sector and (2) implementing advanced technology credits for medium- and heavy-duty natural gas vehicles, and reinstating them for technologies that qualify for the credit under Phase 1. Finally, comments on the considerations related to upstream natural gas vehicle emissions (as requested in the proposed Phase 2 rule) are offered.

Reconsider Application of 49 USC §32905 Manufacturing Incentives

The manufacture of non-petroleum fueled light-duty vehicles is incentivized through the application of volumetric adjustment factors under 49 U.S.C. §32905. Generally one gallon of non-petroleum fuel consumption is treated as 15 percent of one gallon, so that regulatory fuel economy is 6.67 times higher than measured fuel economy.[36] This incentive, originally established under the Alternative Motor Fuels Act of 1988, has been renewed and expanded many times over the intervening years, including as recently as 2014 when expanded allowances for dual fuel natural gas vehicles were added. In short, there is a long legislative history that affirmatively demonstrates congressional intent to facilitate the production and widespread use of alternative fuel vehicles (AFVs).[37]

In the absence of similarly explicit statutory requirements for heavy-duty vehicles, EPA and NHTSA elected not to extend the §32905 allowances to such vehicles when the Phase 1 GHG and fuel economy rules were developed, and to maintain this restriction in the Phase 2 proposal.[38] Although there is no supporting discussion in the Phase 2 proposal, it is clear from discussion included in the final Phase 1 rule that both EPA and NHTSA understand quite clearly the implications of this decision—both in terms of promoting alternative fuels and decreasing manufacturer flexibility—affirmatively stating that the adopted approach of not applying light-duty-equivalent incentives "could have the disadvantage of not doing more to encourage some cost-effective means of reducing petroleum consumption by trucks, and the accompanying energy security costs" and that adopting distinct GHG and fuel economy standard incentives "might enable manufacturers to achieve the twin goals of reducing greenhouse gas emissions and decreasing consumption of petroleum-based fuels in a more cost-effective manner."[39] The Phase 1 discussion also affirms that EPA and NHTSA will reconsider the non-expansion of the light-duty-equivalent incentives in establishing future heavy-duty requirements (76 FR 57125).

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[36] Note: Since fuel economy is measured as X miles per Y gallons, adjusting Y gallons to 0.15Y gallons effectively increases fuel economy by 1 divided by 0.15 (i.e., by a factor of $6.6\overline{6}$).
[37] Note: Intent of legislative action derived from the "Purpose" clause of the Alternative Motor Fuels Act of 1988.
[38] Note: As used in these comments, the terminology heavy-duty is intended to include both medium and heavy-duty vehicles as included in the EPA and NHTSA Phase 2 GHG and fuel economy proposal.
[39] See, e.g., Phase 1 discussion at 76 FR 57123 through 76 FR 57125.

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SAFE believes EPA and NHTSA should undertake such reconsideration and formally expand the §32905 incentives to heavy-duty vehicles. Such expansion will make available to heavy-duty vehicle manufacturers the same incentives that are available to their light-duty counterparts, as well as introduce provisions into the heavy-duty rule that are fully consistent with the statutorily established goal of promoting non-petroleum fuels. From a fueling perspective, there is no rational reason to treat heavy-duty manufacturers differently than their light-duty counterparts. If introducing an AFV into the light-duty fleet is deemed important for national and economic security, and explicit incentives are provided to promote such introduction, introduction of an AFV into the heavy-duty fleet should contribute to the same goal and be worthy of the same incentives. Any other determination is arbitrary as it effectively results in differential treatment of the same fuel.[40]

We recognize that EPA and NHTSA are proposing a fuel economy determination for heavy-duty AFVs that takes advantage of the differential carbon contents of such fuels relative to gasoline and diesel. However, the resulting fuel economy benefit for a fuel such as natural gas is equivalent to a multiplier of 1.25 to 1.5, versus the 6.67 multiplier available to light-duty natural gas vehicle manufacturers. EPA and NHTSA should adopt the same fuel economy incentives for alternative fuels across both sectors.

