SECURING AMERICA'S
FUTURE ENERGY

1111 19TH STREET, NW
SUITE 406
WASHINGTON, DC 20036

TEL: 202-461-2360
FAX: 202-461-2379
SECUREENERGY.ORG

The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks

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October 26, 2018

Fuel Efficiency Standards Should be Modernized to Expand the Use of Advanced Fuels, Promote Driverless Technologies, and Strengthen U.S. Energy Security

Summary

- In 2012, the U.S. National Highway Traffic Safety Administration (NHTSA) and the U.S. Environmental Protection Agency (EPA) together finalized a rulemaking establishing fuel efficiency standards for cars and light-duty trucks for model years 2017 through 2025. The 2012 rulemaking required that the agencies conduct a mid-term evaluation of the standards. The previous administration found the augural standards appropriate and issued the Final Determination in January 2017. After the new administration decided to reconsider the Final Determination, the agencies found that the previous standards were not appropriate. The proposed rule now begins the rulemaking process for new standards, which would maintain the standards from MY 2020 for MY 2021-2026.

- Improved light-duty fuel efficiency has been critically important in lowering the oil intensity of the economy, which in turn strengthens U.S. economic and national security by insulating businesses and consumers from oil price volatility.

- Securing America's Future Energy (SAFE) believes that the opportunity to modernize the fuel efficiency standards while advancing the administration's energy dominance agenda has never been greater. SAFE believes this goal can be achieved while meeting the needs of consumers, the automotive industry, and the nation.

- According to the calculations of the agencies, the cost to the United States of defending the global oil supply is zero. Failure to accurately assess the true military cost of protecting the global oil supply underestimates the value of the benefits. At minimum, approximately $81 billion per year is spent by the U.S. military protecting global oil supplies. The implicit subsidy for all petroleum consumers is approximately $11.25 per barrel of crude oil, or $0.28 per gallon.

- The recent developments around the premeditated murder of journalist Jamal Khashoggi in Istanbul, Turkey serve as a stark reminder of the global oil system's fragility and the risks associated with unforeseen events around the world. Although the nation is undoubtedly more energy secure than it was before the revolution in U.S. shale oil 10 years ago, the United States' dependence on oil continues to present significant economic and national security risks.

- SAFE understands the agencies have expressed safety concerns regarding vehicle lightweighting, but existing research supports the finding that mass reduction can be safely integrated into the current vehicle fleet mix. The agencies' own analysis confirms that mass changes will only bring about a small impact on the overall fatality rate. Rather than focus on mass changes, we encourage the agencies to instead incentivize the introduction of advanced driver assistance technologies (ADAS) to reduce overall crash frequencies and fatalities.

- The agencies argue that unreasonable fuel efficiency standards implemented in the past have resulted in substantial increases in new vehicle prices, which in turn, have or will deter new buyers. This leads to older vehicles staying on U.S. roads longer and prevents the vehicle fleet from realizing the safety gains that newer vehicles offer. It is argued that this significantly harms consumers and justifies a pause in further increases to the standards. SAFE disagrees with these assertions and believes that existing data show that fuel efficiency standards: do not contribute to higher vehicle prices; have not negatively impacted new vehicle sales; and are not keeping consumers in older, dirtier, and less safe vehicles.

- The agencies propose a range of significant changes to the off-cycle technology program, including ending or sunsetting all off-cycle flexibilities. Any elimination, or phase-out, of the off-cycle technology adjustments would threaten to deter or delay investment in connected and automated vehicle technologies and runs counter to the goals of this rulemaking. SAFE encourages the agencies to retain the program, while considering a number of potential improvements tailored to accommodate truly innovative technologies.

- For the first time, the United States is closing in on making fuel choice a reality by bringing electricity, hydrogen, and natural gas fuels into the transportation sector and building fueling infrastructure nationwide. SAFE believes that the agencies should seize this opportunity to enable greater long-term reductions in oil demand, while offering greater flexibility to industry in choosing how to comply with the fuel efficiency standards.

October 26, 2018

Acting Administrator Andrew Wheeler
Environmental Protection Agency
Office of the Administrator 1101A
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Secretary Elaine L. Chao
U.S. Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Administrator Wheeler and Secretary Chao,

Oil dependence is a unique strategic challenge that has undermined the nation's economic sovereignty and national security for over a century. As members of the Energy Security Leadership Council (ESLC), which unites prominent business and military leaders concerned with this threat, we urge the Trump administration to maintain the integrity of the national fuel efficiency program given the crucial role it has played in advancing the nation's energy dominance goals.

As Energy Secretary Rick Perry has stated, "there is no free market in the energy industry." This is especially true with petroleum, and the costs of our dependence are exacerbated through the manipulation of the oil market by the Organization of the Petroleum Exporting Companies (OPEC) and national oil companies. Oil is the lifeblood of the U.S. economy: The nation's transportation sector is 92 percent powered by oil, with no substitutes currently deployable at scale. This costly dependence constrains our foreign policy and transfers our wealth directly into the coffers of nations who share neither our interests nor our values. Even during the period of relatively low oil prices over the past five years, spending on petroleum fuels has accounted for approximately 5 percent of U.S. GDP. Between 1970 and 2015, it is estimated that $3.4 trillion was transferred from the United States to foreign oil producers simply to account for oil price inflation by OPEC.

By accepting the status quo with regards to our oil dependence, American taxpayers and the U.S. military also accept responsibility for securing global oil supply lines at a conservative estimate of $81 billion annually—a cost which is not accounted for by the federal government in its regulatory impact analysis for the fuel economy standards. Domestic production has not solved this crisis. Even with oil imports at a 60-year low, the nation relies on Saudi Arabia and other "swing" oil producers to stabilize global oil markets when facing foreign policy challenges such as Iran's nuclear program, a requirement that limits our foreign policy sovereignty.

Furthermore, the assumption contained in the proposed rulemaking that we will see 30 years of low and stable oil prices is unrealistic, and ultimately dangerous in the context of a pausing of efficiency policies. Oil price volatility is driven by continued misalignment between oil demand and oil supply, which is fueled by global economic growth, global production volumes, geopolitical disruptions, and OPEC intervention, none of which are within the scope of U.S. power to control. The Energy Information Administration (EIA)'s own 2017 analysis sees a range of $50 to $225 per barrel in 2040, illustrating the uncertainty of oil price projections in light of these factors. The proposed rulemaking would increase U.S. gasoline consumption by 500,000 barrels per day through the early 2030s—this is not the path to energy dominance.

Unlike the factors underpinning oil prices which are beyond our power as a nation to control, the fuel efficiency program is ours to determine and serves America's interests by insulating our economy from the volatility of the oil market. We believe these risks, and the current pace of innovation, warrant increasing the stringency of the program by at least 2 percent per year. To further keep the United States at the forefront of global innovation, SAFE and the ELSC urge the administration to leverage the off-cycle credit program to deploy technologies that will save lives and fuel, while keeping the domestic auto industry globally competitive. Immediate adoption of existing advanced driver assistance technologies, in parallel with other traditional efficiency technologies, can generate system-wide fuel savings of 18 to 25 percent while preventing an estimated 9,900 traffic fatalities every year.

Fuel economy standards for light-duty vehicles were implemented for national and economic security reasons. These standards, paired with domestic production, have driven impressive gains in the nation's energy security, but this work is not over. Striking a deal with California will avoid years of counterproductive litigation, increase regulatory certainty for the auto industry, bolster our competitiveness and weaken our adversaries.

The current period of relatively low oil prices and high domestic production has created a sense of complacency that must not be used to justify ceding strategic advantage in efficiency rules, in the hopes that factors outside our control will resolve in our favor. Keeping America prosperous and secure depends on a sustained strategy to end oil dependence and support a thriving automotive industry while strengthening the economy, which can be achieved through the current rulemaking. We thank you for taking the time to consider our full comments, which include our detailed suggestions to achieve this goal.

Sincerely,

Frederick W. Smith
FedEx Corporation

General James T. Conway
34th Commandant, U.S. Marine Corps

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The Importance of Fuel Economy

Improved fuel efficiency is critically important in enhancing U.S. economic and national security. Lowering the oil intensity of the economy by improving vehicle fuel efficiency helps mitigate the vulnerabilities associated with our oil dependence. Although the United States has faced serious challenges as a nation over the past several decades as a result of its dependence on oil, these would have been more serious without the progress made in improving the fuel efficiency of light-duty vehicles.

Oil dependence threatens U.S. national security and long-term economic vitality, and it is the core energy security challenge facing the country today. Although robust domestic liquid fuels production has reduced some of the negative consequences of oil dependence, energy security is primarily a function of consumption, not production. U.S. energy security is determined by oil's role in the economy, and the transportation sector. Mobility—the movement of people, goods, and services throughout the country— is a central component of U.S. economic competitiveness and a cornerstone of the American way of life. Today, this mobility is almost entirely powered by petroleum fuels, which accounted for 92 percent of the transportation energy consumed in 2017.[1]

Since oil is a globally traded commodity, prices are affected by events in oil-producing and oil-consuming countries. The key consequence of this dynamic is that changes in oil supply or demand anywhere tend to affect prices everywhere. Because there are no readily available substitutes to oil in the U.S. transportation sector, volatile crude oil and petroleum product prices represent an enduring threat to the U.S. economy. The recent developments around the premeditated murder of journalist Jamal Khashoggi and the increased potential for a significant global supply disruption serve as a stark reminder of the global oil system's fragility and the risks associated with unforeseen events around the world.

SAFE believes that the standards being considered today can serve as a key pillar for the administration's goal of attaining energy dominance. At a time when gasoline prices are rising, oil markets are contending with increased geopolitical risk and an era of tighter oil supply is predicted. The U.S. Department of Transportation (DOT) and the Environmental Protection Agency (EPA) have a momentous opportunity to place the transportation sector on a trajectory for oil savings that will have clear, positive implications for U.S. energy security in the coming years. In fact, the opportunity to modernize the fuel economy standards, spur innovation in the industry, and advance the administration's energy dominance agenda has never been greater. We encourage the agencies to take advantage of this opportunity and finalize standards that continue to increase in stringency, accommodate and incentivize new and revolutionary technologies, and account for the military costs of oil dependence in this proposed rulemaking.

Fuel Efficiency Standards for MY 2017 – 2025

In 2012, the U.S. National Highway Traffic Safety Administration (NHTSA) and the U.S. Environmental Protection Agency (EPA) together finalized a rulemaking establishing fuel efficiency standards for cars and light-duty trucks for model years (MY) 2017 through 2025.[2] The agencies estimated that the extension of the National Program would conserve approximately four billion barrels of oil over the lifetimes of MY 2017 through MY 2025 light-duty vehicles (LDVs).[3] The 2012 rulemaking required

[1] SAFE analysis based on data from EIA.
[2] NHTSA, "Obama Administration Finalizes Historic 54.5 mpg Fuel Efficiency Standards," August 28, 2012.
[3] NHTSA, *NHTSA and EPA Set Standards to Improve Fuel Economy and Reduce Greenhouse Gases for Passenger Cars and Light Trucks for Model Years 2017 and Beyond*, at 2.

the agencies to conduct a Midterm Evaluation (MTE) of the standards. EPA and NHTSA's requirement was to determine if the standards remain appropriate and to make any necessary adjustments to the rule. Once the MTE was completed in November 2016, the EPA issued a proposed determination for the MTE that called for maintaining the standards. In January 2017, the EPA administrator signed the Final Determination of the MTE, locking the standards in place through 2025. However, in March 2017, the administration indicated that they would reconsider the January 2017 Midterm-Evaluation Final Determination.

While the agencies' reconsideration process ultimately deemed the previous standards to be inappropriate, the agencies must now decide on new standards. The agencies have selected a preferred alternative that exacerbates our vulnerabilities related to oil dependence and is expected, by the agencies own estimates, to increase U.S. oil consumption by nearly half a million barrels per day. America's oil vulnerability, while somewhat reduced, still endures and the nation remains at risk of sudden and large foreign supply disruptions and the damaging consequences of oil price volatility.

Support of One National Program

The agencies' preferred outcome intends to lighten the burden of regulatory compliance for automakers. However, the two major auto industry associations have expressed a preference for a resolution that maintains a unified standard for the federal government and California and incorporates new technologies. Such a resolution would provide regulatory certainty for industry, which has benefited from a framework that brought together disparate interests and created predictability for automakers over the past several years. A rulemaking that disrupts this certainty could lead to a protracted legal battle that would not only prove costly but saddle all stakeholders with years of uncertainty.

As the auto industry is in the midst of one of the most transformative periods in its history, regulatory uncertainty at this transformative moment could prove significantly detrimental to automakers and consumers. It is difficult for automakers to shape their fleets to comply with an uncertain regulatory framework. Moreover, that same uncertainty could delay deployment of new advanced driver-assistance technologies, which have immense potential to save both lives and fuel. Those technologies are poised to achieve mass-market penetration, but the industry requires sufficient lead time to develop and incorporate new technologies. Injecting unpredictability into the investment cycles of automakers at this critical moment has the potential to not only set back safety and efficiency innovations but lead to higher prices for consumers.

SAFE continues to support the National Program, and the important role it plays in reducing oil dependence. We recognize the difficulty in balancing many competing factors but believe that current oil market dynamics reinforce the importance of not weakening the standards. Furthermore, recent events are an important validation of public policies that support long-term goals like efficiency and fuel diversity. Indeed, in the absence of fuel-efficiency standards, global oil price volatility would likely render the country even more exposed to oil price shocks than it is currently.

Solutions

SAFE's mission is to pursue policies and strategies that aggressively reduce the nation's dependence on oil. Ultimately, this will require a diversification of fuel sources in the transportation sector. In pursuit of greater vehicle electrification and in recognition of the promise of autonomous vehicles, SAFE encourages the agencies to carefully consider several issues before finalizing the standards. These issues include reassessing some of the assumptions and inputs used in the model for the technical analysis, adjusting the energy security analysis to account for the military cost of oil dependence, extending incentives for advanced fuel vehicles (AFVs), and examining the off-cycle technology program and its potential to integrate ADAS.

An urgent need exists for policies to insulate the nation from our exposure to the opaque and unfree oil market, and to reduce the dependence on oil that has undermined the nation's economic sovereignty, constrained our foreign policy, and burdened our military forces. Until the U.S. transportation sector is no longer beholden to oil, the country will be vulnerable to oil price volatility. Improving the fuel efficiency of the U.S. vehicle fleet is a valuable insurance policy against this volatility. Continued economic growth and national security will depend in significant part on a clear regulatory structure that prioritizes reduced exposure to global oil price volatility. SAFE looks forward to continuing its dialogue with the administration to develop a fuel economy program that meets these needs.

Reconsidering the Technical Foundation for the NPRM Analysis

SAFE appreciates the opportunity to comment on the proposed fuel efficiency standards. A number of model improvements have been attempted in the most recent analysis which allows the agencies to better evaluate the potential impacts of the standards. However, we have identified several problematic assumptions or interpretations that we believe need to be rectified before a final rulemaking can be completed. Below we offer data, suggestions, and comments on how to improve the analysis to ensure the standards are "appropriate, reasonable, consistent with law, consistent with current and foreseeable future economic realities, and supported by a transparent assessment of current facts and data."[4] We appreciate the opportunity to provide these suggestions and hope that they will be reflected in the final rule.

The Military Cost of Defending the Global Oil Supply

Securing America's Future Energy takes an interest in the economic benefits and costs of the preferred alternative, as well as certain modeling assumptions used in the analysis. Our Energy Security Leadership Council (ESLC) includes numerous business and former military leaders at the highest levels, which uniquely qualifies us to offer comment on the economic externalities from added petroleum use found on Table II-25 in the NPRM (see below, Line 15).[5] SAFE and the ESLC believe that the previous administration, when developing the augural standards, neglected to account for the costs to the United States associated with defending the global oil supply. Today's proposed rule can correct this oversight. SAFE and its ESLC therefore offer the following perspective on the topic and hope the agencies will incorporate the suggestions to ensure that the rule remains consistent with economic realities.

Table II-25 - Benefits and Costs Resulting from the Proposed CAFE Standards (present values discounted at 3%)

Line	Affected Party	Source	Private Benefits and (Costs)	Amount
1	Vehicle Manufacturers	CAFE model	Savings in technology costs to increase fuel economy	$252.6
2			Reduced fine payments for non-compliance	$3.0
3		assumed = -(1+2)	Net loss in revenue from lower vehicle prices	($255.6)
4		net = 1+2+3	Net benefits to manufacturers	$0.0
5	New Vehicle Buyers	assumed = 3	Lower purchase prices for new vehicles	$255.6
6		CAFE model	Reduced injuries and fatalities from higher vehicle weight	$2.4
7			Higher fuel costs from lower fuel economy (at retail prices)*	($152.6)
8			Inconvenience from more frequent refueling	($8.5)
9			Lost mobility benefits from reduced driving	($61.0)
10		net = 5+6+7+8+9	Net benefits to new vehicle buyers	$35.9
11	Used Vehicle Owners	CAFE model	Reduced costs for injuries and property damage costs from driving in used vehicles	$88.3
12	All Private Parties	net = 4+10+11	Net private benefits	$124.2
Line	Affected Party	Source	External Benefits and (Costs)	Amount
13	Rest of U.S. Economy	CAFE Model	Increase in climate damages from added GHG Emissions**	($4.3)
14			Increase in health damages from added emissions of air pollutants**	($1.2)
15			Increase in economic externalities from added petroleum use**	($10.9)
16			Reduction in civil penalty revenue	($3.0)
17			Reduction in external costs from lower vehicle use***	$51.9

[4] NPRM 42987.

[5] SAFE. NPRM. Federal Register. August 24, 2018, pages 43062-43063.

The NPRM mentions the military costs of U.S. oil policy twice. It first states that if U.S. demand for imported petroleum increases, it is "...possible that increased military spending to secure larger oil supplies from unstable regions of the globe will be necessary."[6] SAFE agrees with this assertion and believes that methodologies are available that would allow the agencies to quantify such spending and amend the appropriate line item in their benefit-cost analysis.

The NPRM also argues that, "the scale of oil consumption reductions associated with CAFE standards would be insufficient to alter any existing military missions focused on ensuring the safe and expedient production and transportation of oil around the globe."[7] SAFE believes this to be factually inconsistent with currently available evidence. In 2016, the EPA forecast that the standards for MY 2022-2025, would reduce U.S. petroleum consumption by more than 400,000 and 1 million barrels per day (Mbd) by 2030 and 2050, respectively.[8] Today, the agencies' preferred alternative would result in an increase of U.S. petroleum consumption by 500,000 bd.[9] A change in forecast of such magnitude has meaningful implications for the U.S. economy and our national security. Continued dependence on foreign oil, particularly from the Persian Gulf, will have a profound impact on military spending, despite the recent surge in U.S. domestic oil production. Instead of deliberately ignoring these impacts, the agencies now have an opportunity to account for the military cost of protecting the global supply in their analysis. They should do so by including a minimum 28 cents per gallon cost in their benefit-cost calculations for petroleum externalities. Doing so, would more accurately reflect the true burden on the American military and taxpayers. While it remains uncertain whether such a change would alter the net benefits enough to unambiguously justify a more stringent alternative, including them in the overall calculation is material to the overall impact of the program.[10]

The Case for a Minimum 28 Cent per Gallon Cost Estimate for Defending the Global Oil Supply

In the 2018 Preliminary Regulatory Impact Analysis (PRIA), the agencies stated their justification for not assigning a value to the military security benefits:

> *The analysis does not assign a specific value to the military security benefits of reducing fuel consumption. This view concurs with the conclusions of most recent studies of military-related costs to protect U.S. oil imports, which generally conclude that savings in military spending are unlikely to result from incremental reductions in U.S. consumption of petroleum products resulting from any of the CAFE or CO2 standards considered in this proposal.*[11]

In the 2012 and 2016 rulemakings, as well as in the 2017 Mid-term Evaluation, the agencies explicitly stated that the military costs have a zero weight in the benefit-cost analysis. As is stated more than once, "the main analysis does not assign a value to the military security benefits of reducing fuel consumption."[12] The agencies do discuss military costs in their "sensitivity analysis," but this is inconsequential since only inclusions in the final benefit-cost analysis are determinative.

[6] SAFE. NPRM. Federal Register. August 24, 2018 pages 43106.
[7] SAFE. NPRM. Federal Register. August 24, 2018 page 43212 (footnote 426).
[8] EPA. "Proposed Determination on Appropriateness of the MY 2022-2025 LDV GHG Emissions Standards Under the Midterm Evaluation: Technical Support Document." Nov. 2016. P. 3-24, Table 3.10.
[9] NPRM 42995.
[10] Note: SAFE released an issue brief detailing these calculations last month. See, Jonathan Chanis and Paul Ruiz, "The Military Cost of Defending Global Oil Supplies," Securing America's Future Energy, September 20, 2018.
[11] "SAFE Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks. Preliminary Regulatory Impact Analysis." July 2018, Updated Aug 23, 2018. P. 11.
[12] See, e.g., PRIA, page 8.

Today, the agencies reiterated that they believe the cost to the United States of defending the global oil supply is zero, and decline to include any expense for U.S. efforts to protect the global oil supply.[13] Costs for stationing U.S. troops in and around the Persian Gulf, ceaseless efforts to protect the transit of oil at sea, and costs associated with fighting three wars in the greater Middle East since 1991 are not accounted for when the agencies calculate the net positive impact the standards have had, and continue to have, by reducing U.S. consumption of motor fuels. Failing to appreciate the national security aspect of the fuel efficiency program thus undervalues the benefits.

Fortunately, academic literature provides multiple methodologies for estimating this expense. While it may be true that there are no direct military savings by altering the degree of U.S. oil dependency, the opportunity costs of reduced consumption have profound positive impacts for the defense budget and other military priorities.

The bureaucratic rationale for the "zero cost to defend global oil supplies" stems from the way the U.S. government budgets for defense. Since it is difficult to assign a cost to the oil protection mission—and since the Department of Defense (DoD) would realize no savings if this mission were not pursued—EPA and NHTSA conclude that it is unnecessary to assign any value above zero to this activity. Allocating costs between protecting the global oil supply and other military missions is oftentimes contentious, and any resources freed by reducing or dropping this mission would be reallocated immediately to other existing military priorities. This budgeting approach, however, fails to account for the opportunity costs of protecting the oil supply. It misses the fact that other U.S. defense interests (including improved readiness, cyber security, or hypersonic and space weapons programs) could be pursued if this money were not spent on oil protection. The United States' commitment to global oil protection is very costly, reducing that cost makes it possible for the military to focus on other threats—resulting in a genuine benefit.

In narrowly defined budgetary terms, the primary conclusion from SAFE's examination of this issue is, at minimum, approximately $81 billion per year in costs are incurred by the U.S. military for protecting global oil supplies. This sum is approximately 16 percent of recent DoD base budgets. If one spreads this out over the 19.8 million barrels of oil consumed daily in the United States in 2017, the implicit subsidy for all petroleum consumers is approximately $11.25 per barrel of crude oil, or $0.28 per gallon of all petroleum consumed. If the Overseas Contingency Operations (OCO) fund, which was originally used to isolate Iraq War funding, are included, this cost rises to over $13 per barrel or $0.31 per gallon. And if the long-term, full economic costs of fighting wars in the Middle East are included, the true cost may be more than $30 per barrel of crude oil.[14]

While there is debate over the precise role of oil in America's wars in the greater Middle East, several retired military members of SAFE's ESLC and other defense budget experts that were consulted for this report believe the connection is clear. Excerpts from our conversations with these military and defense experts are included in an Appendix. As then-Vice President Dick Cheney observed in 2004, "Oil is

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[13] See e.g., EPA. "Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Technical Support Document." November 2016. Section 3.5.2.4: "Military Security Cost Components of Energy Security." (Pp. 3-34 - 3-36.)
[14] Analysis by Linda Bilmes and Joseph Stiglitz in "Estimating the Costs of War: Methodological Issues, with Applications to Iraq and Afghanistan" [in Michelle R. Garfinkel and Stergios Skaperdas (eds.), *The Oxford Handbook of the Economics of Peace and Conflict*. 2012.] estimate that this cost "…may well be in the range of $4 to $6 trillion, or even higher, once the long-term budgetary and economic costs are factored in."

unique in that it is so strategic in nature. We are not talking about soapflakes or leisurewear here. Energy is truly fundamental to the world's economy. The Gulf War reflected that reality."[15]

John F. Lehman, former Secretary of the Navy, recently said, "...more than half the Defense budget is for the security of Persian Gulf oil. Defending Persian Gulf oil is a major distraction from existential defense issues. Oil dependency complicates the military equation beyond our comprehension." SAFE has undertaken this analysis to make clear that America's dependence on oil as the primary mobility fuel has costs above and beyond those seen by consumers at the gasoline pump. Sixteen percent of a $500 billion-plus annual base defense budget, or $81 billion, is significant. If one carries this expense out for the duration of the fuel efficiency standards, from 2021-2026, the sum approaches half a trillion-dollars that the United States pays for defending oil. Worse still, if at least part of the costs for America's Middle East wars are included in the calculation, this cost grows significantly.

The people of the United States could do a great many things with the billions of dollars that are currently allocated to protect the global oil supply. As the conversations with SAFE's ESLC and others make clear, the present analysis is not a stalking-horse for reducing the defense budget. Rather, it is done to demonstrate that oil dependency has real military costs. While these costs are obscured by the bureaucratic logic of defense budgeting, they nonetheless exist, and they involve not just billions of dollars annually, but the lives of over a million American servicemen and women. A substantial reduction in transportation sector oil consumption would allow the United States to free itself from the need to assume its role as chief guardian of global oil supplies and permit the country to make better use of resources currently devoted to this purpose. As retired General Duncan McNabb, former commander of the U.S. Transportation Command and another member of SAFE's ESLC said: "If we can reduce our dependence on oil, we could reduce our presence in the Gulf and use the funds for other critical military priorities...The same funds could support different security priorities. We would make different choices that would make us safer and more secure."

Reducing U.S. exposure to the global oil supply system would allow the U.S. military to reallocate more resources toward other strategic considerations. SAFE believes that the current rulemaking process is an ideal place for the agencies to overturn outdated thinking that began under the previous administration, and now include a cost of at least 28 cents for defense of the global oil supply in their benefit-cost calculations. The remainder of this section will describe in further detail the methodology and information used to arrive at the $0.28 per gallon figure. Also included in the Appendix are transcripts from various interviews and other related information.

Historical Background

U.S. policymakers have long appreciated the role of petroleum in national security. The development of the internal combustion engine and mass adoption of petroleum as a fuel for nearly all transportation modes since World War I has made access to petroleum a critical national security and foreign policy priority. Petroleum remains essential for daily life, especially in the transportation sector. A severe and prolonged supply disruption would be economically devastating and potentially catastrophic for the United States. Accordingly, the United States remains active in protecting the global availability of petroleum and ensuring access for itself and its allies. The United States has actively sought to prevent domination of Persian Gulf petroleum-producing states by powers hostile to our interests, and the

[15] "Full text of Dick Cheney's speech at the Institute of Petroleum, Autumn Lunch." London Institute of Petroleum. June 8, 2004.

United States has even gone to war to prevent such domination. The military component of U.S. international petroleum policy is substantial.[16]

Existing Literature on the Military Cost of Protecting the Global Oil Supply

SAFE reviewed the academic and policy community literature on the military cost of protecting the global oil supply. Most of this literature was written between 2003 and 2010, during the second Iraq War, and when the price of gasoline was escalating rapidly. To produce a middle ground estimate, we eliminated the more extreme studies. To be conservative, if a study presented two sets of cost calculations—one including the Iraq War cost and another excluding it—we chose to use the figure excluding the war. This was done to more narrowly define the budget cost and provide a baseline estimate for oil protection expenditures. To present a fuller range of estimates, the war costs were included in a separate review that considered not just the narrow OCO costs, but also the wider and longer-term economic costs of conducting wartime operations.

All methodologies for the narrow studies rely on either geographic- or functional-based calculations to attribute petroleum defense costs. The crux of the issue for geographic calculations are how one isolates regional costs, such as the Persian Gulf, and the share of that region's budget attributable to oil defense. Functional calculations are much more complex and go through the DoD budget by major line items and attribute a share to petroleum defense. Both methodologies largely use a subjective assessment of the attributed costs because of the issues around multipurpose use and asset utility fungibility. A more complete review of methodological issues related to cost attribution can be found below.

After reviewing the literature, we selected six studies to analyze. These studies are listed in Table 1.

Table 1: Cost Estimates Examined

Author(s)	Paper / Study Title
Dancs, Anita	"The Military Cost of Securing Energy." National Priorities Project, Global Research. 2008.
Delucchi Mark A. and James J. Murphy	"U.S. military expenditures to protect the use of Persian Gulf oil for motor vehicles." Energy Policy, 36. 2008.
Gholz, Eugene	"U.S. Spending on its Military Commitments to the Persian Gulf," in Charles L. Glaser and Rosemary A. Kelanic, *Crude Strategy: Rethinking the US Military Commitment to Defend Persian Gulf Oil*. Georgetown University Press, 2016.
Klare, Michael	"The Futile Pursuit of Energy Security by Military Force." *The Brown Journal of World Affairs*, Vol. 13, No. 2. Spring/Summer 2007.
O'Hanlon, Michael	"How Much Does the U.S. Spend Protecting Persian Gulf Oil?" In Carlos Pascual and Jonathan Elkind, eds. *Energy Security: Economics, Politics, Strategies, and Implications*. Brookings Institution Press, 2010.
RAND Corporation (Keith Crane, et al.)	"Imported Oil and U.S. National Security." Chapter 5: Incremental Costs for U.S. Forces to Secure the Supply and Transit of Oil from the Persian Gulf. Santa Monica, 2009.

[16] For a review of this see Jonathan Chanis, "U.S. Foreign Policy and Petroleum" in *Great Decisions 2017*. The Foreign Policy Association. January 2017.

To make this review more meaningful, SAFE looked at the estimates of the above studies and updated them to reflect inflation-adjusted 2017 dollars (see Table 2, next page). Additionally, SAFE took one of the two most rigorous analyses, the RAND study, and used its methodology to recalculate the petroleum protection costs for the 2017 defense budget. All calculations were then expressed in a per-barrel and per-gallon amount based on 2017 U.S. oil consumption.

The featured RAND methodology examines the structure of U.S. forces from "the top down" by dividing the defense budget into increasingly differentiated shares and assigning each share a percentage cost for "energy security."[17] RAND expressed these costs as a percent of each Combatant Command's (CoCom) budget. The study then sums the costs attributed to oil defense to produce a total cost figure. SAFE's updated results utilize RAND's percentage allocation and reproduces their methodology with 2017 DoD budget figures. The updated annual cost of defense of the petroleum supply lines is $87 billion or $0.28 per gallon. A full breakdown of the calculations can be found in the Appendix. A significant feature of the RAND estimate is its conservative bias; it excludes OCO costs and it makes no allowances for the wider and longer-term economic costs of the two most recent Middle East wars.

The second most methodologically-rigorous estimate was produced by Delucchi and Murphy. Their analysis assumes the bulk of U.S. military expenditures for safeguarding global oil supplies are spent in the Persian Gulf and they first established an estimate of the military cost of defending all U.S. interests in the region. Then they created a baseline peacetime estimate by categorizing joint allocative costs (i.e., those not exclusively related to the Gulf) and variable overhead costs. This figure was then compared to estimates of wartime military expenditures, which are averaged over a longer time period instead of concentrated in a few years.

When Delucchi and Murphy examined just the cost of motor fuel for vehicles (i.e., not all oil consumption) in the United States, they determined it to be between $0.03 to $0.15 cents per gallon in 2004 (between $0.04 and $0.19 cents in 2017 dollars). This smaller range does not incorporate a larger subset of categories, including, for example, expenditures related to protecting the interests of U.S. oil companies in the Persian Gulf (that do not just supply the United States), protecting the world economy from the effects of a Persian Gulf supply disruption, and the use of oil by other (non-transportation) sectors in the United States. Consequently, they also provided a much higher estimate of $0.12 to $0.33 cents per gallon equivalent in 2017 dollars for motor fuels only.

[17] Crane, Ibid. P. 66.

Study Findings

The results for the studies analyzed are as follows.

Table 2: Estimated Cost of Protecting Gulf Oil Supplies Recalculated Through Equivalent Percent of 2017 DoD Budget

Author	Cost for Year(s) Observed ($billion)	Percent DoD Budget for Estimated year[1]	Implied 2017 Equivalent Budget ($billion)[2]	Implied 2017 Cost ($/gal)
Dancs, Anita – "peacetime"	$97 (2009)	19%	$99	0.32
Delucchi & Murphy – "High"	$73 (2004)	19%	$102	0.33[3]
Delucchi & Murphy – "Low"	$27 (2004)	7%	$38	0.12[3]
Gholz, Eugene	$75 (2016)	14%	$75	0.25
Klare, Michael	$100 (2008)	21%	$109	0.36
O'Hanlon, Michael	$50 (early 2000s)[4]	13%	$65	0.21
RAND – "Top-Down"	$83 (2009)	16%	$84	0.28
	Average[5]	16%	$81	$0.28

[1] If the study did not provide a specific percentage figure, SAFE calculated it by dividing the author's absolute expenditure figure by that year's base defense budget (i.e., excluding OCO funding).
[2] Base 2017 Department of Defense Budget of $513 billion was utilized (excludes Overseas Contingency Operations funding).
[3] For vehicle motor fuel only; does not include the other half of the barrel.
[4] The year 2005 was used as the base year.
[5] Averages may differ slightly due to rounding.

An Estimate with Wider Economic Costs

In other work done in the last several years, two economists, Linda Bilmes and Joseph Stiglitz, have estimated the full budgetary and economic costs to the United States of the wars in Iraq and Afghanistan. This approach specifically considers the microeconomic and macroeconomic impacts which are not considered by standard budget-based models. In 2012, the authors concluded that the true costs of these conflicts "…may well be in the range of $4 to $6 trillion, or even higher, once the long-term budgetary and economic costs are factored in."[18] Among other things, these costs include payments for veterans' lifetime healthcare and disability expenses, the accelerated depreciation and replacement of military hardware, large and negative U.S. workforce impacts, and other macroeconomic affects such as increased oil insecurity, oil price volatility, and the effects of the war on monetary policy.

[18] Bilmes and Stiglitz. "Estimating the Costs of War: Methodological Issues, with Applications to Iraq and Afghanistan." Op. Cit.

In 2010, Bilmes and Stiglitz estimated that lifetime medical claims by returning veterans constitute between $600 and $934 billion of unrecognized future liabilities.[19] In a 2008 book, the authors estimated higher U.S. debt servicing costs due to the wars at $288 billion.[20] In a 2006 article, they also "conservatively" estimated that the Iraq War cost the United States $300 billion through higher oil prices—and this was just for the first six years of the war.[21] The wars also negatively affected the U.S. long-run economic growth rate through such things as the loss of reservists' wages while in service, and the loss of contractor lives and the lifetime treatment costs of injured contractors who are cared for outside the Veterans Administration system. Bilmes and Stiglitz specifically took issue with the U.S. government's official accounting for the statistical value of a life that does not include the economic impact of foregone productivity and income. They estimated this impact at $6.1 million per life lost, as opposed to a DoD budgetary impact of approximately $500,000 per life. Commercial calculations of the monetary value of a human life in the United States tend to be very close to the estimate used by Bilmes and Stiglitz, though the value of a statistical life used in assessing the standards is higher, so this remains a conservative estimate.

If one uses the midpoint of the Bilmes-Stiglitz total cost estimate, $5 trillion, a conservative estimate of the per gallon cost for these wars easily exceeds $30 per barrel (over $0.70 per gallon) over a 20-year period. This war cost is largely additional to the $0.28 per gallon cost calculated from the other estimates utilizing the base defense budget. In sum, the estimated $0.28 per gallon estimate is likely a very conservative number for the cost of oil dependence.

Conclusion

The literature on the direct military cost to the United States of protecting the global petroleum supply indicates that the cost is, at minimum, approximately $81 billion per year, or approximately 16 percent of recent DoD base budgets. If one spreads this out over 19.8 Mbd of petroleum consumed in the U.S. in 2017, the implicit oil subsidy is roughly 28 cents per gallon. If the OCO fund is included this cost would be approximately 32 cents per gallon. If the long-term, full economic costs of fighting Middle East wars are included, the figure would likely exceed $4 trillion and more than $0.70 per gallon.

SAFE and its ESLC strongly believe that a cost of at least $0.28 per gallon should be used by EPA and NHTSA when looking at the economic externalities of petroleum use. The funds spent by the U.S. government each year to protect the global oil supply should undoubtedly be factored into the benefit-cost analysis.

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[19] Ibid.
[20] *The Three Trillion Dollar War*. W.W. Norton, 2008.
[21] Bilmes and Stiglitz. "Estimating the Costs of War*." Op. Cit.* P. 23.

Response to the Agencies' Assessment of the State of U.S. Energy Security

The recent developments around the premeditated murder of journalist Jamal Khashoggi in Istanbul, Turkey serve as a stark reminder of the global oil system's fragility and the risks associated with unforeseen events around the world. In response to possible U.S. sanctions against Saudi Arabia over the killing, an official at the Saudi Press Agency said, the kingdom rejects "any threats of economic sanctions or political pressure" and cautioned that it would "respond with greater action."[22] A publication by Turki Al Dakhil, a close confidant of the Royal Court and head of the state-owned Arabiya news network, also warned "If President Trump was angered by $80 oil, nobody should rule out the price jumping to $100 and $200 a barrel or maybe double that figure."[23] This response, marking Saudi Arabia's willingness to deploy the "oil weapon" against the United States, underscores a strategic vulnerability.

While this latest Saudi threat highlights the instability of the global oil market, it is clear that U.S. oil vulnerability endures. In fact, the United States has never been more exposed to the vagaries of the global oil market than it is today.[24] Nevertheless, the agencies assert that the United States has "entered a new [oil] paradigm."[25] They contend that there is now less urgency for the United States to conserve energy because oil prices "will rise only moderately in the future" and that "price shocks are less likely."[26] While passages in both the NPRM and PRIA make some effort to present alternative views, the assessment that the United States is "currently producing enough oil to satisfy nearly all of its energy needs" seriously discounts the global nature of the oil market and the enduring vulnerabilities associated with our dependence.[27] Although the nation is undoubtedly more energy secure than it was before the start of the U.S. shale oil revolution ten years ago, the United States' dependence on oil continues to present serious economic and national security risks.

The agencies have an important responsibility to the nation to ensure this rulemaking addresses these challenges. SAFE believes that increasingly stringent fuel efficiency standards are necessary and that it would be imprudent to select an alternative that would increase U.S. oil consumption by more than 500,000 barrels per day. Applying the 0.28 cent per gallon of motor gasoline cost estimate detailed in the previous section, a 500,000 barrel per day increase in consumption results in an additional $2.1 billion per year to defend global oil supplies. These costs would be compounded onto the $81 billion per year that the United States already spends safeguarding these supplies. Oil has enormous economic costs, and so it is important the agencies understand the nature of the global oil market and the risks associated with our dependence. To that end, the agencies standards should satisfactorily minimize these vulnerabilities.

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[22] See, e.g., Saphora Smith and Linda Givetash, "Saudi Arabia rejects 'threats' after Trump comments on missing journalist Jamal Khashoggi," NBC News, October 14, 2018.
[23] See, e.g., Sam Meredith, "Al Arabiya op-ed warns of oil spike and 'economic disaster' if US sanctions Saudi Arabia," CNBC, October 15, 2018.
[24] EIA, "The U.S. is an active participant in petroleum markets as both an importer and exporter." April 18, 2018.
[25] EPA and NHTSA, PRIA, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021 – 2026 Passenger Cars and Light Trucks. July 2018 – (Updated August 23, 2018), pp. 114 and 124; EPA and NHTSA, "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks," NPRM, *Federal Register,* Vol. 83, No. 165, August 24, 2018.
[26] Ibid. Pp. 123 and 119.
[27] Ibid. Pp. 43211-43212.

Oil's Role in the U.S. Economy

The idea that the United States could achieve independence from the global oil market is fundamentally misguided. At its core, the American energy security problem remains one of overwhelming dependence on petroleum. Oil remains America's vital fuel, accounting for nearly 40 percent of total primary energy consumption, a share larger than any other energy source.[28] But that measure alone understates its importance because petroleum today accounts for 92 percent of the energy consumed in transportation—a share largely unchanged since the advent of the automobile, and there are no short-term transportation alternatives available at scale. This reliance has made oil the lifeblood of the U.S. economy. As SAFE demonstrated in the military cost of dependence section of these comments, the necessity to access reliable and affordable supplies continue to be a vital national security interest.

Oil derives its strategic significance from its role in the overall U.S. economy. The total value of oil consumed by the United States represents a significant portion of all economic activity in the nation. Even when oil prices are low, the value of total consumption remains large. More generally, the United States is by far the world's largest oil consumer. Between 2010 and 2018, U.S. oil demand averaged 19.4 Mbd, about 22 percent of the world total.[29] Today, the U.S. transportation sector alone consumes more oil than any national economy in the world. At nearly 14 Mbd, transportation currently accounts for more than 70 percent of total U.S. oil demand.[30] The largest share is attributable to passenger vehicles, which currently consume more than 8 Mbd.[31]

Since oil is relatively easy to move by tankers, pipelines, rail cars, and trucks, there is essentially a single global market. Oil prices are determined in relatively open (but not free) markets, and it is traded globally. This means that prices are affected by events in oil-producing and oil-consuming countries around the world. In some cases, oil prices even can be significantly affected by events in countries that are neither large oil consumers nor large producers—for example, by countries that host important shipping channels or infrastructure. The key consequence of this dynamic is that changes in oil supply or demand anywhere tend to affect prices everywhere. The impact on the United States—or any other consuming country—is a function of the amount of oil consumed and it is not primarily related to the amount of oil imported.

In the case of both oil crises during the 1970s, global oil price increases were driven by supply-side events. At the height of the 1973-74 OPEC oil embargo, the disruption to global oil supplies peaked at 4.3 Mbd, or 8 percent of global supplies. There were gasoline shortages, lines at filling stations, and eventually rationing. Outbreaks of violence related to obtaining gasoline were not uncommon.[32] The recession after the 1973–74 oil shock was the worst since the 1930s, and it was not eclipsed until the Great Recession of 2007–09. This supply interruption drove an almost 300 percent increase in global oil prices, a shock that affected the entire global economy.

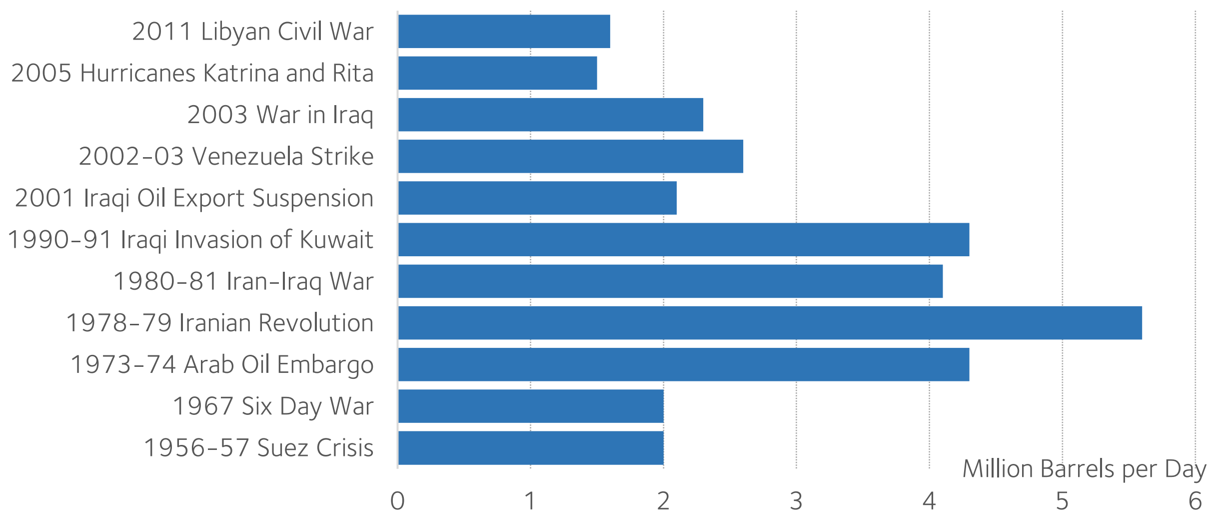
[28] SAFE analysis based on data from EIA, *Monthly Energy Review* (*MER)*, September 2018, Table 1.3 (2018 data).
[29] SAFE analysis based on data from EIA, *Monthly Energy Review*, September 2018, "Petroleum Overview" (Table 1.2).
[30] EIA, *Monthly Energy Review*, September 2018, "Petroleum Consumption: Transportation and Electric Power Sectors" (Table 3.7c).
[31] Oak Ridge National Laboratory, *Transportation Energy Data Book Edition 36.2*, Table 1.14, August 31, 2018.
[32] See Meg Jacobs. *Panic at the Pump: The Energy Crisis and the Transformation of American Politics in the 1970s.* Hill and Wang, 2017.

Sudden, Large Foreign Supply Outages are Still Highly Possible

The NPRM and PRIA assert that sudden and major supply disruptions and price shocks are less likely than in the past.[33] However, this is far from evident, especially if the period in question is through 2050. Constructing the proposed rule off this assumption is imprudent.