Advanced Technology Credits for CO_2

The EPA and NHTSA have proposed to eliminate the advanced technology credits that were available under the heavy-duty vehicle Phase 1 rule. Under that rule, credits (expressed in terms of a 1.5 times production multiplier, with specified class transfer caps) were available to promote the introduction of hybrid, Rankine cycle waste heat recovery, all-electric, and fuel cell technology. Under the proposed Phase 2 rule, these credits would be discontinued under the premise that the applicable standards presume the use of advanced technology and will, therefore, sufficiently incentivize market introduction.

Here again, there is a stark contrast with regard to the treatment of advanced heavy-duty vehicle technology as compared to similar technology under the 2017-2025 light-duty rule. Under the light-duty rule, manufacturers can generate CO_2 credits (expressed in terms of a production multiplier) through model year 2021 by introducing all-electric, plugin hybrid electric, fuel cell, and dedicated and dual fuel natural gas vehicles.[41] These credits are intended to incentivize the early introduction of advanced technology to overcome market barriers and facilitate compliance with subsequent, more stringent standards. Natural gas is recognized for both its ability to serve as a bridge technology toward the introduction of hydrogen fuel cell vehicles and the fact that it faces similar market barriers to those of other advanced technologies (77 FR 62816).

[40] Note: EPA and NHTSA "justify" such differential treatment in their discussion of the Phase 1 rule by citing the benefits of reduced reporting and compliance determination requirements, coupled with the possibility that providing the §32905 incentives might lead to little increased production of alternative fueled vehicles or that alternative fuels may be imported. However, all of these "justifications" are independent of market sector and would apply equally to light- and heavy-duty manufacturers. Clearly, such rationale were rejected when statutory requirements were established to provide incentives in the light-duty sector so it is not at all clear why they would carry more weight in rejecting these same incentives for the heavy-duty sector.

[41] Note: Specific production multipliers are: (1) for all-electric and fuel cell vehicles, 2.0 in model years 2017 through 2019, 1.75 in model year 2020, and 1.5 in model year 2021, (2) for plugin hybrid electric and natural gas vehicles, 1.6 in model years 2017 through 2019, 1.45 in model year 2020, and 1.3 in model year 2021.

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While the most stringent proposed Phase 2 standards for heavy-duty trucks may indeed presume some degree of advanced technology, with regard to waste heat recovery in particular, little if any hybrid, all-electric, fuel cell, or natural gas vehicle technology will be *required* to achieve the proposed standards. Thus, there is little difference in the role of these technologies in achieving the standards as currently proposed or adopted (as applicable) in the light- and heavy-duty sectors. The rationale offered by EPA and NHTSA for adopting advanced technology credits in the light-duty sector applies at least equally and without exception to the heavy-duty sector. In fact, the rationale is more pronounced in the heavy-duty sector given that the magnitude of advanced technology market barriers is higher due to substantially greater cost and engineering issues associated with heavy-duty vehicle development, production, and use.

This differential treatment across sectors is amplified when one considers that under the light-duty rule, EPA and NHTSA adopted credits even for non-plug-in hybrid (and effectively equivalent) technology when installed on a full sized pickup truck.[42,43] Supporting justification included:

> "The agencies believe that offering incentives in the earlier years of this program that encourage the deployment of technologies that can significantly improve the efficiency of these vehicles and that also will foster production of those technologies at levels that will help achieve economies of scale, will promote greater fuel savings overall and make these technologies more cost effective and available in the later model years of this rulemaking to assist in compliance with the standards." (77 FR 62738)

> "Although there may not be inherent reasons for a lack of hybrid technology migration to large trucks, it is clear that this migration has nevertheless been slow to materialize for practical/economic reasons, including in-use duty cycles and customer expectations. These issues still need to be addressed by the designers of large pickups to successfully introduce these technologies in these trucks, and we believe that assistance in the form of a focused, well-defined incentive program is warranted." (77 FR 62739)

For so-called strong hybrids, these credits can be earned through the duration of the currently adopted light-duty standards (i.e., through model year 2025).[44] As was the case for the general advanced technology credits, these same justifications not only hold true, but are magnified when expressed in terms of the "in-use duty cycles and customer expectations" of the heavy-duty sector.