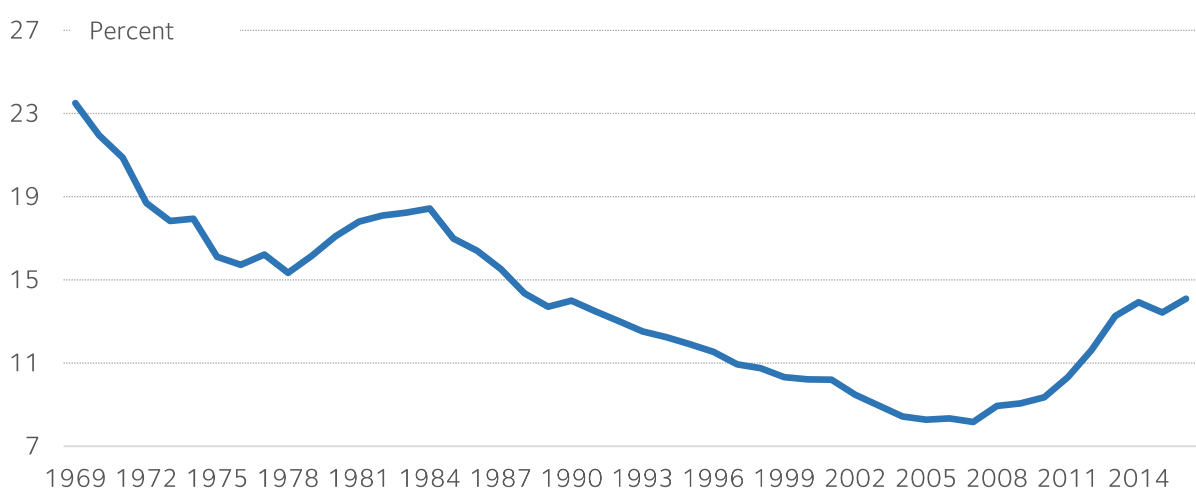
The United States has not experienced a large oil supply disruption since 2003 when the Venezuelan outages combined with reduced Iraqi production to remove approximately 5 million barrels per day (Mbd) at its peak from the market. It has become easy to view U.S. light-tight oil (LTO) production as a silver bullet for solving the U.S. oil dependency problem but given how much the United States relies on the global oil supply for gross imports and as a price setting mechanism, the impact of a large foreign disruption would immediately affect the United States (see Figures 1).

Figure 1: Major World Oil Supply Disruptions



Source: EIA.

Figure 2: U.S. Share of Global Oil Production



Source: EIA

[33] PRIA. Op. cit. pp. 123 and 119.

At the time of the last Venezuela/Iraq oil supply disruption, U.S. oil production (crude and NGLs) constituted 9.5 percent of global production. (See chart 1 above.) Since this disruption, U.S. production of oil has more than doubled to over 12 Mbd and the U.S. share of global production has risen to 14 percent above. However, the U.S. share of global production is still significantly lower than during the 1970s and the first oil shock. Consequently, when the NPRM and PRIA note that the U.S. share of consumption is now lower than previous periods and that the nation is therefore more secure,[34] it fails to account for the even sharper decline in the U.S. share of global production.

The Agencies Should Consider a Wider Range of Price and Production Projections

To conduct an evaluation of the potential implications for energy security in the proposed rule, the PRIA and NPRM utilize the EIA's "Reference Case" projections from the Annual Energy Outlook (AEO). SAFE recognizes the value of EIA's AEO as the standard tool used in a regulatory impact analysis by U.S. government agencies to evaluate long-term oil price trends. However, given the EIA's own acknowledgement of the difficulty in using these projections, the reference case numbers should not be the exclusive case the agencies use to assess the state of U.S. oil security. Only acknowledging this in the sensitively analysis insufficiently recognizes the imprecision of the AEO reference case.

The EIA cautions that, "Projections in the AEO should be interpreted with a clear understanding of the assumptions that inform them and the limitations inherent in any modeling effort."[35] Projections are "an estimate of something in the future, based on present data or trends."[36] AEO's projections for oil prices, gasoline prices, U.S. petroleum production, and net imports are not meant as accurate forecasts of the future. In fact, the EIA regularly quantifies the accuracy of its previous AEO projections. EIA's own assessment shows a significant range of error including, "…absolute percent differences for energy prices between 10% and 40%. Net imports tend to exhibit even larger average differences, ranging between 40% and 90%."[37] It should be noted that these EIA appraisals only extended for approximately one decade. Any future projections conducted for a longer time scale would show an even wider range of potential error.

The benefit-cost analysis conducted for the proposed rule is highly sensitive to changes in oil prices. Nowhere is this more evident than with the assumed maximum gasoline price for 2017 through 2050. The 2017 AEO, upon which the proposed rulemaking is based, includes a significant range of oil price assumptions: the low oil price projection keeps prices below $50 per barrel through 2040; the high oil price projection sees $225 per barrel; the reference case sees oil prices around $105 per barrel.[38] Based on the reference case projection, the agencies assume retail gasoline prices between 2018 and 2050 will not exceed $4 per gallon.[39] The agencies acknowledge some uncertainty, but do not account for the extremely high range of variance that EIA projects. As the figure below indicates, gasoline prices through 2050 range widely from approximately $2.41 on the low end, to almost $5.95 on the high end.

Notably, the AEO High Gasoline Price shows prices rising above $5/gallon by the mid-2020s. If prices were above $5/gallon, there would be significant urgency to conserve oil. The agencies should plan for

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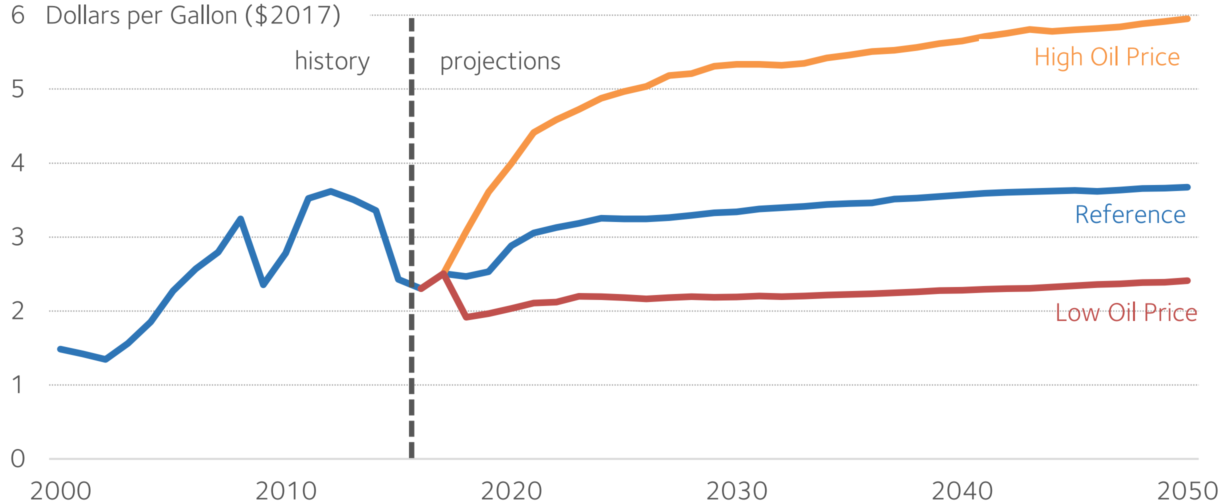
[34] PRIA, Op. cit. p. 116.
[35] EIA. "AEO, 2018 with Projections to 2050." Feb. 6, 2018. P. 8.
[36] American Heritage Dictionary.
[37] EIA. *AEO. Retrospective Review, 2017.* September, 2017. P 2.
[38] Adam Sieminski. EIA. AEO, 2017. January 5, 2017. P. 16.
[39] PRIA. Op. Cit. P. 118.

Figure 3: Motor Gasoline Retail Prices



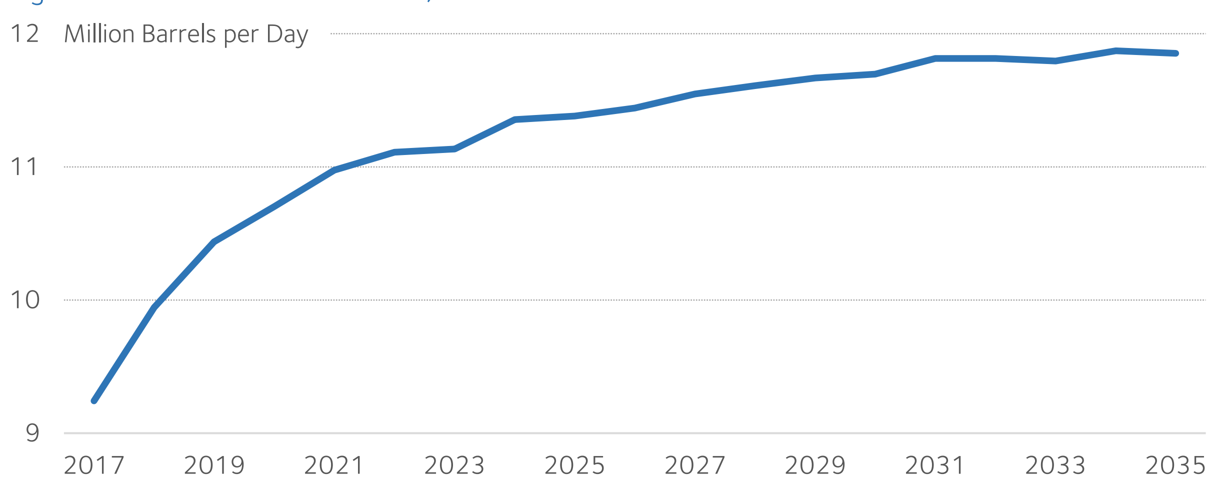
Source: EIA.

such a contingency. Simply "deferring" to the reference case allows the agencies to give inadequate weight to the enormous range of uncertainly inherent in the proposed rule.[40]

Discerning the Relationship between Crude Oil and Petroleum Liquids

The primary feedstock to produce gasoline is crude oil. If the agencies want to consider the economic significance of petroleum production or total U.S. energy security, then focusing on "liquids" production is appropriate. However, if the agencies wish to assess the U.S. transportation sector and gasoline security, then the primary metric should not be liquids, but crude oil. As indicated in the EIA reference case data in chart 4 below, future U.S. crude oil growth is significantly more restrained than the liquids projection. However, even in the AEO reference crude oil production projection, there are issues which suggest the agencies should be more cautious in using this reference data as evidence for a "new oil paradigm."

Figure 4: U.S. Crude Oil Production, EIA Reference Case



Source: EIA.

[40] NPRM. Op. Cit. P. 43002.

Interpretation of EIA Production Data

The agencies state that U.S. oil production will continue to grow steadily for the next 30 years. As stated in the PRIA, "…increases in domestic petroleum production are expected to continue through [the next three decades] as technological advances allow for easier and more cost-effective production of oil from conventional and unconventional resources."[41] It is notable, however, that *the agencies make a substantial data error when utilizing EIA projections* of petroleum production growth. In Table 3-1 ("Petroleum Production and Supply") of the PRIA, the agencies confuse two different EIA data sets and thus they overstate future projections of U.S. production growth.[42] Contrary to what is in the table, included below, the EIA reference case does not say that U.S. petroleum production will grow from 13.1 Mbd in 2017, to 17.9 Mbd in 2020, (i.e. a 4.8 Mbd increase). The historical figures in the table (including the figure for 2017) contain production of crude oil, condensate, and natural gas liquids. The second set of EIA data contained in Table 3-1 (the projections starting with 2020), include all these items plus renewables and refinery processing gains. As a result, the table overstates U.S. production growth by close to 2 Mbd.[43] Moreover, and as noted above, by focusing on all "liquids" and not just crude oil, a less then correct picture of future U.S. oil security is presented.

Leaving aside the incorrect data and the use of liquids production instead of crude oil, the analysis presents a highly optimistic case for future U.S petroleum growth that is not evident across the range of EIA AEO projections. Many positive factors would have to occur for U.S. production growth (even of

Table 3-1 - Petroleum Production and Supply (Million Barrels per Day)[52]

	Domestic Petroleum Production[53, 54]	Net Petroleum Imports[55, 56]	U.S. Petroleum Consumption[57, 58]	World Petroleum Consumption[59, 60]	Net Imports as a Share of U.S. Consumption[61, 62]
1975	10.0	5.8	16.3	56.2	35.8%
1985	10.6	4.3	15.7	60.0	27.3%
1995	8.3	7.9	17.7	70.0	44.5%
2005	6.9	12.5	20.8	84.4	60.3%
2010	7.5	9.4	19.2	89.0	49.2%
2012	8.9	7.4	18.5	91.0	40.0%
2014	11.8	5.1	19.1	93.6	26.5%
2015	12.8	4.7	19.5	95.3	24.1%
2016	12.4	4.8	19.7	96.9	24.4%
2017	13.1	4.2	19.9	98.3	21.1%
2020 (projected)	17.9	2.3	20.3	100.0	11.5%
2025 (projected)	18.9	0.7	19.7	101.9	3.4%
2030 (projected)	19.4	-0.2	19.2	104.2	-0.9%
2035 (projected)	19.7	-0.6	19.1	108.0	-3.2%

[41] PRIA. Op. cit. P. 114.

[42] P. 115.

[43] Note: Technically, the agencies disclose the data incompatibility in the chart's footnotes, but one really has to be familiar with the data to understand it. But more importantly, the agencies never disclose the false assessment (if they knew about it) that the figures present.

liquids) to continue growing for three decades. Eventually drilling technologies, resource availability, prices, or some combination of the three will constrain U.S. production growth. As the CEO of Schlumberger (the world's largest oil service provider) recently said: "The well-established market consensus that the Permian can continue to provide 1.5 million barrels per day of annual production growth for the foreseeable future is starting to be called into question."[44]

While the NPRM and PRIA note some of the above points, the final analysis makes it clear that the agencies reject the uncertainty of continued U.S. production growth. SAFE thinks that this is imprudent, and if the agencies cannot provide a compelling explanation for why U.S. production will increase for three decades, this assumption should be abandoned.

Reassessing the United States' Future as a Net Petroleum Exporter

The agencies argue that the U.S. shale oil revolution has transformed the global oil industry and that U.S. oil security is assured through ever increasing domestic oil production. Advances in oil industry technology and higher prices have reduced current American oil imports, and in the future, the agencies state that imports will be even lower.[45] According to the proposed rulemaking, "…the U.S. is projected to become a net exporter of petroleum and petroleum products by 2030."[46] In the intervening period, if there were a sudden and large foreign supply disruption, U.S. shale oil producers could compensate for lost oil imports since shale is more responsive to higher prices. Leaving aside the fact that oil security is primarily determined by the amount of oil consumption, not by the level of imports, this view overemphasizes the degree and significance of the changes brought about by increased U.S. oil production. According to the proposed rulemaking:

> *Increase(s) in domestic production (are) projected to decrease U.S. reliance on foreign oil substantially over the next two decades. Net imports accounted for 24.1 percent of U.S. domestic production in 2015 but are projected to decline to 3.4 percent by 2025, and the U.S. is projected to become a net exporter of petroleum and petroleum products by 2030.*[47]

However, as seen in the figure below, the EIA has five primary projections and three show the nation as a significant net importer of petroleum, or only a very modest net exporter. Even in the (third) reference case projection used by the agencies, the United States is only "a modest net exporter of petroleum from 2029 to 2045."[48]

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[44] Paal Kibsgaard, quoted in Ed Crooks, "Schlumberger chief warns on US shale oil production. *Financial Times*. Oct. 19, 2018

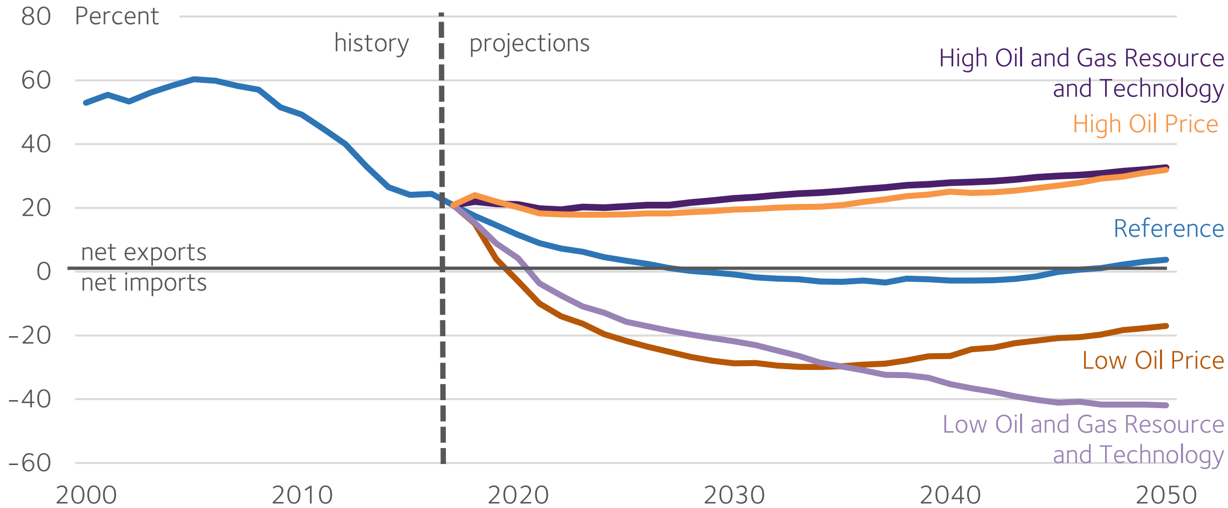
[45] Ibid. Pp. 116-118.

[46] Ibid. P. 114.

[47] PRIA. Op. Cit. P. 114.

[48] EIA. "AEO, 2018 with Projections to 2050." Feb. 6, 2018. P. 53.

Figure 5: Petroleum Net Imports and Exports as a Percentage of Product Supplied



Source: EIA.

The notion that the United States will achieve oil security by becoming a *substantial* net petroleum exporter is highly uncertain. In fact, it is unlikely to occur in any meaningful way for any prolonged period of time. Even if it did, a very large portion of those exports would be much lower value products such as condensate and NGLs (e.g., ethane and propene). Combining all these lower value hydrocarbons with crude oil presents an overly optimistic picture of the potential outlook for U.S. exports and its implications for oil security. Moreover, under all EIA AEO projections, gross crude oil imports will still range from 3 to 6 Mbd and will represent between 15 and 30 percent of total U.S. petroleum consumption.[49] Even at the lower end, this number is substantial and would undoubtedly include meaningful quantities of crude oil from OPEC or OPEC-allied nations. Consequently, the United States is, and will remain, dependent on global crude oil markets for a substantial part of its crude oil supply.

Gross Oil Imports Will Continue to Impact U.S. Energy Security

SAFE is concerned that the energy security analysis presented by the agencies underappreciates the importance of gross crude oil imports. It is important to note that while U.S. net import dependence has declined over the last few years, the United States will still require substantial purchases of crude oil from abroad for the foreseeable future. Such a dependence on gross crude oil imports constitutes an important national security vulnerability and should be acknowledged by the agencies.

From a refinery processing and profitability perspective, crude oil is not fungible.[50] Over the last 30 years, the types of crude oils produced and traded globally has increased substantially. Many of these crudes, which now constitute a very large part of the world's supply, vary enormously by quality and processing characteristics. Previously, when crude oil production was more localized and when refineries and end-product markets were less differentiated, quality differentials between crude oils were less important. Today, however, they are very important.

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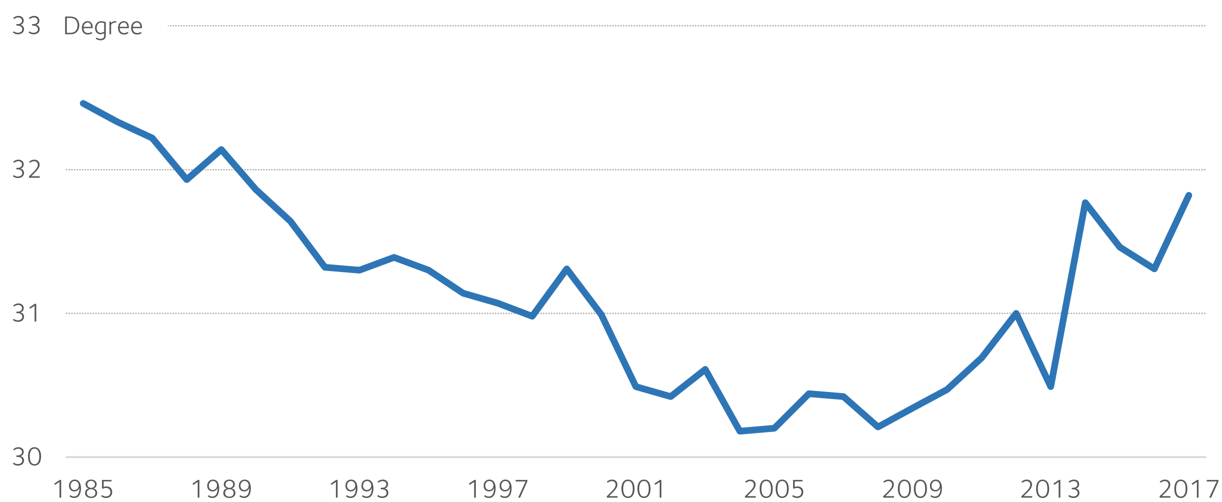
[49] EIA, AEO.
[50] See Jonathan Chanis, Crude Oil Is Not Fungible, Where It Comes from Does Matter. *American Foreign Policy Interests*. May/June 2012. Pages 144-148.

In September 2018, the United States imported 7.8 Mbd of crude oil and it exported 2.1 Mbd of crude oil.[51] The reason it did not process that 2.1 Mbd domestically, and just imported 5.7 Mbd, is that the domestic refinery system is not optimized for the ever-increasing amounts of tight oil. LTO made up 54 percent of total U.S production in 2017, and nearly 90 percent of the 3.1 Mbd growth in U.S. production from 2010 to 2017.[52] The EIA 2018 reference case projects U.S. tight oil production to increase through the early 2040s, when it will surpass 8.2 Mbd. It will then make up almost 70 percent of total U.S. production.[53]

As the chart below shows, U.S. refineries once processed high levels of light crude oil, but since 1980 over 175 refineries have closed, many of which were designed to process lighter (and sweeter) oil.[54] Presently, U.S. refineries are saturated with LTO. They are not configured to process the ever-increasing volumes of this oil, at least without spending heavily on upgrading projects. As the quantity of LTO in the system increases, it becomes more difficult for refiners to produce the required amount of refined products, especially middle distillates (e.g., diesel fuel, jet fuel, marine gas oil, etc.).[55] Since it is more profitable to export excess LTO and import foreign heavier crudes, the industry has shown little interest in upgrading U.S. refineries to handle ever-increasing domestic LTO production. This is economically rational. It is just cheaper to buy foreign feedstock. Consequently, even if the United States were to become a net petroleum exporter, meeting domestic refinery demand from 100 percent locally-produced crude oil is extremely unlikely and the gross import dependence and vulnerability is likely to endure.

Figure 6: Average API Gravity of U.S. Refinery Input



Source: EIA.

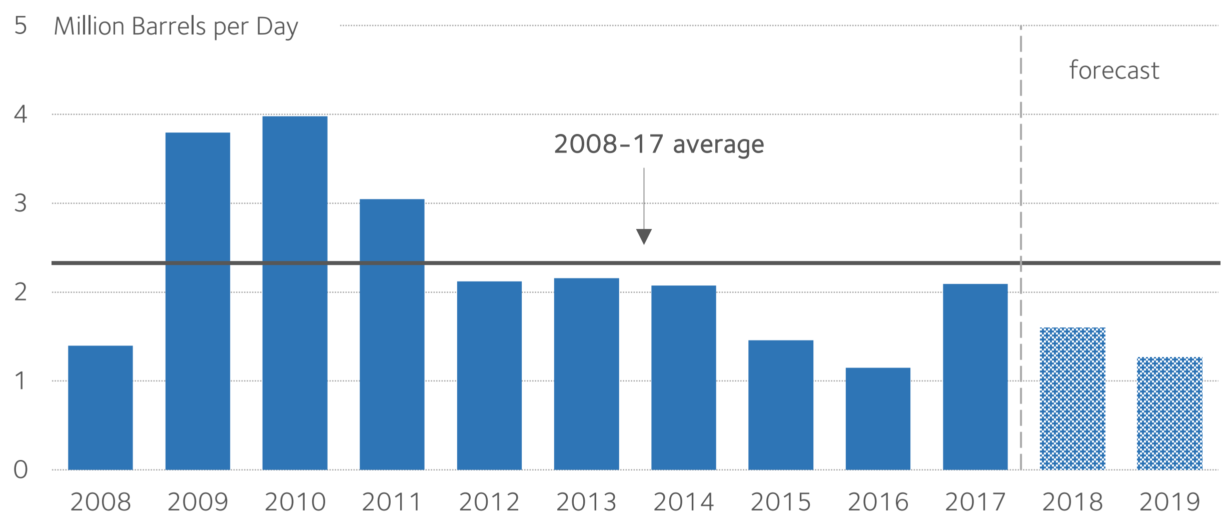
[51] EIA. Petroleum & Other Liquids. "Weekly Imports & Exports." Oct. 11, 2018.
[52] EIA. "U.S. crude oil production growth projected to be led by light, sweet crude oil." April 9, 2018.
[53] EIA. "Tight oil remains the leading source of future U.S. crude oil production." Feb. 22, 2018.
[54] Since 1980, over 175 U.S. refineries have closed, and a very large part of this capacity, especially in the midcontinent and along the east coast have been refineries built to process light sweet crude oil. See Edward Swain. "Sulfur, Coke, and Crude Quality-Conclusion U.S. Crude Slate Continues to Get Heavier, Higher in Sulfur." *Oil and Gas Journal*. Jan. 9, 1995; EIA. Refinery Capacity and Utilization, Selected Years, 1949-2011. AER. 2011 and EIA. "U.S. Refineries, Operable Capacity as of January 1, 2017."
[55] Since U.S. refineries were not built to process large amounts of LTO, they have limited processing capacity for such oil. Reconfiguration is possible by purchasing / constructing new equipment such as preflash towers, light ends recovery and naphtha processing units, but this is expensive.

U.S. Oil Production Can Not Compensate for a Sudden and Large Foreign Supply Disruption

In the event of a sudden and prolonged global disruption of even 3 to 4 Mbd, the normal flow of imports to the United States and other countries would be interrupted and it would be near impossible for the United States and other countries to make up for most of this lost volume. Global oil producers, including the United States, have neither sufficient spare production capacity nor the ability (at least in an economically relevant timeframe) to bring on new production to compensate for such a supply disruption. Moreover, the prices necessary to elicit this supply response (e.g., $100, $150, $200 or higher) would greatly reduce the benefits of having the added supply (see below). Globally, producers lack sufficient spare production capacity to substantially increase production to compensate for a sizable outage of more than 1-2 Mbd.

Oil security and spare capacity are inversely related and historically spare oil production capacity of approximately 3-4 percent of global demand has usually been sufficient to cushion normal and unforeseen minor global outages. But this level usually only compensates for modest global outrages and it tends to only occur after unexpected declines in oil demand. This has not been the case for most of the last fifteen years as global oil consumption has increased by 12.5 Mbd. According to the EIA, OPEC currently has 1.6 Mbd of surplus production capacity. (See the chart below.) Next year, OPEC spare capacity is forecast to fall to 1.3 Mbd. As spare capacity declines, the danger of a supply disruption increases.[56]

Figure 7: OPEC Surplus Crude Oil Production Capacity



Source: EIA.

The agencies note that some argue that U.S. shale production is more price responsive and thus could quickly compensate for any foreign disruption. This, however, is mistaken. By itself, U.S. shale production is more price responsive, but it is produced in a system with many other binding constraints. Most notable is an absence of adequate pipeline capacity to take the oil out of the producing regions. It might take $5-7 million and 9-12 months to drill and complete a shale well in some basins, but it takes 2 years or more and billions of dollars to plan and build a U.S. pipeline, even in the best of circumstances. From an oil security perspective, the agility and nimbleness of shale production is offset by the stiffness and capital intensity of infrastructure. The increasing reliance on short-cycle oil

[56] Sizable spare production capacity tends to occur only after unexpected declines in oil demand, and global demand has been rising significantly for the last three years.

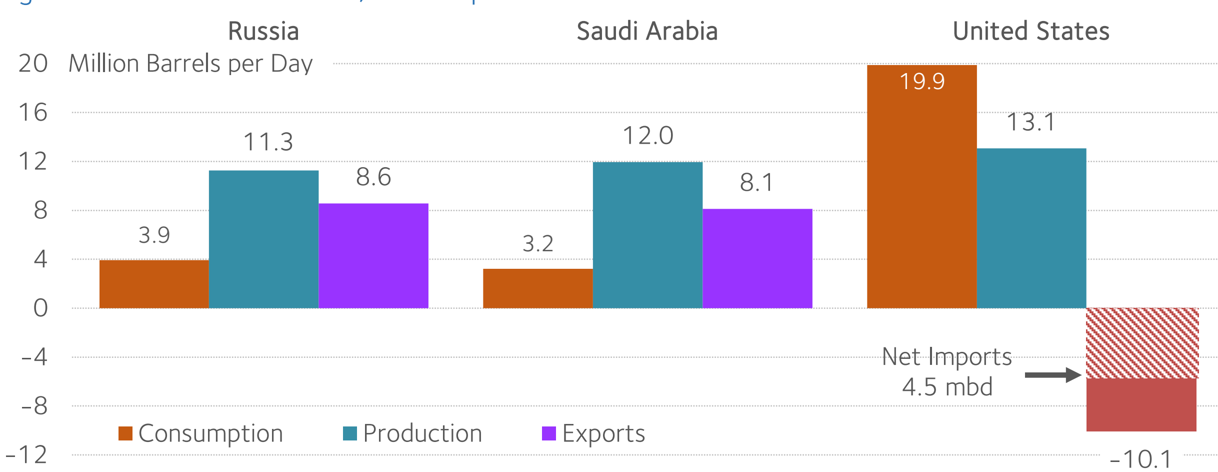
investment has given the U.S. some ability to responds to a foreign disruption, but it could do little to offset a substantial disruption in the short-term. In the interim, severe economic hardship induced by higher prices (see below) and even a return of violence at the gas pump would mostly likely arise.[57]

Even restricting exports of U.S. crude oil in the short run would not guarantee the domestic availability of sufficient refined products. First, the 1.5-2 Mbd of crude oil currently exported could not replace 5-6 Mbd of gross U.S. crude oil imports, and second, as noted, the U.S. refinery system is sub-optimally suited for additional amounts of shale oil. In the short run, shunting more LTO into the domestic refining system would likely force refinery runs to decline.[58] Consequently, meeting U.S. refined product demand, especially for diesel fuel, which is the lifeblood of domestic commerce, could be problematic.[59] Additionally, if current trends continue, even the U.S. Strategic Petroleum Reserve (SPR) will be less useful than previously thought. Since 2011, the U.S. government has sold close to 65 million barrels from the SPR and it is committed to selling an additional 194 million barrels (or one-third of what remains) by 2025.

The United States is Still Inextricably Tied to the Global Oil Price

In global oil market terms, even with higher production levels and reduced imports, the United States is still a price-taker, not a price-maker.[60] Consequently, the United States must accept the prevailing global oil price since it lacks sufficient market power to influence decisively this price. Relative to its consumption needs and production costs, the U.S. oil position is much less advantaged than that of Russia or Saudi Arabia, the other two dominant global oil producers. The United States produces 10 percent and consumes 20 percent of the world's petroleum supply, and the cost of U.S. production is much higher than in most other major producing countries. Despite a pervasive narrative to the contrary, the present U.S. production and consumption profile does not provide the strongest base

Figure 8: Gross Oil Production, Consumption and Trade



Note: Includes crude oil and petroleum products.
Source: BP, p.l.c.

[57] For a review of what this (including the violence) was like in the 1970s, see Meg Jacobs, *Panic at the Pump: The Energy Crisis and the Transformation of American Politics in the 1970s.* (Hill and Wang, 2017)
[58] And the long run, large investments in upgrading capacity would have to be made in order to accommodate this type of oil in larger quantities.
[59] Since U.S. refineries were not built to process large amounts of shale oil, they have limited secondary unit processing capacity for such oil. Reconfiguration is possible, but it is very costly and thus far the industry has shown little interest in expending the funds to upgrade the refineries.
[60] A price-taker is a market participant that is not able to dictate the prices of a good or service it produces.

from which to transform global oil supply and demand patterns. (See chart 8 above.) This is particularly true since the cost to produce a barrel of crude oil varies from under $10 per barrel in Saudi Arabia, to approximately $17.50 per barrel in Russia. In the United States half-cycle cost is over $35 per barrel,[61] and the full-cycle cost for LTO is over $60 per barrel.

Some argue that the shale revolution already has transformed the global petroleum industry and that U.S. oil security is assured through ever increasing domestic oil production and decreasing imports. However, as detailed above, this is a very problematic narrative and the United States has not entered a new oil paradigm. Foreign-sourced crude oil remains critical to meeting domestic U.S. oil requirements and the country is firmly tied to the global oil price set by others.

An Oil Price Shock Will Still Damage the U.S. Economy and Its Consumers

In the NPRM, the agencies recognize that there is "…considerable debate about the magnitude and continued relevance of potential economic damages from sudden increases in petroleum prices…" However, the agencies clearly side with the view that the U.S. "…has probably reduced the potential costs of oil price shocks to the U.S. economy…"[62] SAFE, along with a number of prominent economists, disagrees with this conclusion and thinks that a sudden and large oil price increase would still do substantial damage to the U.S. economy and its oil consumers.

The crux of the issue concerns how responsive variables such as gasoline demand or GDP are to changes in gasoline prices. As noted by the agencies, some economists have suggested that the price and income elasticities of demand have increased and that the elasticities of inflation and GDP to oil prices have decreased.[63] However, this notion has been increasingly challenged.[64] Many now argue that the U.S. economy may be slightly more resilient against modest and gradual gasoline price increases, but that large and sudden price increases can still be quite damaging.[65] While there are qualifications for price shocks driven by demand increases (as opposed to supply disruptions), the more concerned view continues to see a persistent and very negative relationship between a rapid and large increase in petroleum prices and GDP, employment, inflation and other variables.[66] While increased domestic oil production may have slightly offset some of this negativity by reducing wealth transfers out of the country, it has not altered the fundamental oil price increase-negative macroeconomic relationship.

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[61] Rystad Energy, quoted in CNN Money. November 23, 2015. To some extent, especially relative to Russia, part of the higher U.S. production costs is due to higher environmental standards followed in the United States.
[62] PRIA. Op. Cit. P. 1070.
[63] See, e.g., Cristina Conflitti and Matteo Luciani, "Oil price pass-through into core inflation," Finance and Economics Discussion Series 2017-085, Washington: Board of Governors of the Federal Reserve, 2017; Tobias N. Rasmussen and Agustín Roitman, "Oil Shocks in a Global Perspective: Are they Really that Bad?," International Monetary Fund, August 2011; and M.A. Hooker, "Oil and the macroeconomy revisited," Working Paper, Board of Governors of the Federal Reserve System, 1999.
[64] Jonathan Hughes, Christopher Knittel, and Daniel Sperling, "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand," National Bureau of Economic Research, Working Paper 12530, September 2006; Keith Sill, "The macroeconomics of oil shocks," Business Review, 2007; Olivier Blanchard and Jordi Gali, "The Macroeconomic Effects of Oil Shocks: Why are the 2000s So Different from the 1970s?," National Bureau of Economic Research, Working Paper 13368, November 2007; and Stephen Brown and Mine Yucel, "Oil Prices and Economic Activity: A Question of neutrality," Economic and Financial Review, Federal Reserve Bank of Dallas, 1999.
[65] Gbadebo A. Oladosu et al., "Impacts of oil price shocks on the United States economy: A meta-analysis of the oil price elasticity of GDP for net oil-importing economies," Energy Policy, Volume 115, April 2018, p. 523-44.
[66] See, e.g., Carmine Difiglio, "Oil, economic growth and strategic petroleum stocks," Energy Policy, Volume 5, December 2014, p. 48-58.

Two prominent economists illustrating this view recently said they "…found no evidence that the emergence of the shale oil sector has fundamentally altered the propagation of oil price shocks to the U.S. economy."[67] Another warned that since the world has not seen a major supply disruption since 2003, the newer research relying on recent data "..may not capture the effects of major oil supply disruptions [that yield] stronger and asymmetric responses [and] might generate more inelastic supply and demand responses and a stronger GDP response…"[68]

A comprehensive study sponsored by the U.S. Department of Energy in 2016 reviewed the literature and tested various oil price elasticities with different macroeconomic models. It concluded that "…big supply disruptions may put more stress on economic relationships than the small oil supply disruptions…might generate more inelastic supply and demand responses and [result in] a greater price shock and a bigger GDP loss."[69] "The fact that the historically large oil supply disruptions are concentrated in an earlier period not well covered by the most current estimates reduces our confidence in them."[70] Smaller, gradually phased in price increases may be less disruptive, but a larger and more abrupt increase would be very damaging. There is an oil price tipping point beyond which higher prices would do serious economic damage to the U.S. economy.

Numerous researchers have modeled the effects of oil price increases on the U.S. economy. The table below shows an earlier estimate produced by IHS Markit using its Global Insight Model (formerly the DRI-WEFA Model) for a $10 per barrel oil price increase.[71] This, older IHS estimates is a good rough assessment because it uses elasticities which would now be close to the midpoint range of the debate. The IHS assessment can be applied to the approximately $10 increase the United States recently experienced from December 2017, until mid-July, 2018.[72] During this period, WTI crude oil prices rose from the high-fifty dollar per barrel range, to the high-sixties.[73] If this new price level endures for several quarters, according to the model (all things being equal), in one-year, real GDP will be $37 billion lower, and in two years it will be approximately $90 billion lower than it otherwise would have been.[74] Inflation two years forward will be a half a percent higher, and real disposable income per capita (currently $39,563) will decline by approximately $210.[75] The economy will employ 120,000 fewer workers in one year and over 400,000 fewer workers in two years. Finally, vehicle sales will decline by close to 200,000 units and 270,000 units, respectively.

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[67] Kristiane Baumeister and Lutz Kilian. "Lower Oil Prices and the U.S. Economy; Is it Different this Time?" Brookings Papers. Sep. 15, 2016. P. 332.
[68] Stephen P.A. Brown. "New estimates of the security costs of U.S. oil consumption." *Energy Journal*. Nov., 2018. P. 1.
[69] Alan Krupnick, Richard Morgenstern, Nathan Balke, Stephen P.A. Brown, Ana María Herrera, and Shashank Mohan. "Oil Supply Shocks, US GDP, and the Security Premium." Resources for the Future. November, 2017. P. 20.
[70] Ibid. P. 23.
[71] Nigel Gault. Oil Prices and the U.S. Economy. IHS Markit. February 24, 2011. (The average WTI price over the 30 days before this estimate was written was $88.25/barrel. Hence, a $10 change is roughly an 11% change.)
[72] As noted, the metric is less valuable in calculating the impact of the price rise from the high $20, to the low $50 from early 2016, to late 2017. This is an example of a sharp price increase subsequent to a major price decline.
[73] "WTI Crude Oil Futures Price." Bloomberg, LLP.
[74] Calculated off a $17.385 trillion GDP ("Real Gross Domestic Product." St. Louis Federal Reserve.)
[75] Calculated off a February, 2018 level ("Real Disposable Personal Income: Per Capita." St. Louis Federal Reserve.)

Table 3: IHS Model-Estimated Full Effects of a $10/Barrel Rise in Oil Prices

	Year One	Year Two
Real GDP	-0.21	-0.52
Real Consumer Spending	-0.23	-0.51
Real Disposable Income	-0.40	-0.53
Consumer Price Index (CPI)	0.46	0.52
Employment (thousands)	-120	-410
Vehicle Sales (thousands)	-180	-270

In the end, the benefits that come with increased oil prices (e.g., higher oil industry wages and increased investment) are simply not enough to outweigh the overall losses to the non-oil parts of the economy. Shale production is no doubt a positive element in the global oil market, but it is not enough to safeguard America's interest in the face of OPEC and Russian price manipulation.

The Global Oil Market Remains Unfree

As Energy Secretary Rick Perry stated at the end of 2017, "… it's really important for people to understand, in general terms, there is no free market in the energy industry."[76] Secretary Perry was speaking about energy in generalities, but this fact is exceptionally demonstrable with regards to oil given the active market manipulation of the OPEC cartel. This manipulation must be understood as part of any legitimate effort to address U.S. energy security concerns. While a free market solution to America's oil problem would be preferred, this is just not possible as long as Saudi Arabia and OPEC, continue to manipulate the market.

The lack of a free and fair market is primarily due to the fact that as much as 90 percent of conventional oil reserves are held by national oil companies (NOCs).[77] Though a few NOCs function as highly sophisticated companies at the frontier of industry technology and standards, NOCs usually function as branches of their central government, depositing production revenues into the national treasury where they may be diverted to other purposes. This distortion leads to underinvestment in some of the world's lowest cost, most accessible oil reserves. Simply put, there is no free market for oil as long as the OPEC NOCs continue to behave as they do.

The presence and continued active management of oil prices and supply by OPEC is one of the most significant drivers of risk and uncertainty in oil markets. Controlling over 75 percent of the world's lowest cost oil reserves, OPEC leverages its oil resources and state-controlled oil companies of member states to exert significant control over oil markets and prices to serve the interests of its member states. In addition to coordinated supply responses, OPEC has found it can manipulate prices by managing investor and trader sentiment through public statements and rhetoric, "jawboning" oil

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[76] Timonthy Cama, "Perry: There is no free market in the energy industry," The Hill, October 6, 2017.
[77] Silvana Tordo, Brandon Tracy, and Noora Arfaa, *National Oil Companies and Value Creation*, The World Bank, 2011, at xi.

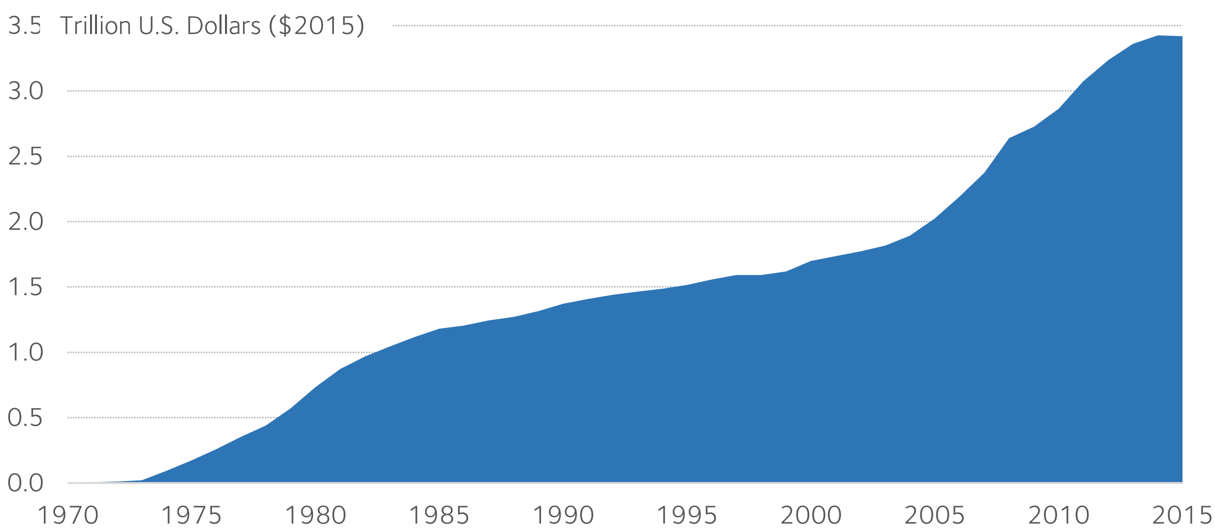
prices from a low of $28 per barrel in February 2016 to end the year at $58 per barrel, even while adding 1.4 Mbd of supply to the oil market during that time.

It was OPEC's historic oil embargo in 1973 and the economically debilitating oil price shocks that resulted which prompted the United States to implement the fuel economy program. Although no single event has replicated the severity of the embargo, OPEC's recent behavior demonstrates a renewed commitment to consolidating control over oil prices and supply. OPEC drove down the price of oil in 2014 by maintaining high levels of production—a response to booming oil output in the U.S. shale patch. This shocked the market, which expected Saudi Arabia to restrict supply. The sharp decline in oil prices caused more than 310 corporate bankruptcies in the U.S. oil and gas sector, and the loss of over 195,000 U.S. jobs.