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[42] Note: Full sized pickup means a pickup with bed length and width of at least 60 and 48 inches respectively and payload and towing capacities of at least 1700 and 5000 pounds respectively.

[43] Note: The specific credits are 10 grams CO_2 per mile (equivalent to 0.00113 gallons per mile) for mild hybrids, 20 grams CO_2 per mile (equivalent to 0.00225 gallons per mile) for strong hybrids, 10 grams CO_2 per mile (equivalent to 0.00113 gallons per mile) for vehicles demonstrating CO_2 performance 15 percent better than their footprint based target, and 20 grams CO_2 per mile (equivalent to 0.00225 gallons per mile) for vehicles demonstrating CO_2 performance 20 percent better than their footprint based target. The 10 gram credits can be earned in model years 2017 through 2021, while the 20 gram credits can be earned in model years 2017 through 2025. To earn mild hybrid credits, the technology must be installed on 20, 30, 55, 70, and 80 percent of full sized pickup trucks in model years 2017 through 2021 respectively. To earn the 10 gram performance credits, the enabling technology must be installed on 15, 20, 28, 35, and 40 percent of full sized pickup trucks in model years 2017 through 2021 respectively. Strong hybrid and 20 percent performance credits require installation on 10 percent of full sized pickup trucks in each model year 2017 through 2025. A vehicle cannot earn both a hybrid and performance credit.

[44] A strong hybrid is a hybrid electric vehicle that recovers at least 65 percent of the braking energy used over the fuel economy test cycle.

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While the introduction of advanced technology in the heavy-duty sector is worthy of a credit program based solely on cost and engineering issues that are compounded with size, the disparate treatment of such technology under the adopted light-duty and proposed heavy-duty programs is itself sufficient evidence of such need. There is simply no rational reason that heavy-duty manufacturers should be held to less flexible requirements than their light-duty counterparts. EPA and NHTSA should reconsider their proposal in this regard and implement a "focused, well-defined" advanced technology incentive program for heavy-duty vehicles. Ideally, this program would mimic that of the light-duty sector, covering the same technology that is common to both and including any additional advanced technology specific to the heavy-duty sector. Thus, credits should, at a minimum, be established for hybrid, all-electric, fuel cell, and natural gas technology. The earning period for the heavy-duty program should be adjusted from that of the light-duty rule to reflect the differential time periods of standards implemented under the applicable rules, allowing credits to be earned at least through model year 2026 (the last model year prior to the implementation of the most stringent proposed heavy-duty standards).

FIGURE 6 • COMPARISON OF NON-PETROLEUM VEHICLE ALLOWANCES

Program	Segment	EVs/PHEVs/FCVs	NGVs
CO_2 Standards	Light Duty	Zero CO_2 and production multipliers through MY2021, zero CO_2 for 200,000 to 600,000 vehicles thereafter	Production multipliers through MY2021
	Medium- and Heavy-duty	Zero CO_2 through end of rule and "smaller than light duty" production multipliers through MY2020	No credit provisions
Fuel Economy Standards	Light Duty	Fuel cycle energy with 6.67 multiplier	6.67 multiplier
	Medium- and Heavy-duty	Zero fuel consumption (infinite fuel economy)	25 to 35 percent increase due to gasoline/diesel fuel carbon content assumption

Note: Indicated credits for PHEV are only for electric-only operating fraction. MY = model year.
More "generous" credits indicated in red font.