After driving down prices, in 2015 and 2016, OPEC increased oil prices in 2017 by holding extraordinary meetings and negotiating deals with other oil producers and manipulating market sentiment. This buoyed oil prices without any actual cuts being implemented. Following a year of discussions, during which oil prices more than doubled while OPEC increased supply, the group established a production target of 32.5 million barrels per day, and incorporated other major oil producing countries, including Russia, as a part of a long-term agreement to accelerate the market rebalancing and boost prices. In this agreement, OPEC and its allies formed the Vienna Group which re-imposed individual national quotas and established a monitoring committee to ensure compliance. By the end of 2017, the "Vienna Group" cut production by 1.8 Mbd, or almost 2 percent of global supply. Now, OPEC continues its active collaboration with Russia and other petrostates, publicizing its intentions to establish a "timeless" alliance, consolidating control over 55 percent of global daily oil supply.[78]

OPEC's market power is set to grow over time. The vast majority of the world's proven reserves are located in OPEC countries, with almost two-thirds in the Middle East. Furthermore, media reports show that OPEC has worked to establish collaborative dialogue with Wall Street and hedge funds to understand how to manage market sentiment and speculative trading.[79] U.S. businesses and consumers

Figure 9: Cumulative Wealth Transfers to Foreign Oil Producers, 1970 - 2015



Source: SAFE analysis based on data from ORNL.

[78] Platts, Russia raises expectations of 'timeless' OPEC oil alliance, April 9 2018.
[79] Benoit Faucon, "OPEC Woos Old Nemesis—Wall Street," Wall Street Journal, March 6, 2017.

have no way to divine the decisions of these producers who work outside the free market. Vienna Group coordination has recently pushed prices to four-year highs, meaning consumers who purchased larger vehicles when prices were driven low are now forced to spend greater proportions of their household budgets on gasoline--just one of the many risks of energy security complacency.

These is no question that despite its unrivaled value as an energy source and transportation fuel, oil dependence has exacted a heavy toll on the nation's security and prosperity over the decades. By one estimate, and as shown in the chart above, the United States has already transferred over $3 trillion to foreign oil producers as a result of oil price increases from their collusion.

Conclusion: A 500,000 Barrel per Day Increase in U.S. Consumption of Petroleum is Substantial and it Increases U.S. Oil Insecurity

The United States has not experienced a large oil supply disruption since 2003 when Venezuelan outages combined with reduced Iraqi production to remove approximately 5 Mbd from the market. It has become easy to view shale production as a silver bullet for solving the nation's oil dependence problem. However, a large foreign supply disruption would have a lasting and negative impact on the United States. Shale production is helpful, but it is not enough to safeguard America's interest in the face of OPEC price manipulation.

By the agencies' own calculation, the proposed rule will increase U.S. oil consumption by about 500,000 barrels per day.[80] This is a significant increase in oil consumption. On an annual basis, it is 182.5 million barrels per year; over ten years this is 1.8 billion barrels. Volumetrically, it is equivalent to over half of current crude oil imports from Saudi Arabia. At $75 a barrel, this is worth $137 billion. At approximately $3 per gallon for gasoline, a half a million barrels per day increase in consumption will take $23 billion a year from consumers, and $115 billion from 2021 through 2025. Such a large amount will have an important and negative impact on the U.S. balance of trade. It also will increase the energy intensity of the U.S. economy. What might seem like a small amount relative to daily consumption adds up to a great deal over the next two decades. SAFE believes that the agencies should reevaluate their energy security analysis in light of the details presented above.

[80] NPRM. Op. cit. Pp. 42998 and 42995.

Concerns of Reduced Safety from Lightweighting Vehicles and Other Factors Overstated

The question surrounding safety and fuel economy has historically centered around whether making a vehicle lighter, and thus more fuel-efficient, increases the risk of fatalities. Based on a review of safety literature, including NHTSA's assessment of lightweighting and other mass reduction technologies, SAFE believes it is inaccurate to argue that there is any meaningful safety risk associated with lightweighting vehicles.[81] Available evidence indicates mass reduction, as a compliance strategy for fuel efficiency standards, cannot conclusively be shown to increase fatalities. Nevertheless, the proposed rulemaking finds the potential for some impacts on the fatality rate under the agencies' preferred scenario.[82] "In light of the reality that vehicle manufacturers may choose the relatively cost-effective technology option of vehicle lightweighting for a wide array of vehicles and not just the largest and heaviest, it is now recognized that as the stringency of standards increases, so does the likelihood that higher stringency will increase on-road fatalities," the agencies say in the current rulemaking.[83] This rationale is at odds with NHTSA's own safety literature and outside experts who have found that lightweighting, when done properly, creates no increased safety risk.[84] Furthermore, the agencies' own analysis finds there is little to no variation in fatalities associated with mass reduction, no matter which scenario the agencies choose.[85] Moreover, the agencies' conclusions of other safety impacts stem from confusing and seemingly-flawed modeling that should be revisited before the rule is finalized.

Mass Changes Produce Small Safety Impact

Mass reduction has historically been among the diverse set of technical approaches automakers have used to comply with fuel economy standards. This approach changed in 2012 when the agencies moved to a footprint-based standard. Under the new program, auto manufacturers lightened some vehicles without making them smaller and were discouraged from choosing downsizing as a primary compliance strategy.[86] NHTSA's 2012 rulemaking acknowledged that weight reductions in these heaviest of vehicles produced net positive results for not only vehicle fuel economy but also the overall fatality rate. "Any reasonable combination of mass reductions while holding [the] footprint constant in MY 2017 to 2025 vehicles [...] would be approximately safety-neutral" and "would not significantly increase fatalities and might well decrease them."[87] More than two-thirds of new light-duty vehicle sales are now light trucks, providing ample opportunity to further improve U.S. auto safety through the program.[88]

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[81] NHTSA, EPA, and CARB, *Technical Assessment Report*, 2016; and National Academies of Sciences (NAS), *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles*, *2015.*
[82] Proposed Rule at 43111. "NHTSA does not consider this conclusion to be definitive because of the relatively wide confidence bounds of the estimates. The estimated mass effects are similar among analyses for both classes of passenger cars; for all reports, the estimate for lighter passenger cars is statistically significant at the 85-percent confidence level, while the estimate for passenger cars is insignificant."
[83] Id. at 42991.
[84] Id. at 43016. "NHTSA's research of historical crash data indicates that holding footprint constant, and decreasing the mass of the largest vehicles, will have a net positive safety impact to drivers overall, while holding footprint constant and decreasing the mass of the smallest vehicles will have a net decrease in fleetwide safety."
[85] Id. at 43152.
[86] EPA and NHTSA, *2017 and Later Model year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards,* October 15, 2012.
[87] Kahane, C.J., *Relationships Between Fatality Risk, Mass, and Footprint in Model Year 2000-2007 Passenger Cars and LTVs.* NHTSA, Docket Number NHTSA-2010-0152-0023, Washington, D.C., August 2012.
[88] SAFE analysis based on data from the Bureau of Economic Analysis.

In 2015, a National Academy of Sciences (NAS) panel contracted by NHTSA concluded that lightweighting the entire vehicle fleet was unlikely to have adverse effects on either vehicle or highway safety. The panel concluded that while there may be limited safety risks associated with a transition period between the current fleet mix and one that is lightweighted, those risks could be mitigated.[89] Principally, experts have established, and the agencies have acknowledged in the NPRM, that making vehicles lighter while keeping their footprints constant would have a beneficial impact on safety for society, especially if the most significant weight reductions came from the heaviest of cars.[90]

Moving away from conventional iron and steel alloys to advanced, lightweight materials, reduces the weight of vehicle chasses and improves overall safety. Heavier steel may account for as much as 40 percent of the typical vehicle's body weight.[91] Consequently, lightweighting the heaviest vehicles, including pickup trucks and sports-utility vehicles, can lead to substantial safety improvements. Many of the recent and planned reductions announced by automakers have been exclusively among cars with footprints exceeding 50 square feet.[92] These reductions make the heaviest cars lighter but retain the size of the vehicle's footprint. The popular 2015 Ford F-150, for example, was downweighted as much as 700 pounds from the 2014 model year.[93] The Ford F-150 has a five-star crash safety rating and still retains its status as one of the best-selling trucks in the United States.[94]

In the 2017 through 2025 rulemaking process for the augural standards, NHTSA and EPA found that fleetwide new minivans and light-duty trucks could be safely downweighted as much as 20 percent.[95] Large cars could see a 10 percent weight reduction.[96] In addition to aluminum composite vehicle bodies, carbon fiber-integrated systems have also emerged as an advanced material to achieve these reductions. Aluminum, magnesium, and plastic/composite materials promise new design flexibilities which are at increasingly competitive costs compared to more traditional components.[97] One promising example out of the Pacific Northwest National Laboratory found a 20 percent improvement in the weight of carbon fiber-reinforced polymer over conventional steel and fiberglass materials.[98]

The industry is driving down costs with these innovative substitutions, but it is important to note that innovations like these are occurring in larger cars with footprints greater than 41 square feet.[99] Put plainly, industry is not lightweighting small vehicles. To state otherwise, overstates the safety impacts

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[89] Note: During this transition phase there could be an increase in safety risk due to greater differences in the weights of two vehicles involved in two vehicle crashes, if one vehicle is down-weighted while the other is not.
[90] Proposed Rule at 43016.
[91] Note: NAS estimate based on a vehicle with a curb weight of 3,800 pounds. National Academies of Sciences, *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles*¸ 2015 at 222.
[92] Analysis by The Aluminum Association provided to SAFE.
[93] Puckett, S.M. & Kindelberger, J.C., *Relationships Between Fatality Risk, Mass, and Footprint in Model year 2003-2010 Passenger Cars and LTVs,* 2016.
[94] NAS, *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles*¸ 2015 at 36; and Matthew DeBord, "Take a closer look at Ford's F-series pickup trucks — the best-selling vehicles in the US," Business Insider, April 19, 2018.
[95] NAS, *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles*¸ 2015 at 241; and U.S. Department of Energy, *Workshop Report: Light-Duty Vehicles Technical Requirements and Gaps for Lightweight and Propulsion Materials,* February 2013.
[96] Id.
[97] See, e.g., John German, *Lightweighting as a Measure to Reduce GHG Emissions*, The International Council on Clean Transportation, April 2012.
[98] Pacific Northwest National Laboratory, Press Release, "PNNL Leads Team to Accelerate Development of Affordable Carbon Fiber Composites," October 2017.
[99] Analysis by The Aluminum Association provided to SAFE.

of the preferred scenario versus the current program. This overstatement, in turn, inflates the projected costs of the alternatives.

It is notable that mass changes are a comparatively small proportion of the program's overall stated safety impact when compared to sales and rebound effects. At a three percent discount rate, vehicle mass only accounts for 160 out of 12,700 total projected annual fatality decreases under the agencies' preferred scenario.[100] As shown below in Table II-73 of the proposed rulemaking, this proportion is extraordinarily small (1.2% of the total claimed) relative to fatalities claimed as a result of other modeling outputs projected in this proposal.

Table II-73 - Change in Safety Parameters from CAFE Augural Standards Baseline Total Fatalities MY 1977-2029, 3% Discount Rate

Change in Safety Parameters from Augural Standards Baseline								
Total Fatalities MY 1977-2029, 3% Discount Rate								
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8
Fatalities								
Mass changes	-160	-147	-143	-173	-152	-73	-12	-30
Sales Impacts	-6,180	-5,680	-5,260	-4,280	-3,170	-2,550	-1,030	-1,480
Subtotal CAFE Atrb.	-6,340	-5,830	-5,400	-4,460	-3,330	-2,630	-1,050	-1,520
Rebound effect	-6,340	-5,960	-5,620	-4,850	-3,610	-3,320	-2,200	-2,170
Total	-12,700	-11,800	-11,000	-9,300	-6,940	-5,950	-3,240	-3,690

While automotive manufacturers will lightweight some heavier vehicles, SAFE believes this is only one of many valid pathways industry may choose to comply with the current program. SAFE understands the agencies have expressed safety concerns regarding vehicle lightweighting, but existing research supports the finding that mass reduction can be safely integrated into the current vehicle fleet mix. Among each of the identified alternatives, the agencies' own analysis confirms that mass changes will only bring about a small impact on the overall fatality rate. SAFE, therefore, encourages the agencies to reconsider concerns over roadway safety resulting from vehicle lightweighting and reassess whether they remain more important than EPCA's mandate for the agencies to consider energy conservation.

Advanced Driver Assistance Features and Auto Safety

Rather than focus on mass changes, SAFE encourages the agencies to instead incentivize the introduction of advanced driver assistance technologies (ADAS) to reduce overall crash frequencies and fatalities. A recent Boston Consulting Group, Inc. (BCG) report concluded that equipping all cars in the United States with ADAS features, including forward collision warning, lane departure warning and prevention, automatic braking, blind spot detection, and adaptive headlines, could prevent 28 percent of all crashes. To put these safety benefits in context, BCG estimates ADAS would prevent approximately 9,900 fatalities and save about $251 billion to society each year.[101] By comparison, seatbelts and frontal air bags saved approximately 15,000 and 2,800 lives in 2007, the latest year studied.[102] If widely deployed, ADAS technologies would be poised to join seatbelts and airbags as

[100] Proposed Rule at 43152.
[101] Note: NHTSA estimates there are roughly 38,000 traffic fatalities on U.S. roads and highways every year. Boston Consulting Group, Inc. and Motor & Equipment Manufacturers Association, "A Roadmap to Safer Driving through Advanced Driver Assistance Systems," at 2, 13, and 14, 2015.
[102] NHTSA, "Lives Saved Calculations for Seat Belts and Frontal Air Bags," December 2009, at 2.

highly effective safety technologies.[103] NHTSA's own analysis has found similar wide-ranging impacts.[104]

NHTSA can incentivize the introduction of these technologies at an accelerated pace.[105] While the greater introduction of ADAS may mask short-term changes in the fatality risk associated with lightweighting in response to the standards, the long-term benefit is the widespread use of technologies that reduce any risk associated with a transition to a lighter vehicle fleet. SAFE calls the agencies' attention to the potential for an accelerated deployment of emerging crash avoidance technologies as a way of moving the vehicle fleet through this transition period. Delaying the standards, especially for light trucks, will only further increase the mass disparity between light trucks and cars, and increase the safety risks.

Other Stated Safety Impacts from Modeling That Requires Further Work

As noted above, the vast majority of fatality impacts claimed by the proposed rule and PRIA come not from the research on safety and fuel economy, but from a new module within the model that attempts to project human behavior and driver habits, as well as from the "rebound effect."[106] In both of these cases, projected deaths result from assumptions about vehicle miles traveled (VMT)—a factor that correlates with traffic accidents—that seem highly implausible in the real world. The results are confusing analysis and counterintuitive conclusions that undermine transparency as well as the utility of the cost-benefit analysis for understanding critical issues such as safety.

With respect to NHTSA's new modeling of consumer behavior, we appreciate the value in attempting to better determine how costs associated with policy decisions for fuel efficiency standards could affect consumers' decisions about whether to purchase a new vehicle, and thus the rate at which the fleet of vehicles on the road turns over. However, we believe that NHTSA's new model needs significant refinement and clarification for its results to be meaningful and transparent to the public as part of a cost-benefit analysis.

Specifically, the model is predicated on the assumption that regulatory costs lead to decreases in new car sales and keep more old cars on the road. As noted elsewhere our comments, SAFE disagrees with that assumption and believes that existing data show standards do not negatively impact new vehicle sales. Moreover, when projected within the new model, this problematic assumption cascades into a series of confounding conclusions.

First, the model assumes that each deferred purchase of a new car results in many additional old cars remaining on the road. As shown below in the agencies' Table VII-88, this leads to the confusing conclusion that maintaining the existing standards would, cumulatively, result in 46 million more cars on the road in 2025 compared to the Administration's preferred alternative—meaning that stronger fuel economy standards would result in a much larger fleet.[107]

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[103] SAFE, "Using Fuel Efficiency Regulations to Conserve Fuel and Save Lives by Accelerating Industry Investment in Autonomous and Connected Vehicles," April 2018.
[104] NHTSA, "U.S. Department of Transportation Issues Advance Notice of Proposed Rulemaking to Begin Implementation of Vehicle-to-Vehicle Communications Technology," Aug. 18, 2014.
[105] Note: For example, NHTSA recently issued an NPRM on adaptive headlights. SAFE would encourage NHTSA to pursue this and similar avenues for streamlining the integration of safety technologies that are currently not considered and/or enabled by existing federal motor vehicle safety standards.
[106] Note: The rebound effect refers to the assumption that more fuel-efficient cars compel consumers to drive more because the incremental cost of fuel decreases.
[107] NPRM, 43351.

Table VII-88 - Cumulative Changes in Fleet Size, Usage and Fatalities for MY's 1977-2029 Under CAFE Program

Model Year Standards Through	MY 2021	MY 2022	MY 2023	MY 2024	MY 2025	MY 2026	TOTAL
Cumulative Changes in Fleet Size, Usage and Fatalities Through MY 2029							
Fleet Size (millions)	-31	-28	-38	-48	-46	0	-190
Share LT, CY 2040	45%	45%	45%	45%	45%	45%	N/A
VMT, Fatalities, and Fuel Consumption for MY's 2017-2029							
VMT, with rebound (billion miles)	-222	-149	-200	-236	-219	0	-1,030
VMT, without rebound (billion miles)	-48	-29	-43	-46	-70	0	-235
Fatalities, with rebound	-1,840	-1,160	-1,740	-2,010	-1,880	0	-8,630
Fatalities, without rebound	-420	-175	-452	-442	-666	0	-2,160
Fuel Consumption, with rebound (billion gallons)	20	14	18	23	17	0	91
Fuel Consumption, without rebound (billion gallons)	26	18	23	29	21	0	116
VMT, Fatalities, and Fuel Consumption for MY's 1977-2016							
VMT, with rebound (billion miles)	-76.6	-70.4	-88.0	-115	-91.4	0	-441
VMT, without rebound (billion miles)	-79.3	-72.8	-91.0	-119	-94.5	0	-457
Fatalities, with rebound	-711	-646	-804	-1,060	-829	0	-4,050
Fatalities, without rebound	-737	-669	-832	-1,090	-856	0	-4,180
Fuel Consumption, with rebound (billion gallons)	-3.33	-2.87	-3.58	-4.65	-3.65	0	-18.1
Fuel Consumption, without rebound (billion gallons)	-3.46	-2.98	-3.71	-4.82	-3.78	0	-18.8

The impact of VMT on the agencies' argument on fatalities is an important one. The information contained in Table VII-88 is particularly important because it identifies where the additional VMT (or reduced VMT) will come from. Unfortunately, the table is unnecessarily convoluted. Its title indicates it is a cumulative assessment of VMT between 1977 and 2029. However, the columns representing model years only include MY 2021 through MY 2026. So does MY 2021 include all years prior to it? In addition, the table is broken into 2017-2029 and 1977-2016 sections. It is unclear why this was done and the additional value the reader should take from it.

As best we can discern, the agencies' model projects, according to Table VII-88, that by adopting the preferred scenario, more new cars will be put on the road and, somehow, that will reduce VMT by 692 billion miles. This conclusion is problematic. In the real world a driver's basic travel needs—work, school, groceries, healthcare, and the like—would not increase by his or her choice to use one or more older vehicles versus purchasing a new one. Further, new cars tend to be driven more that old cars because of greater reliability, efficiency and appeal. There is ample literature on this and the NPRM's own estimates of rebound effect support this assertion. Nonetheless, the model translates these presumed extra miles into thousands of assumed traffic fatalities, notwithstanding the underlying flaws in the logic of the VMT projections.

Notably, a memorandum from EPA included within the docket explained, and endeavored to correct, the technical parameters that led the model to this conclusion, asserting more broadly that, "EPA does not support the use of the CAFE consumer choice and scrappage model for a primary analysis for the NPRM standard setting," though EPA provided multiple suggestions for its future refinement.[108]

As stated above, exaggerated estimates of vehicle miles traveled are then compounded by a factor called the "rebound effect," which assumes that drivers will travel more miles in a more fuel-efficient car because the cost of driving is cheaper. This seemingly runs counter to the notion that stronger fuel

108 Email 5 – Email from William Charmley to Chandana Achanta – June 18, 2018.

efficiency standards would depress new car sales and result in consumers driving more old cars. Notwithstanding the inherently conflicting nature of these arguments, the NPRM assumes double the rebound rate of the previous rules (which utilized 10 percent rebound), and also a higher rebound rate than a 2007 NPRM proposed by the Bush Administration, which utilized a 15 percent rebound rate.[109] Nonetheless, despite attributing thousands of deaths to fuel economy standards on account of the rebound effect, the PRIA also asserts that rebound effect is not itself a regulatory impact, stating that: "nothing in the higher CAFE standards compels consumers to drive additional miles. If consumers choose to do so, they are making a decision..."[110]

As noted above, the total treatment of VMT points to significant flaws with the logical premises of the agencies' modeling yet is central to the arguments in the proposal regarding safety and fuel economy standards. We recommend that the final rule remove or significantly revise these assumptions to improve transparency, data quality, and the logic and usefulness of the results for understanding actual regulatory impacts.

[109] NHTSA, *Average Fuel Economy Standards Passenger Cars and Light Trucks Model Years 2011-2015*, 2008, at 182.
[110] PRIA, 1329.

Response to Findings that Increased Vehicle Purchase Prices are Deterring New Buyers

The agencies argue that unreasonable fuel efficiency standards implemented in the past have resulted in substantial increases in new vehicle prices, which in turn, have or will deter new buyers.[111] This leads to older vehicles staying on U.S. roads longer and prevents the vehicle fleet from realizing the safety gains that newer vehicles offer. It is argued that this significantly harms consumers and justifies a pause in further increases to the standards. SAFE disagrees with these assertions and believes that existing data shows that fuel efficiency standards are a minor contributor to higher vehicle prices; that the standards have not negatively impacted new vehicle sales; and are not keeping consumers in older, dirtier, and less safe vehicles.

The Large Change in the Cost of Compliance Should be Further Explained

Vehicle manufacturers are always looking to reduce the costs for vehicle components. The integration of technologies that make cars more fuel efficient are no exception. The automobile industry has shown an exceptional ability to meet the standards without inordinately increasing final sale prices. Nevertheless, the standards can impact initial vehicle pricing, though any changes should be weighed against the fuel savings to consumers that would result over the useful life of the vehicle. In 2012, the agencies estimated that compliance would increase the purchase price of a vehicle by between $1,500 and $1,800 through 2025.[112] In January 2017, the EPA estimated that emission standards would add a cost for MY 2021-2026 of $875 per vehicle.[113] Another estimate from the Alliance of Automobile Manufacturers estimated the approximated cost of compliance at $1,249 per vehicle.[114]

The agencies current rulemaking argues that "...today's analysis shows the previously-issued standards through model year 2025 could eventually increase average vehicle prices by approximately $2,700."[115] SAFE believes the magnitude of increase warrants further clarification. Although the agencies argue "circumstances have changed" and "analytical methods and inputs have been updated," a thorough analysis should provide a side-by-side comparison of the changing circumstances, methods, and inputs used to arrive at this determination.[116] This would help achieve the agencies' stated goal of creating standards that are "supported by a transparent assessment of current facts and data."[117]

Costs Due to Fuel Efficiency Standards are a Minor Contributor to Higher Vehicle Prices

The NPRM cites a Kelley Blue Book average for new vehicles price of $36,000 and comments that vehicles are increasingly unaffordable.[118] However, the Kelley Blue Book article cited indicates that "as volume shifts away from cars, the average vehicle price ticks up."[119] Nevertheless, the NPRM analysis makes explicit that the higher costs are due in large part to the fuel efficiency standards. While it is

[111] NPRM. Op. Cit. p. 43075.
[112] NPRM. Op. Cit. p. 42994.
[113] Note: EPA offered a range of $800-$1,115. EPA, "Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation," January 2017. Pp. 5, 20 and 28.
[114] "Things to know about Trump's rollback of CAFE fuel-economy standards", CBS/AP, March 16, 2017.
[115] NPRM. Op. Cit. p. 42994.
[116] Cite all quoted text.
[117] NPRM. Op. Cit. p. 42987.
[118] NPRM. Op. Cit. p. 42994.
[119] See, e.g., Kelley Blue Book, "Average New-Car Prices Rise Nearly 4 Percent for January 2018 On Shifting Sales Mix, According to Kelley Blue Book," February 1, 2018.

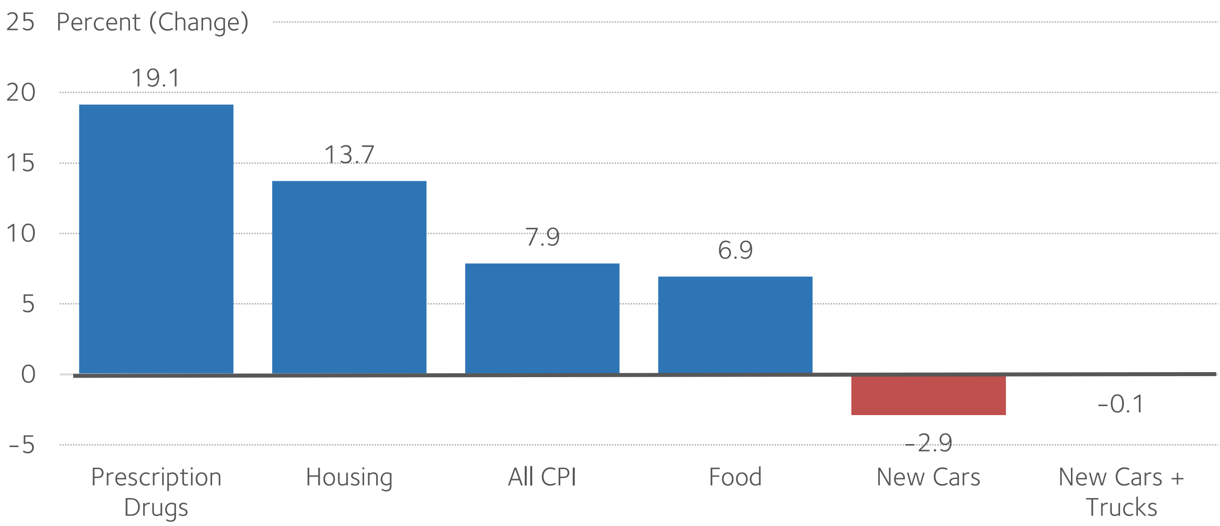
empirically true that nominal vehicle purchase prices have increased, other evidence suggests that the agencies should more carefully consider all the factors that have led to such increases.

First, the price data cited in the NPRM is only vehicle transaction prices—or what new car buyers choose to pay. This data does not isolate changes in performance and other features, many of which are added at a premium to the vehicle price and positively impact automakers' profit margins. In and of itself, the vehicle price increases say little, if anything, about compliance costs.

On a relative basis, cars have remained largely affordable over the past decade. In contrast to the agencies determination that vehicle prices are more expensive, inflation-adjusted new car purchase prices have *fallen by three percent* since 2013 even as the total Consumer Price Index (CPI) has risen by eight percent (see figure below). Compared to the relative increases in CPI for other common expenditures, this is a very small increase. For example, the chart below shows that housing has increased by 14 percent, food has risen by seven percent, and prescription drugs have risen by 19 percent over the same five-year period.[120] Industry argues that future fuel economy benefits will be more expensive and yield fewer improvements on a percentage basis than past increases suggest. However, uncertainty in the available evidence indicates how future fuel economy gains will impact industry and consumers in the real world.

When isolating the nominal base price of vehicles, or the starting manufacturer suggested retail price (MSRP) since 2013, prices have also increased. However, when the base price for new vehicles is adjusted for inflation, comparative prices have stayed largely flat. As shown in Table 4, Bureau of Economic Analysis (BEA) data shows the average transaction price for a new car, in nominal terms, declined almost 1 percent, and fell almost 6 percent in inflation-adjusted terms.

Figure 10: New Car Price Changes Relative to Other CPI Components, April 2013 to April 2018



Source: SAFE analysis based on data from BLS.

[120] Bureau of Labor Statistics, Consumer Price Index. May 24, 2018.

Table 4: Average Price of New Domestic and Imported Cars, 2013 & 2017

	Domestic		Import		Total	
Year	Current	Constant 2017	Current	Constant 2017	Nominal	Real ($2017)
2013	23,914	25,163	29,754	31,307	25,570	26,906
2017	23,423	23,423	31,473	31,473	25,367	25,367
Change $	-491	-1,740	1,719	165	-204	-1,539
Change %	-2.1%	-6.9%	5.8%	0.5%	-0.8%	-5.7%

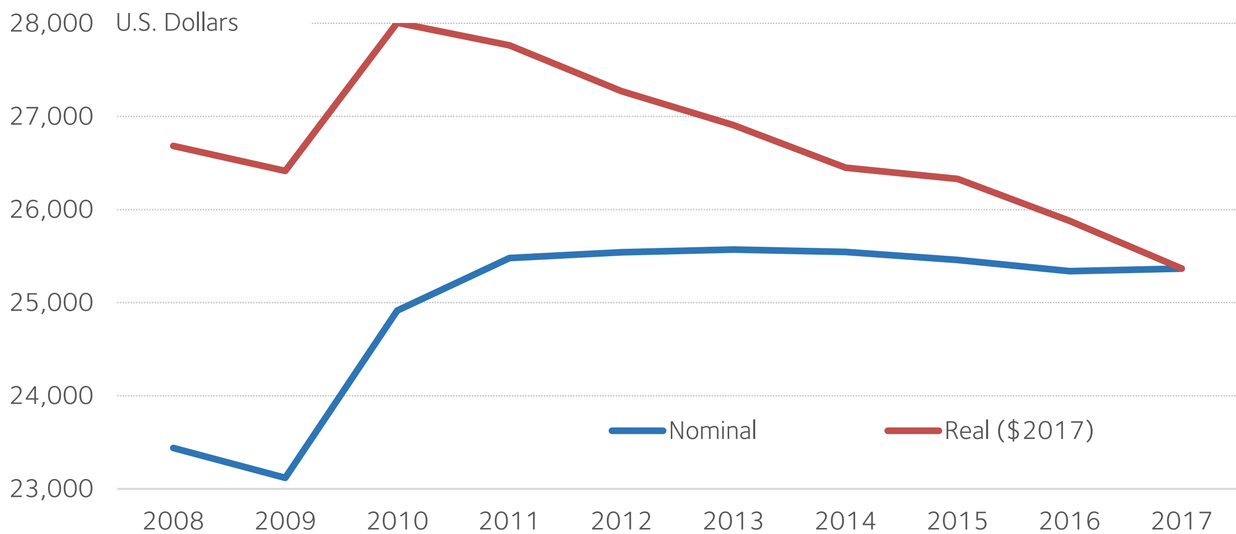
Sources: Oak Ridge National Laboratory, "Average Price of a New Car," Table 10.13. *Transportation Energy Data Book.* April 2018.

The BEA data also illustrates how domestically manufactured car prices have declined while imported vehicle prices have risen. This change demonstrates the *de minimis* role of fuel efficiency standards in overall car price increases. Since the engineering and manufacturing cost of the equipment necessary to improve fuel economy has remained roughly the same for domestic and foreign cars, the wide price gap between domestic- and foreign-manufactured vehicles indicates the increased price pressure is heavily influenced by consumers choosing more luxury features.

Even over a ten-year period, BEA data shows new car prices declining almost 5 percent. While there was a nominal price increase in 2009 and 2010, the chart below shows that these prices are substantially lower once they are adjusted for inflation.

Notably, the agencies stated that prices are lower now than in the past, once adjusted for inflation. "[A]lthough average transaction prices for new vehicles have been rising steadily since the recession ended, prices are not yet at historical highs when adjusted for inflation. The period of highest inflation-adjusted transaction prices occurred from 1996–2006, when the average transaction price for a new light-duty vehicle was consistently higher than the price in 2015."[121]

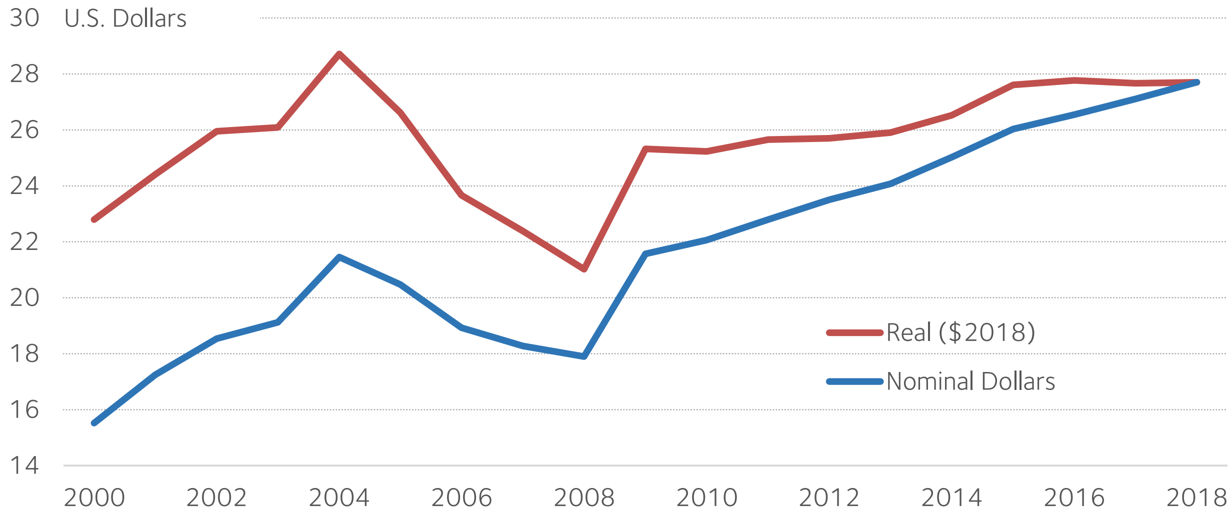
Figure 11: Inflation-Adjusted Price of New Car in Real Dollars has Declined



Source: BLS.

[121] NPRM. Op. Cit. P. 43074.

Figure 12: Real Ford F-150 Starting MSRPs Lower Today than in 2004



Source: SAFE analysis based on data from MSN/JATO.

The lack of long term, real price pressure also can be seen in the chart above which compares nominal and real prices for the Ford F-150 pick-up truck. For example, the 2018 Ford F-150 MSRP begins at $27,705. In 2018 dollars, the 2004 model cost $28,017. The 2018 base model contains a 3.3 liter, V6 engine producing 290 horsepower. In 2004, the base F-150 contained a 4.6 Liter, V8 engine that produced 231 horsepower. The 2018 model also includes many consumer and safety features that were not available on the 2004 model. In quality-adjusted terms, the 2018 vehicle is much better than the 2004 vehicle, and in inflation-adjusted terms, it is available at a lower price than in 2004.

As is evident from Table 5, in so far as there was upward pressure on nominal F-150 base prices, it began before the 2008 round of fuel efficiency changes. Moreover, the steady and sharply higher "fully loaded" F-150 prices indicate that standards have had little to do with the higher prices, since the range of technologies and changes necessary to meet the standards on the base model and fully loaded models are largely similar. Today's higher end Ford F-150 comes with much more equipment and features than the Ford F-150 ten years ago. Box side steps, tailgate lift assist, moon roofs, premium entertainment systems, and other add-ons can greatly increase the price of a fully-loaded vehicle by tens of thousands of dollars over the base vehicle price. This change can be clearly seen from the divergence in the base MSRP and the fully-loaded MSRP. In 1996, a fully-loaded MSRP was 1.4 times the base MSRP, in 2005 it was two times as much, and in 2018 it is 2.3 times the base price. The trend of luxury loading, not fuel efficiency standards, is primarily responsible for higher prices. While this is just one example, selected for illustrative purposes, the trend is likely to be seen in many other vehicle models.

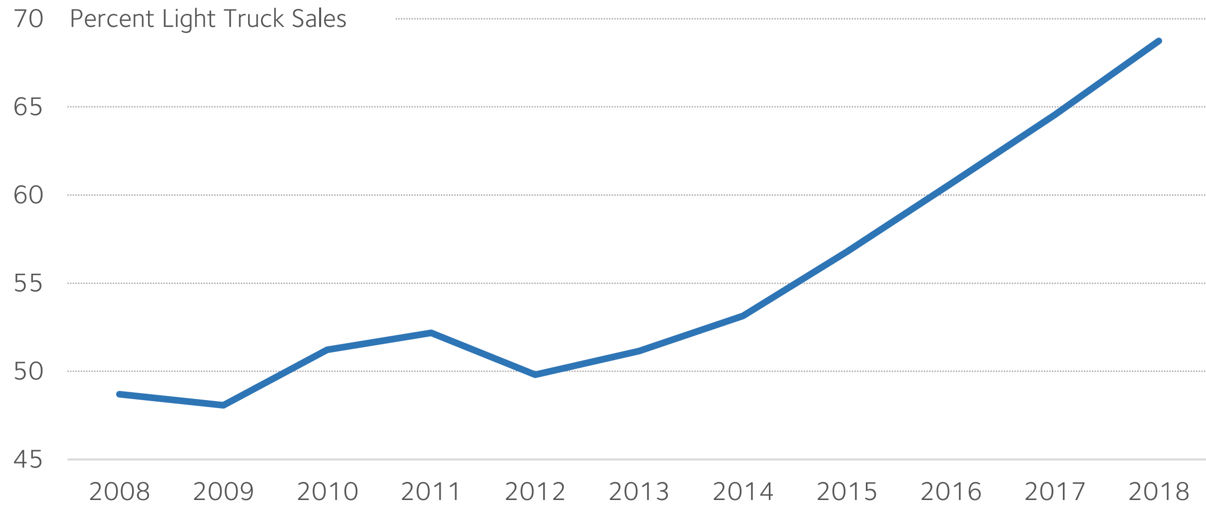
Table 5: Ford F-150 Prices, 2000-18

Year	From	To	Engine	Horse Power	Transmission
2000	$15,520	$31,755	4.2 L 205 HP V 6	205	5-Speed
2001	$17,245	$34,405	4.2 L 202 HP V 6	202	5-Speed
2002	$18,540	$35,995	4.2 L 202 HP V 6	202	5-Speed
2003	$19,125	$37,035	4.2 L 202 HP V 6	202	5-Speed
2004	$21,455	$35,990	4.6 L 231 HP V 8	231	5-Speed
2005	$20,475	$40,090	4.2 L 202 HP V 6	202	5-Speed
2006	$18,930	$40,055	4.2 L 202 HP V 6	202	5-Speed
2007	$18,275	$39,285	4.2 L 202 HP V 6	202	5-Speed
2008	$17,900	$40,205	4.2 L 202 HP V 6	202	5-Speed
2009	$21,565	$44,355	4.6 L 248 HP V 8	248	4-Speed
2010	$22,060	$46,740	4.6 L 248 HP V 8	248	4-Speed
2011	$22,790	$51,770	3.7 L 302 HP V 6	302	6-Speed
2012	$23,500	$52,305	3.7 L 302 HP V 6	302	6-Speed
2013	$24,070	$53,300	3.7 L 302 HP V 6	302	6-Speed
2014	$25,025	$54,410	3.7 L 302 HP V 6	302	6-Speed
2015	$26,030	$55,305	3.5 L 283 HP V 6	283	6-Speed
2016	$26,540	$62,310	3.5 L 283 HP V 6	283	6-Speed
2017	$27,110	$63,625	3.5 L 283 HP V 6	283	6-Speed
2018	$27,705	$64,785	3.3 L 290 HP V 6	290	6-Speed

Long-term, nominal vehicle price increases are partly due to changes in the vehicle sales mix toward sport-utility vehicles (SUVs), pickup trucks, and imported luxury sedans, and the sale of newer and higher-priced equipment and features. In 2008, SUV and pickup truck sales constituted 48 percent of sales. As seen in Figure 10, by 2017, SUVs' proportion of the sales mix reached 63 percent of LDV sales. These changing consumer preferences, not equipment costs due to the standards, were the primary driver of increased LDV price pressure. As a report by Edmunds stated, "the average transaction prices for pickup trucks has ballooned in the last decade, more than doubling the industry's average transaction price lift as the segment's entrants have become larger and more contented [i.e., loaded with expensive options]."[122] A J.D. Power study from 2012 to 2016 found the average transaction price of midsized SUVs increased by 10.6 percent to nearly $35,000 and large SUVs were up 22.9 percent to nearly $58,000. Higher prices in the midsize and large SUV segment contrasted with midsized sedan prices, which fell by 1.2 percent to $21,951. Compact car prices fell even more by 5.2 percent to $18,648.[123]

[122] Edmunds, "Transaction Prices: The Myth of the Average Priced Vehicle," January 30, 2015.
[123] Ryan ZumMallen. "Trucks Lead Soaring Automotive Transaction Prices." Trucks.com. Feb. 2, 2018.

Figure 13: New Light Truck Sales Increase and Skew the Pricing Averages



Source: SAFE analysis based on data from BEA.

Another example of the modest impact fuel economy improvements have had on car and truck prices can be found in the BLS's "Report on Quality Changes" for the various model years since 2008."[124] From MY 2008 through 2018, all quality changes, including fuel economy, have accounted for only 30 percent of new passenger vehicle price increases and 26 percent of light truck price increases. Fuel economy changes are only a small fraction of all quality adjustments. Other adjustments include changes affecting reliability, durability, safety, maneuverability, speed, acceleration and deceleration, carrying capacity, and comfort or convenience.

As the agencies note, the affordability of a vehicle often is complicated by the level of interest rates and the structure of payment terms. Consequently, it is difficult to make an apples-to-apples comparison based on how different variables impact affordability from year to year. The primary drivers of higher vehicle prices have been the cost of materials and consumer preferences for larger vehicles with more high-end features.[125] This finding is supported by outside analysis including form Kelley Blue Book which stated that "…[vehicle] manufacturers have also begun offering more features as standard in order to appeal to consumers, and those features are trickling down into lower trim levels faster than ever. For instance, just a few years ago, heated seats were confined to luxury brands. Today, they're optional on even the most basic vehicles and standard on most middle and upper trim levels across all sizes, segments, and brands."[126] Even NHTSA Deputy Administrator Heidi King recently said on a call with reporters discussing the release of the NPRM that:

> *You asked if the primary vehicle costs are associated with fuel economy—I couldn't say, I doubt it quite frankly as an economist, but there are a lot of things going on with cars, a lot of changes in design that consumers are demanding. In addition to fuel economy there's safety innovations, and they're complicated machines.*

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[124] See BLS. "Archived PPI Reports on Quality Changes for Motor Vehicles."
[125] Adrienne Roberts: "Auto Dealers Worry New Vehicle Prices May be Getting Too High," The Wall Street Journal, May 2018 https://www.wsj.com/articles/auto-dealers-worry-new-vehicle-prices-may-be-getting-too-high-1522017100; Sarah O'Brien: New-Car Shoppers: Brace Yourselves for Higher Costs," CNBC, April 2018. https://www.cnbc.com/2018/04/18/new-car-shoppers-face-higher-costs-from-auto-prices-loan-rates.html
[126] See, e.g., Leslie Hayward, "How Much Have Fuel Economy Standards Boosted the Price of Cars?," Energy Fuse, August 23, 2018.

Certainly, fuel economy is an important part of the cost structure, but has it historically been the primary driver? Typically, that's labor and materials and manufacturing.[127]

Given the vast amount of data and evidence we have thus far following the implementation of the fuel efficiency standards, there is little reason to suspect that the program has been or will now become a major contributor to vehicle price inflation. Instead, the increases reflect consumer demand for new features and larger vehicles, such as pick-up trucks and SUVs, which are more expensive than small passenger vehicles.

The Standards Have Not Negatively Impacted New Vehicle Sales

One of the agencies concerns centers around the notion that fuel efficiency regulations negatively impact vehicle sales.[128] Consequently, the proposed rule argues that the standards should be paused to encourage new vehicle sales and stimulate fleet turnover. First, this assertion is partly predicated upon the concern that vehicles are too expensive, and the standards are responsible for vehicle price increases. That assertion is incorrect and was discussed in detail above. The agencies state that if "vehicle sales have not already hit their breaking point, they may be close."[129] Both points are not supported by historical data, and there is little indication we are near a "breaking point" but rather an inflection point where much of the pent-up demand from the recession has been addressed and sales growth going forward will flatten out, not because of fuel economy technology costs, but because of normal business cycles.

Over the last few years, the United States has experienced record vehicle sales. Data for the last five, ten, and twenty years clearly indicate that sales have not declined. A comparison of sales data for May 2018, for example, shows sales have been roughly the same for the last five years. Annual sales are up over 2 million vehicles, or 12.5 percent relative to sales over the last ten years. Annual sales are over a million vehicles higher, 6.5 percent over the last twenty years.