Treatment of Upstream Natural Gas Emissions

Traditionally, with the limited exception of vehicles powered by energy sources that are recharged through off-board fuel combustion, emissions associated with the upstream production and distribution of vehicular fuels have been regulated independently of established motor vehicle GHG and fuel economy standards.[45] There is fundamentally sound rationale behind such an approach since

[45] Note: Generally, vehicles powered by energy sources that are recharged through off-board fuel combustion are all-electric or plug-in electric hybrid vehicles whose batteries are recharged using energy generated through upstream fuel combustion. Upstream combustion and distribution losses for such vehicles are considered in determining *light-duty* vehicle fuel economy and will be considered beginning as early as model year 2020 in determining *light-duty* vehicle CO_2 emissions. Prior to model year 2020 and for some period thereafter until a

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vehicle manufacturers have no authority over the production and distribution of vehicular fuels. Fuel producers and distributors are separately regulated entities subject to controls established for their respective industries.

Nevertheless, the EPA and NHTSA have requested comment on whether it would it be appropriate to adjust the tailpipe GHG emission (and, by extension, fuel consumption) standards for natural gas vehicles by a factor to reflect the lifecycle emissions of natural gas vehicles relative to diesel-powered vehicles. While the benefits of such an approach might possibly be rationalized in a more static and certain world, it is difficult to envision any type of a practical and equitable system.

Vehicle manufacturers have no control over upstream fuel production and distribution, yet under a lifecycle approach vehicle manufacturers would be required to discount motor vehicle technology impacts for the actions (or inactions) of independently regulated entities or the agencies that regulate them, even as they vary across time or regions. Would vehicle manufacturers suffer the consequences of upstream regulatory stringency decisions over which they have no control? Given that production methods and associated controls are continually evolving, how would upstream evolutionary impacts be reflected in regulated downstream adjustments in a timely fashion? Lifecycle adjustments would have to be dynamically tied to changes in upstream controls. Moreover, lifecycle changes would have to be dynamically applied to *previously* certified vehicles since the upstream emissions performance of fuels being utilized in both new and existing vehicles would be equally affected. Further, since any adjustment would be based on the ratio of upstream performance for two fuels, how would differences in the uncertainty of a generalized lifecycle estimate for each fuel be resolved? Clearly, there are a number of complex issues that would need to be addressed before equitable upstream adjustments could even be practically considered.

Even ignoring practicalities, a lifecycle approach would, at a minimum, require an adjustment factor to be developed for *all* fuels, not simply natural gas, as well as for *all* vehicle sectors. Adopted standards applicable to light-duty natural gas (or any other alternatively-fueled) vehicles are not subject to lifecycle adjustment. Given that such adjustments would be fuel, not vehicle, specific, there is no basis for establishing an adjustment that is isolated to the heavy-duty sector. In recognition of these various issues, and given the diversity of fuel portfolios and carbon emissions at utilities around the country (which will also change over time), SAFE believes that the appropriate approach to regulating carbon emissions throughout the economy is to regulate them at the point of combustion and not at the point where the power is consumed. SAFE recommends that the EPA and NHTSA abandon any potential lifecycle approach and focus on adopting cost effective control strategies for regulating vehicle and upstream entities separately.

Conclusion

SAFE believes that the deployment of alternative fuels represents the best long-term solution to the dangers posed by oil dependence. Yet, widespread use of these fuels will take decades to achieve. The United States will continue to rely substantially, even dominantly, on petroleum-based transportation fuels to power its transportation system for many years to come, exposing the nation to profound

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specified vehicle production threshold is exceeded, all-electric vehicle operation is assumed to emit zero CO_2. Upstream emissions for all-electric *heavy-duty* vehicles are not considered throughout the proposed Phase 2 period (i.e., CO_2 emissions and fuel consumption for such vehicles are assumed to be zero).

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economic and national security risks. The best way to reduce these risks while that transformation is taking place is to further reduce the oil intensity of the U.S. economy by improving the fuel efficiency of the vehicle fleet. Medium and heavy-duty vehicles represent a crucial component of this effort.

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