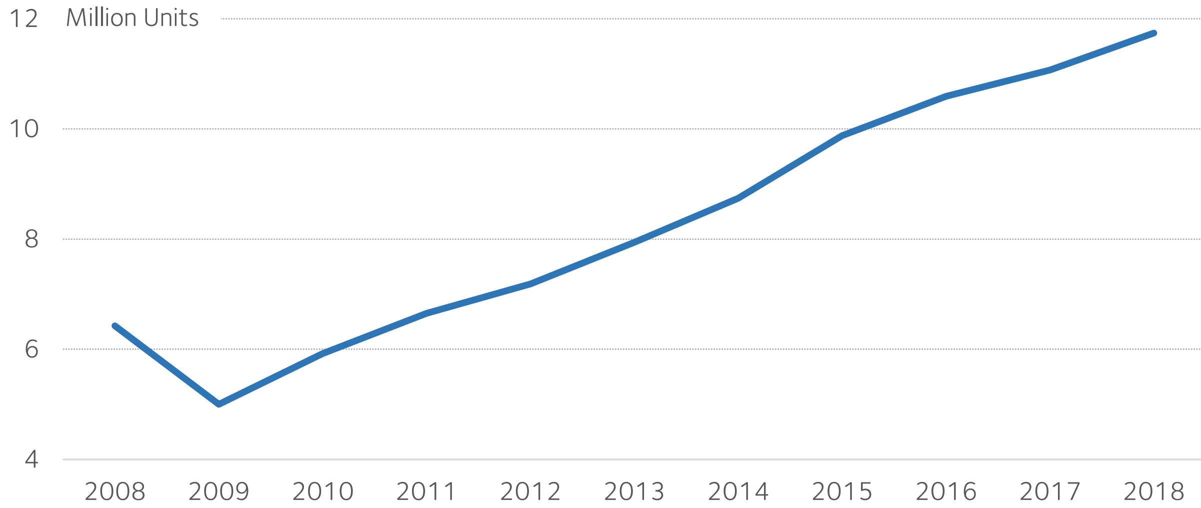
Table 6: New U.S. Light-Duty Vehicle Sales

Period	Vehicle Sold (annualized, million)	Change to May 2018	% Change to May 2018
May 2018	16.8		
Avg. Sales Last 5 years	16.9	-0.1	-0.6
Avg. Sales Last 10 years	14.7	2.1	12.5
Avg. Sales Last 20 years	15.7	1.1	6.5

The 2008 Great Recession significantly reduced vehicle sales, which is unsurprising given historical trends. However, sales since that time have fully recovered. During the Great Recession, sales dropped to 10.9 million vehicles sold in 2009, and rose steadily thereafter, reaching a historical record of 17.9 million units sold in 2016. In fact, three of the highest six years of vehicle sales in industry history occurred in 2015, 2016, and 2017, as seen in Figure 11.

[127] Heidi King and Bill Wehrum. EPA-NHTSA Conference Call. August 2, 2018.
[128] NPRM. Op. Cit. among other places page 43293.
[129] NPRM. Op. Cit. 43223.

Figure 14: New Annualized Light-Duty Vehicle Sales



Source: SAFE analysis based on data from BEA.

Notably, the agencies own acknowledgement of historical trends does not support the assertion that vehicle prices are higher due to the standards. The agencies clearly state that vehicle sales are "highly pro-cyclical" and average vehicle sales prices tend to move "…in parallel with changes in economic growth." Other factors such as consumer confidence and labor force participation are more important and "change in average price is not as determinative of total sales as the other variables."[130] Therefore, the "…analysis was unable to incorporate any measure of new car and light truck fuel economy in the model that added to its ability to explain historical variation in sales, even after experimenting with alternative measures such as the unweighted and sales-weighted averages fuel economy of models sold in each quarter, the level of fuel economy they were required to achieve, and the change in their fuel economy from previous periods."[131] It is difficult to assert that the standards have damaged vehicle sales since the data indicates sales have not suffered, particularly during the most recent period of fuel efficiency regulation.

Fuel Economy Standards Are Not Keeping Consumers in "Older, Dirtier, and Less Safe Vehicles."

The rulemaking argues that fuel economy standards have increased vehicle purchase prices, deterring consumers from making new vehicle purchases, and thus keeping older vehicles on the road for longer.[132] Specifically, the NPRM states that vehicles are staying on the road longer, with the average age of cars on the road approaching 12 years, a historical high.[133] Part of this assertion is predicated upon the belief that vehicles are too expensive and the fuel efficiency standards are responsible for this price rise. That incorrect assertion has been discussed above. This assertion also implies that excessively high vehicle costs are keeping consumers from replacing their vehicles. However, vehicle

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130 NPRM. Op. Cit. Pp. 43074-43075.
131 IbId. p. 43074.
132 "Higher vehicle prices, which result from more stringent fuel economy standards, have an effect on consumer purchasing decisions. As prices increase, the market-wide incentive to extract additional travel from used vehicle increases." NPRM. Op. Cit. P. 42993.
133 NPRM. Op. Cit. P. 42995.

sales are not suffering. There are many reasons why motorists are holding on to vehicles for longer time periods.[134]

First, despite the 12-year high headline statistic, the average age of a car driven in 2017 is only six months more than a vehicle driven in 2009. The average age of a car driven in 2009 was only six months more than a car driven in 2001.[135] It therefore is unlikely that regulatory changes between 2009 and 2017 are causing Americans to drive older vehicles. The low vehicle sales volumes in the aftermath of the 2008 recession help explain the current six-month aging of the fleet.[136] Assuming vehicle replacement continues to occur normally, the average vehicle age is likely to decline.

Second, J.D. Power's consumer surveys show that vehicle dependability has significantly improved. The industry research group found that dependability is at its "best level ever."[137] Consequently, vehicles are holding their value for longer and there is higher demand for used vehicles.[138] This increased dependability translates to longer on-road vehicle lifespans. Importantly, the 12-year average vehicle age of cars on the road coincides with surging new vehicle sales and record total vehicles in use, estimated to be nearly 258 million units. Improved dependability of vehicles is understood to be the primary reason why motorists are holding on to cars for longer.[139]

Available data does not support the implication that increasingly expensive vehicles are not being replaced because of fuel efficiency standards. In inflation-adjusted terms, vehicles are not that much more expensive, and the standards have not made cars appreciably more expensive. Vehicle sales have not precipitously fallen and, in fact, improved quality and durability have kept many older vehicles on the road for longer.

Conclusion

It is true that the average nominal vehicle price is higher than in the past, but once adjusted for inflation and the other variables discussed above, prices are not at record highs. Vehicles today are more durable, safe, and have better features than older models. These improvements make for better cars, but they also increase new vehicle prices. Critically, fuel efficiency regulations are a minor factor compared to labor and material costs, new technology add-ons, the changing vehicle sales mix, interest rates and auto lending terms, which all appreciably affect vehicle pricing more than increasingly stringent fuel efficiency standards. Vehicles with higher fuel efficiency save drivers' money and these savings offset other increases arising from insurance, maintenance and repair costs, and state taxes and local fees. Since the standards do not have a major role in creating higher vehicle prices, or in suppressing sales, SAFE does not think using such justification is warranted for pausing the fuel economy program's increasing stringency for the 2021-26 standards. At the very least, if the rule is going to discuss the cost implications of these technologies, the rule should pair that discussion with a description of the fuel savings that come along with that technology and offset the cost—at least by some portion.

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[134] IHS Markit, "Vehicles Getting Older: Average Age of Light Cars and Trucks in U.S. Again in 2016 to 11.6 Years, IHS Markit Says," November 22, 2016, https://news.ihsmarkit.com/press-release/automotive/vehicles-getting-older-average-age-light-cars-and-trucks-us-rises-again-201
[135] SAFE analysis based on preliminary data from FHWA's 2017 National Household Travel Survey.
[136] Ibid.
[137] J.D. Power, "Most Owners Still in Love with their 3-Year-Old Vehicles, J.D. Power Finds." February 14, 2018.
[138] Ibid.
[139] Note: Vehicle dependability, as defined by J.D. Power, measures the number of problems experienced per 100 vehicles (PP100) during the past 12 months by original owners of 2015 model-year vehicles. A lower score reflects higher quality.

Autonomous Vehicles: Economic and Employment Impacts

Past rulemakings have identified the impacts fuel-efficiency standards would have on industry employment. The most recent analysis now quantifies some of those effects. SAFE is encouraged by this development. However, the proposed rulemaking does not examine the "effects of increased usage of car-sharing, ride-sharing, and automated vehicles."[140] Over the past year, SAFE has undertaken such an analysis and demonstrated how the deployment and adoption of partially and fully autonomous vehicles will impact the U.S. labor market. Adapted from a larger study commissioned by six prominent economists, SAFE's analysis found that AVs will add between $3 to $6 trillion in cumulative consumer and societal benefits to the U.S. economy. Annually, the full deployment of AVs could realize $800 billion in economic and societal benefits.

The scale of these impacts will be substantial. While the current rulemaking focuses its employment analysis on automotive labor, it does not examine how "changes may affect the macro economy and possibly change employment in adjacent industries."[141] SAFE's report provides the foundation to consider these and other relevant economic and labor factors.[142] We hope the agencies may find this information to be useful as they refine or widen the scope of their employment or larger analysis.

Autonomous Vehicles Will Lead to New Jobs

It is important to consider any labor market impact of AVs in relation to past instances of rapid economic or technological transformation. SAFE's study found that AVs would likely lead to significant productivity gains and economic growth—bringing to mind the rapid economic growth that accompanied the post-Second World War expansion, building of the Interstate Highway System, and suburbanization of the United States. The overall economic and social impacts of deploying AVs are very likely to be significant and positive.

While reports to date have warned of rapid and massive job losses, SAFE's analysis found a relatively measured and shorter-term impact on the labor market perhaps as far as several decades in the future. AV-related job loss is expected to contribute 0.06 to 0.13 of one percent to the U.S. unemployment rate, representing approximately 170,000 to 380,000 jobs in the late 2040s. In context, today's labor force employs approximately 160 million workers. The number of workers impacted will be considerably smaller than the recessions of the early 2000s and the 2009 Great Recession, which contributed an additional 1.6 and 5 percent to the unemployment rate, respectively.[143]

SAFE's analysis also found that new jobs are expected to be created in three broad categories: new transportation jobs; new AV-related jobs; and new jobs providing other goods and services. To the extent that AVs reduce both the explicit and implicit costs of transportation, people will demand more transportation—requiring greater employment in new transportation jobs. These roles include fleet vehicle dispatchers and repair workers, as well as tasks that are currently bundled with driving, such as package delivery. AV-related manufacturing will be a prime driver for AV-related jobs, as AVs will still need to be manufactured. Employment may also be impacted by changes in mileage patterns for AVs as they are adopted in a fleet-based model, with significant implications for fleet turnover and new vehicle sales. While the public may require fewer vehicles to serve their transportation needs, the vehicles will likely be heavily used and replaced far more often than today's vehicles. Other areas of expansion

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[140] NPRM, 43078.
[141] NPRM, 43436.
[142] NPRM, 43078.
[143] Note: These results are sensitive to the speed of AV deployment. If deployment occurs more rapidly, the impacts will be higher, and if deployment proceeds more gradually, the impacts will be lower.

include the hardware and software required for AV operation. Furthermore, it is not known how consumers will spend their surplus income once AVs reduce the cost of travel. For example, consumers could eat out more often, spend more money on healthcare or renovate their homes. Finally, new jobs and services created is an indefinite category, as it is unknown what consumer tastes and business models will emerge after AV deployment.

AVs will also substantially increase access to employment within a commutable range. The average commuting trip in the United States is 9.8 miles and is often conducted at rush hour when traffic is very congested. According to transportation economists, shifting an individual from a driver to a passenger can be worth up to 32.5 percent of the person's hourly wage. Extrapolated across the nation, the represents a significant value.

If AVs reach their potential for eliminating congestion, they will increase regional travel speeds when broadly deployed. Combining the impact of faster through-speeds on roads with an increasing willingness to spend time in a vehicle means that individuals will be willing to travel significantly farther in search of a job. These improvements also translate into productivity gains. For workers who cannot find a job appropriate for their skills, access to a broader range of jobs can mean the difference between gainful employment and poverty. For employers, access to a broader pool of skilled workers can translate into success and growth. Previous experience shows that a 1 percent improvement in accessibility to a region's central business district improves regional productivity by 1.1 percent.[144] Similarly, a 10 percent increase in average speed, all other things constant, leads to a 15-18 percent increase in the labor market size, making it easier for enterprises to find the skills they need and for workers to find the job they want. This, in turn, leads to a 2.9 percent increase in productivity.[145]

Quantified Benefits of Autonomous Vehicles

A conservative microeconomic analysis completed by one of the report's authors estimates economic benefits of up to $800 billion per year with full deployment of AVs.[146]

Table 7: Quantified Benefits of Autonomous Vehicles

Public Benefits by 2050 (annual)	$633 Billion
Congestion Mitigation	$71 Billion
Accident Reduction – Economic Impact	$118 Billion
Accident Reduction – Quality of Life Improvements	$385 Billion
Reduced Oil Consumption	$53 Billion
Consumer Benefits by 2050 (annual)	$163 Billion
Value of Time	$153 Billion
Reduction in Cost of Current Taxi Service	$10 Billion
Total Annual Benefits by 2050	$796 Billion

[144] David Hartgen and Gregory Fields: Gridlock and Growth June 2009, Reason Foundation.
[145] Remy Prud'homme and Chang-Woon Lee: Size, Sprawl, Speed, and the Efficiency of Cities November 8, 2001, Observatoire de l'Économie et des Institutions Locales.
[146] David Montgomery, "Public and Private Benefits of Autonomous Vehicles," June 2018, at 3.

The value of AV benefits through 2050 will likely be between $3.2 trillion and $6.3 trillion. This is a partial estimate looking at a narrow set of case studies—a full estimate would likely be significantly higher.

Accident Reduction: In 2010, the National Highway Traffic Safety Administration (NHTSA) estimated the economic costs of car crashes to be $242 billion per year. When quality-of-life costs are added into the estimate, the total value of societal harm was approximately $836 billion per year. Extrapolating these values based on more recent crash and driving data puts the annual societal cost of crashes at over $1 trillion today.

Reduced Oil Consumption: Oil holds a virtual monopoly on vehicle fuels, with petroleum accounting for 92 percent of the fuel used to power the U.S. transportation system. By precipitating a shift away from petroleum as the dominant fuel source, AVs can substantially reduce America's reliance on oil. An analysis of the energy security and environmental benefits of increased EV uptake as a result of AV deployment supports an estimated $58 billion societal benefit.

Congestion: Crashes are a major source of road congestion and improved safety from AVs and better throughput (e.g. through reduced bottlenecks) could significantly reduce the current costs of congestion. Close to 7 billion hours are lost in traffic and over 3 billion gallons of fuel similarly are wasted every year.

Improved Access to Retail and Jobs: SAFE modelling of road speeds around specific retail establishments found that the increased willingness of shoppers to travel—even by just two minutes each way—could significantly increase a mall's customer base. In one example of a mall in Columbus, OH modelled by SAFE, nearly 50 percent more customers were in range of a typical shopping trip with an extra two minutes of travel. Additionally, SAFE modeling identified numerous economically disadvantaged localities for whom better transportation options would lead to greater employment opportunities. For a group of four struggling cities (Gary, IN, Benton Harbor, MI, Elmira, NY, and Wilmington, DE), SAFE modeled how increased traffic speeds from AV adoption and greater willingness to travel could impact the number of jobs within reach. An illustrative example can be found in the graphic above. For several cities analyzed by SAFE, the number of available jobs in commuting distance would triple with the widespread deployment of autonomous vehicles.

Increased Access to Easton Town Center

Source: SAFE analysis based on framework from David Montgomery, *Public and Private Benefits of Autonomous Vehicles*, June 2018.

SAFE believes that autonomous vehicles will soon play a transformative role in society. Automakers and technology developers continue to invest billions of dollars to bring the technology to market. While the agencies have not yet fully considered how to account for or evaluate all the potential impacts AVs will have, SAFE believes that AVs will be deployed in some capacity during the timeframe of the current standards. It is therefore necessary to begin examining the economic and employment impacts of AVs and SAFE strongly encourages the agencies to formally do so. SAFE is willing and able to provide any additional information or underlying data mentioned in the comments above or in our full report that may facilitate the agencies considering this issue more fully.

Modernizing the Off-Cycle Technology Program to Save Lives and Fuel

The NPRM proposes a range of significant changes to the off-cycle technology program, including ending or sunsetting all off-cycle flexibilities. At the same time, the NPRM solicits new ideas to recognize and incentivize connected and autonomous vehicle (CAV) technology. SAFE believes CAVs have tremendous potential to save lives. When combined with ride-sharing and electric powertrains, they can also increase efficiencies and save fuel. Any elimination, or phase-out, of the off-cycle technology adjustments would threaten to deter or delay investment in CAV technologies, and runs counter to the goals of this rulemaking. As the agencies acknowledge, compliance flexibilities "can help to reduce overall regulatory costs while maintaining or improving programmatic benefits."[147] SAFE encourages the agencies to retain the program, while considering several potential improvements tailored to accommodate truly innovative technologies.

This section presents SAFE modeling which shows how CAV technologies will impact the standards, as well as a legal rationale for including incentives for CAVs through the existing off-cycle program. SAFE suggests a methodology for implementing off-cycle technology adjustments related to CAV technology and recommends that the agencies partner with industry to develop a pilot program that lays the groundwork for a more rigorous, data-centric regulatory approach. SAFE also recommends the off-cycle technology program include provisions that can be updated as necessary to incentivize the fuel efficiency impacts of autonomy once those benefits are better understood. As it remains unclear when and to what degree such shifts and impacts may occur, allowing these incentives to remain flexible will allow the agencies to be responsive to new developments in the automotive industry.

Impacts of Connected and Automated Vehicle Technology

Research studies have concluded that universal adoption of existing crash-avoidance technologies could save 9,900 lives each year.[148] These same technologies could eventually generate system-wide fuel savings of 18 to 25 percent when integrated in parallel with other efficiency technologies. The full details of these findings can be found in SAFE's April 2018 report, Using Fuel Efficiency Regulations to Conserve Fuel and Save Lives by Accelerating Industry Investment in Autonomous and Connected Vehicles.[149]

While it remains unclear as to exactly when CAV technologies may penetrate the vehicle fleet, many of the changes resulting from this transition would almost undoubtedly reduce fuel consumption and emissions. SAFE has undertaken analysis that identifies some of the potential impacts CAV technology may have in relation to the standards. A review of two dozen studies underpinned the analysis and identified the following set of potential savings. Most of these savings are additive with other efficiency technologies and, together identify the potential to reduce fuel consumption by 18 to 25 percent if deployed throughout the fleet. The results from our analysis are summarized in Table 8.

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[147] NPRM, 43441.

[148] Boston Consulting Group Inc. and Motor & Equipment Manufacturers Association: "A Roadmap to Safer Driving through Advanced Driver Assistance Systems," at 2, 2015, www.mema.org/sites/default/files/MEMA%20BCG%20ADAS%20Report.pdf

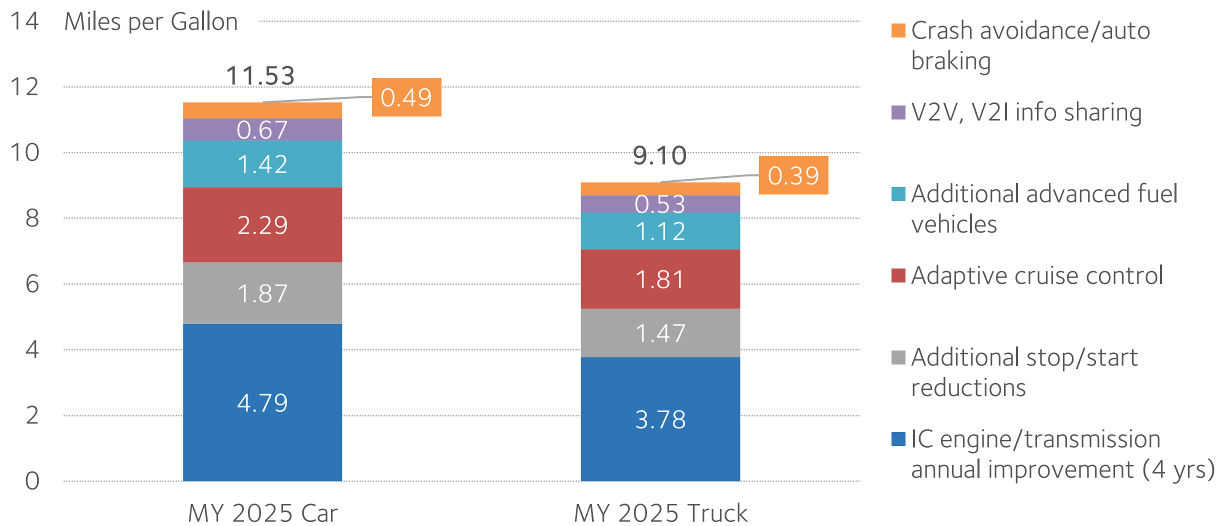
[149] SAFE: "Using Fuel Efficiency Regulations to Conserve Fuel and Save Lives by Accelerating Industry Investment in Autonomous and Connected Vehicles," April 2018, secureenergy.org/report/avsandfueleconomy.

Table 8: Fuel Economy Benefits of Emerging Autonomous and Connected Technologies

Strategy	Vehicle Benefit (estimated over all driving, even though main benefit may be on highways)	Additional Benefit if Majority of Vehicles are Equipped	Mechanism
Driver-enabled adaptive cruise control (base)	7% to 10% (assumes enabled 100% on highways)	None	Smoother driving
Crash warning systems	0%	3%	Less total crashes and therefore less idle/year
V2V information sharing	+2% to 4%	Included in vehicle benefit	Smoother driving Level 2
V2I information sharing	+1% to 3%	Included in vehicle benefit	Smoother driving Level 3 and congestion avoidance
AVs and CAVs (w/platooning)	+5%	Included in vehicle benefit	Smoother driving Level 3 and congestion avoidance
Total	15% - 22%	3%	**18% - 25%**

Figure 15 also visualizes the estimated fuel economy benefits if the technologies outlined above were to be fully realized and widely deployed. The graph assumes an annual efficiency gain in the internal combustion engine of 1.5 percent per year between 2022 and 2025. This would lead to improvements of 4.8 miles per gallon (mpg) in cars and 3.8 mpg in light trucks, respectively. Additional start/stop improvements that the industry could adopt readily would add an additional 1.9 mpg for cars and 1.5 mpg for light trucks. Adaptive cruise control, vehicle-to-vehicle (V2V) and crash avoidance could account for another 2.3 mpg for cars and 1.8 mpg for trucks. Altogether, this approach could provide 11.5 mpg compliance for cars and 9.1 mpg compliance for light trucks.

Figure 15: Estimated Fuel Economy Benefit to 2025



Source: Air Improvement Resource, Inc. analysis prepared for SAFE.

Applications of Connected and Automated Vehicle Technology

CAV technology can improve vehicle efficiency and reduce fuel consumption in several ways. Some of the effects will be seen at the individual vehicle level. Other improvements occur when new transportation-related systems are deployed. Still others are the result of wide-scale adoption of full CAV technology. An initial review of the literature shows the potential for these technologies to improve fuel economy by up to 25 percent when they are optimized and aggregated alongside other traditional efficiency technologies.[150] While more data is needed to confirm early research, their potential is incredibly promising and warrants serious examination from the agencies. At a high level, CAV technologies can improve fuel efficiency through several broad applications.

- Smoother Driving: Increased situational awareness and computer-aided acceleration/braking reduces fuel consumed during sharp accelerations.
- Improved System Efficiency: Connectivity and automation can lead to fewer collisions which, in addition to the safety benefits, also reduces traffic associated with congestion. Connectivity can improve routing decisions so that vehicles travel on roads with less congestion, thereby conserving fuel.
- Transform Business Models: The deployment of autonomous vehicles will likely occur, at least in part, through fleets that are not privately owned. SAFE research has demonstrated that most AVs are built on electric powertrains,[151] indicating the potential for a more rapid shift to advanced fuel powertrains.[152]

Each of these types of applications have different implications for fuel consumption. In the "smoother driving" category, some types of CAV technologies are already commercially available. These include advanced driver assistance systems (ADAS) that will enable safer and more efficient driving. Often,

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[150] SAFE analysis and additional modeling of existing literature.
[151] Skylar Drennan: "California AV Testing Data Points To Synergies Between Autonomy And Electrification," *The Fuse*, March 21, 2018, http://energyfuse.org/california-av-testing-data-points-synergies-autonomy-electric-vehicles/
[152] See, e.g., Daniel Sperling, Three Revolutions, March 1, 2018.

these technologies have vehicle-level impacts whose efficiency gains cannot yet be captured on the 2-cycle or 5-cycle testing procedures. However, it is possible that a modified testing procedure could be developed to account for them and SAFE encourages the agencies to establish such a process.

Other CAV technologies improve system-wide efficiencies, leading to a network effect when many vehicles have CAV technology. AV technologies will have network effects that make the transportation system more efficient. If every car had these capabilities, vehicle efficiency will improve as the number of vehicle accidents declines. Accident-related congestion in the United States, for example, wastes nearly one billion gallons of fuel and creates about 9.5 million tons of CO_2 on an annual basis.[153] ADAS and connectivity could mitigate the causes of about 85 percent of crashes. The system-level benefits are considerable. [154]

These technologies are challenging to integrate into the standards because there is no direct test that can be applied to a single CAV, unlike the current system which measures the efficiencies of individual vehicles. The savings are only observed through broad deployment. Reductions in fuel consumption and emissions can nevertheless be accurately estimated through models of CAV deployment. Recent advances in traffic simulation funded by the Advanced Research Projects Agency-Energy (ARPA-E) point to emerging capabilities to better understand the impact of technology on traffic flow. These and other methodologies should be evaluated as the agencies consider developing such a capacity.

Finally, the deployment and adoption of fully autonomous vehicles may have radical impacts on fuel consumption due to changing business models and shifts in consumer demand for particular vehicle models. For example, both economics and engineering suggest that the shift to shared, autonomous vehicles will go hand-in-hand with the transition to advanced fuels.[155] Full automation is likely to render vehicle ownership a less attractive economic proposition and allow on-demand fleets to serve a large fraction of travel demand.[156] These economic considerations underpin SAFE's modeling, which has shown that the future light-duty fleet will use an advanced fuel source, which will likely be electricity. This shift could precipitate a decrease in emissions by 90 percent relative to conventional, human-driven cars and by about 70 percent relative to hybrids.[157]

The Importance of Preserving the Off-Cycle Technology Program

The NPRM states "connected and autonomous vehicles have the potential to significantly impact vehicle emissions in the future."[158] However, these impacts will not be captured by the 2-cycle or even the 5-cycle procedures. Since the technology has real-world implications, it is especially important to capture them within a regulatory framework that incentivizes developers to prioritize fuel savings.

The structural limitations of traditional dynamometer tests make it difficult to create these incentives. For both NHTSA and EPA standards, vehicle compliance is measured by running the vehicle through a predetermined set of accelerations that mimic real-world conditions. This test does not have the flexibility to account for the ability of AVs to improve fuel efficiency performance by accelerating and

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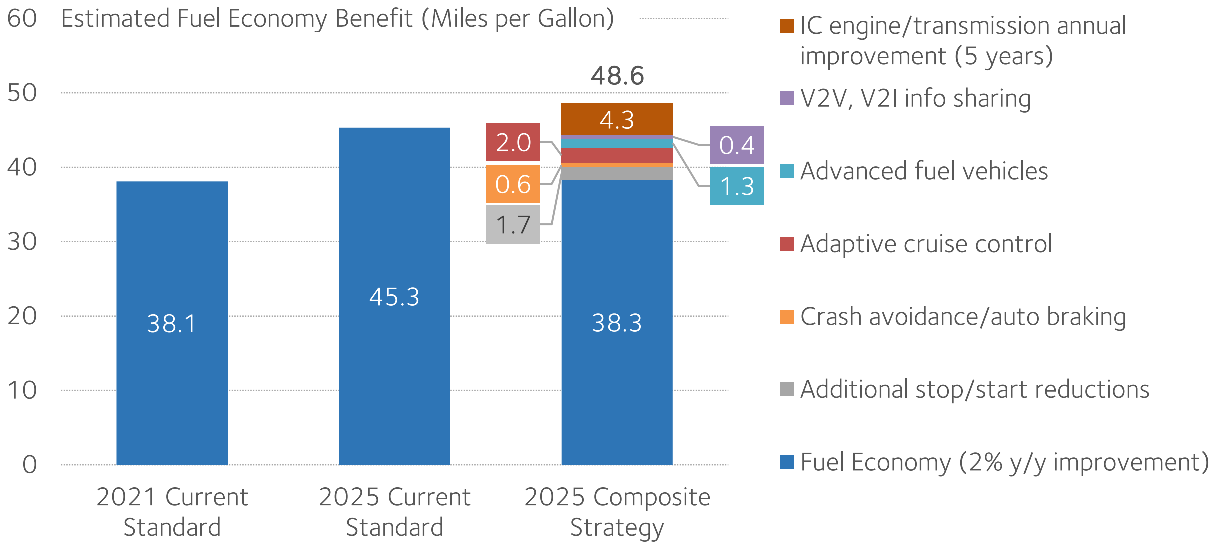
[153] *2015 Urban Mobility Scorecard*. Texas A&M Transportation Institute and INRIX (2015); Mercedes-Benz USA. "Request for Comment (RFC) on Reconsideration of the Final Determination of the Mid-Term Evaluation of Greenhouse Gas Emission Standards for MY 2022-2025 Light-Duty Vehicles," (2017).
[154] Frost & Sullivan, "Vehicle-to-Everything Technologies for Connected Cars" (Aug. 2017).
[142] NPRM, p. 43493

158 NPRM, p. 43463.

Figure 16: Estimated Fuel Economy Benefit to 2025 Under Three Scenarios



Source: Air Improvement Resource, Inc. prepared for SAFE.

decelerating more smoothly than humans, avoiding congestion-causing accidents, or having the capability to identify and take alternative, less congested routes.

As the NPRM recognizes, there are myriad ways to incentivize connectivity, collision avoidance, or ridesharing technology. Some benefits—such as smoother driving resulting from adaptive cruise control systems—can deliver fuel economy benefits in the short term.[159] Other technologies, such as collision avoidance, will deliver fuel savings when they are deployed in large volumes. The agencies should carefully craft provisions that, in addition to maximizing the safety benefits of these technologies, ensure developers use them to help save fuel as well.

The ability to account for new technologies in the future rests on the agencies retaining current flexibility mechanisms. SAFE therefore urges the agencies to retain the off-cycle technology program, which will preserve the option to update it as necessary to allow its use to incentivize the deployment of CAV technologies.

The figure above shows the relative impact certain technologies could have in varying scenarios, assuming all contributions were recognized and granted fuel consumption improvement values. The augural standard call for an improvement in fuel economy from 38.1 mpg in 2021 to 45.3 mpg in 2025. Under a composite strategy that uses the maximum benefits of each available technology, the standards could achieve 48.6 mpg in 2025, almost 10 percent higher than the current 2025 obligation.

The Legal Authority to Include CAV Technology in the Off-Cycle Technology Program

SAFE agrees with EPA and NHTSA's assessment that they have the authority to grant fuel consumption improvement values to CAV technologies. SAFE also agrees that these values may be granted for new business models, including ridesharing and transportation network companies. We encourage the agencies to exercise this authority to give industry more flexibility to choose how it will comply with the fuel efficiency standards. A legal opinion commissioned by SAFE concluded that, "there is no statutory prohibition on allowing congestion mitigation and safety-related technology to be credited in

[159] Mersky and Samaras (2016).

the CAFE and GHG programs."[160] A full discussion of the agencies' authorities to implement fuel consumption improvement values for connected and autonomous vehicles is contained in a legal memo that SAFE has shared with stakeholders and the agencies.

Of note is the 2012 Final Rule specifically enjoining an off-cycle credit for "safety, crash avoidance, and congestion mitigation technologies."[161] The previous administration made these technologies ineligible due to stated policy and political reasons. Such a prohibition is not required by statute. The prohibition against providing credit was enacted for technology designed to prevent crashes as well as any technology required under NHTSA's Federal Motor Vehicle Safety Standards ("FMVSS").

SAFE believes that the agencies should reverse the previous administration's decision and preserve the option to provide adjustments for dual-use technology that improves safety and saves fuel. By increasing the value of these technologies to manufacturers, off-cycle credits would hasten the deployment of these technologies into the vehicle fleet.

Recommended Updates to the Off-Cycle Technology Program

Society stands at the cusp of a technological revolution in transportation. The emergence of new safety technologies holds the promise of reducing today's nearly 40,000 annual road deaths in the United States each year. When new business models from transportation network companies and highly automated vehicles are combined, there is significant potential to make strides in achieving the aims of the agencies to improve efficiency. [162] Policies that incentivize the deployment of these technologies can not only save fuel but save lives by accelerating the adoption of safety technology. Additionally, without incentives for fuel savings, it is unlikely that developers will "tune" safety technologies to maximize fuel savings potential.

EPA and NHTSA have many policy levers contained within the program to achieve these significant fuel savings benefits. To preserve optionality and flexibility, SAFE recommends the Agencies should not eliminate or sunset the off-cycle credit program. Additionally, the agencies should remove the existing prescription against awarding off-cycle credits to safety technologies. Certainly, where companies can present convincing quantitative evidence of the impact of installed CAV technology, they should be appropriately awarded credits. Technology is now at a point where there is strong evidence that it will improve system-wide efficiencies, but under the current program, the evidence of those safety and fuel savings benefits may not be robust enough to support a conventional application for an off-cycle credit.

SAFE applauds the Agencies for soliciting comments in the NPRM on ideas such as offering a pre-determined credit, perhaps as a percentage of a company's fleet average, for installing CAV technologies, credits for vehicles certified at a high level of automation (as per the SAE J3016 standard) or granting credits for vehicles used in dedicated fleets. SAFE supports further consideration of all these ideas.

SAFE's view is that while regulators, companies, and researchers do fully understand the fuel efficiency impacts of CAV technologies, there is a compelling public policy case to incentivize the uptake of CAV technology. There is additionally a compelling need to gather more real-world data on the impacts of CAV technologies. SAFE, therefore, recommends that the Agencies prioritize creating a program that promotes adoption while gaining data through real-world testing and data sharing. At a high level, this

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[160] Hogan Lovells memo.
[161] 2012 Final Rule at 62,730, 62,732-62,736, 62,836.
[162] Ibid.

would take the form of a temporary granting of a predetermined number of credits for a list of several CAV technologies. Trial credits could also be included for business model innovations such as using vehicles solely in fleet-based transportation.

Such an effort by EPA would help NHTSA achieve its two congressionally-mandated objectives of fuel economy for national security and safety. Such a program should be designed to offer compliance credit to the automakers for the duration of the program. In exchange for the compliance credit, manufacturers would agree to a set of deployment parameters with the agencies and share all relevant data with NHTSA and EPA. To be effective, this program should run for a minimum of three years and up to a maximum of five years and should be designed to start in model year 2021 and conclude with model years 2024 to 2025 vehicles. If at the end of the test period the technologies demonstrate real-world results, the federal agencies should work to incorporate them into future compliance periods. Such a research program could also identify ways real-world data could be used to more effectively to assess technologies that are already part of the off-cycle credit program.

As an example of how the program could function, currently General Motors includes its Super Cruise technology on several Cadillac models and plans to include it on the full Cadillac brand by 2020. That data is transmitted, anonymously and securely, via OnStar. As part of this program, GM could agree to a program which shares the relevant emissions and fuel consumption data with the agencies. This data is already collected and anonymized, so it can be incorporated into the program quickly. GM could then agree to a ramp up period to a significant number of vehicles beyond the Cadillac brand to, say, 50,000 vehicles across the full GM lineup that would have this technology installed and included in the program.

The exact grams per mile credit allocated to those car companies that participate will need to be determined in conjunction with the overall regulatory target that is eventually set for the 2021-2025 timeframe. Only at that point could the companies make the determination of what size credit would be sufficient for participating in the program at the necessary scale. Nevertheless, in preliminary conversations we have had with various stakeholders, we recommend setting the minimum credit at two grams per mile for ADAS and other connected technology that currently exists. There should be a discussion around the compliance credit necessary to induce near-ready technologies into the market place (and into this test program).

In short, connectivity and autonomous vehicle technology will have a broad positive impact on the efficiency of the U.S. transportation system. While the downstream impacts of broad AV adoption are not fully understood, there is much more certainty on the impacts of building block technologies that comprise these systems. By utilizing fuel efficiency policies within the current authorities of the agencies to better evaluate these technologies, the U.S. can not only create more opportunities to save fuel in the short-term but also begin the process of modernizing energy policy for the impacts of AVs for the coming decades.

Advanced Fuel Vehicles, Fuel Diversity, and Critical Minerals Supply

The current rulemaking is occurring in the midst of tremendous change and innovation across the transportation sector. With the rise of autonomous vehicles, transportation in the United States is poised to enter a period of unprecedented development. Autonomous vehicle fleets can advance our progress toward the goal of energy dominance, as advanced technology vehicles prove to be the best vehicle platform from both an economic and technological perspective.

As these trends begin to converge, SAFE encourages the agencies to use the fuel efficiency standards to increase fuel diversity and leverage the program to accelerate the transition to a safer, cleaner transportation sector. We believe that the preferred alternative, which eliminates the incentives and flexibilities for these vehicles, fails to fully balance the need of the nation to conserve energy as required by EPCA.

To advance U.S. economic and national security goals, SAFE urges the agencies to continue support for advanced technology vehicles by maintaining the fuel-neutral credit multiplier through the duration of the rulemaking. Inclusion of this flexibility will allow automakers to count each advanced technology vehicle sold as more than one vehicle for compliance calculations.[163] Maintaining this provision will sustain momentum toward the widespread adoption of electric vehicles. Some have argued that mass production of advanced technology vehicles will require reliance on a number of strategic minerals, and this has caused some to ask whether we are trading one dependency, on oil, for another. SAFE addresses those concerns below. In addition, SAFE encourages the agencies to allow all upstream emissions from advanced fuel vehicles to be considered "zero," while also removing the manufacturer sales cap.

For the first time, the United States is closing in on making fuel choice a reality by bringing electricity, hydrogen, and natural gas fuels into the transportation sector and building fueling infrastructure nationwide. SAFE believes that the agencies should seize this opportunity to enable greater long-term reductions in oil demand, while offering greater flexibility to industry in choosing how to comply with the fuel efficiency standards.

Advanced Fuel Vehicles

The United States has made genuine progress toward advancing energy security since the country first became aware in the early 1970s of the risks posed by oil dependence. The oil intensity of the economy has been reduced by nearly 50 percent since that time.[164] Although the United States has faced serious challenges over the past several decades as a result of its oil dependence, these would have been more severe without the progress made to improve the fuel efficiency of light-duty vehicles.

Yet, further strengthening U.S. energy security requires a transportation system no longer predominantly beholden to the global oil market and its structural volatility. Advanced fuel vehicles powered by non-petroleum energy sources—electricity, natural gas, or hydrogen—are an attractive solution. Electric vehicles (EVs), for example, draw energy from the electrical grid's existing generation, transmission, and distribution infrastructure. This electricity is generated from a diverse set of largely domestic fuels including coal, natural gas, nuclear, and renewables. The figure below highlights the stability of electricity prices versus the volatility that affects the global oil market. Sudden and

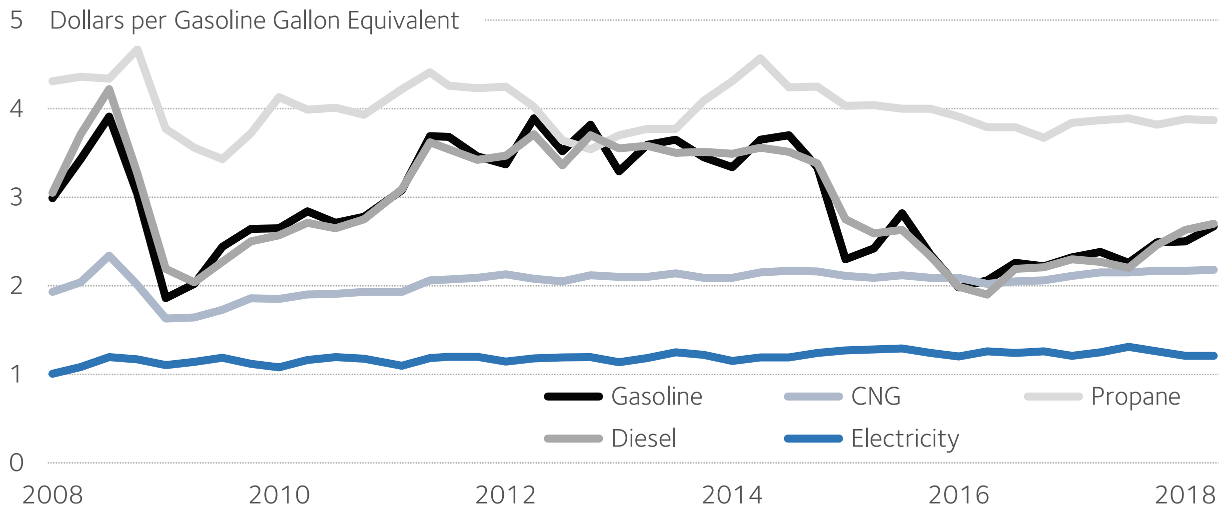
[163] NPRM, 43461

[164] Note: Oil intensity is defined as oil consumption per unit of economic activity (gross domestic product) and; SAFE analysis based on data from EIA (U.S. oil consumption) and BEA (GDP).

unpredictable fluctuations in liquid fuel prices create uncertainty that affect business and consumer budgetary decisions. Ultimately, this volatility results in more economic dislocations and less efficient resource allocations that prevent the U.S. economy from maximizing its potential. In extreme situations, volatility can lead to recessions.

Electric vehicles, thus far, have shown the most promise in the advanced fuel vehicle market. As of October 2018, cumulative light-duty electric vehicle sales in the United States since January 2011 have topped 1 million units, but still represent just over 1 percent of new LDV sales.[165] Importantly, automakers continue to expand geographical availability and now offer more affordable vehicle options with improved range. Nearly 50 different EV models are now available in nearly every passenger vehicle segment—compact cars, sedans, SUVs, and minivans.[166] Initial estimates predict another 120 models will be available for sale by 2020.[167]

Figure 17: Transportation Fuel Prices, 2008-18



Source: SAFE analysis based on data from Clean Cities Alternative Fuel Price Reports

Despite this progress, EVs and other advanced fuel vehicles have not met the overly optimistic sales forecasts by automakers. National sales remain heavily skewed, with more than 50 percent of EV sales in California, a state that represented only 12 percent of the new vehicle market in 2017.[168] The most notable barrier remains purchase cost, though other obstacles to broad commercial adoption remain. These obstacles underscore the need for continued incentives in the fuel efficiency standards.

Volatile petroleum prices are also affecting demand for better fuel economy and advanced fuel vehicles.[169] Many recent gasoline price spikes have been both sharp and temporary, a phenomenon that often leads consumers to make decisions based on short-term thinking. As a result, consumers frequently undervalue fuel efficiency. Over the long term, many research studies have shown that EVs'

[165] For details see, Paul Ruiz, "U.S. Reaches 1 Million Electric Vehicle Sales." The Fuse. October 11, 2018.
[166] Ibid.
[167] Bloomberg
[168] SAFE analysis based on data from The Auto Alliance: Advanced Technology Vehicle Sales Dashboard; and SAFE analysis based on data from The California New Car Dealers Association: Fourth Quarter 2017 – California Auto Outlook.
[169] See, e.g., Bloomberg New Energy Finance, "Oil Price Plunge and Clean Energy – The Real Impact," December 22, 2014.

total cost of ownership is lower than that of comparable internal combustion engine vehicles, which can lead to significant consumer savings.

Encouraging the development and adoption of advanced fuel vehicles not only increases innovation but offers consumers a choice of fuels and allows motorists to make vehicle purchasing decisions that suit their needs while providing greater certainty on long-term fuel prices. These technologies are still in the early stages of commercialization, but as costs continue to fall and consumers gain confidence in alternatives, the nation's oil dependence can be meaningfully reduced.

Advanced Fuel Multiplier

Given both the role advanced fuel vehicles play in strengthening energy security and the hurdles they need to overcome, fuel efficiency standards should be leveraged to encourage fuel diversity. One of the mechanisms used to facilitate compliance with the standards is EPA's accounting system that allows for trading, banking, and borrowing of credits. These provisions help automakers smooth, and therefore lower, the cost of complying with regulations.[170] For example, when an individual manufacturer exceeds its compliance obligation for a given year, the company earns credits that can then be traded, banked for future use, or applied to a prior year within certain constraints.[171]

As part of this credit market, EPA provides automakers an extra incentive for every advanced fuel vehicle they sell. One EV or fuel-cell vehicle (FCV) sold currently counts as two for compliance purposes. Table 9 shows that under the current program the incentive multiplier will phase out from 2x for electric and FCV in 2019, to zero in 2022. Plug-in hybrid electric vehicles (PHEVs) receive 1.6x credit in 2019 before also phasing out in 2022. Given the critical role these vehicles will play in achieving sustainable energy dominance, SAFE supports maintaining these credits through the life of the program.

Table 9: Incentive Multipliers Allowed for MY 2017-21 and SAFE Proposal for 2022-25

Model Year	EV and FCV (Existing)	EV and FCV (SAFE Proposed)	PHEV (Existing)	PHEV (SAFE Proposed)
2017 to 2019	2.00	2.00	1.60	1.60
2020	1.75	2.00	1.45	1.60
2021	1.50	2.00	1.30	1.60
2022 to 2025	0.00	2.00	0.00	1.60

Maintaining and extending the fuel-neutral multiplier credit is beneficial to the United States for three distinct reasons. First, the credit acts as a tool to account for the fact that advanced fuel vehicles do not use oil. Second, while automakers are provided additional incentives to sell advanced fuel vehicles because they are an early-stage technology, these vehicles' ability to disrupt existing energy security vulnerabilities means they can advance national energy and environmental goals to a degree that other

[170] Benjamin Leard and Virginia McConnell, "New Markets for Credit Trading under US Automobile Greenhouse Gas and Fuel Economy Standards," Resources for the Future, May 2017.
[171] Michael Greenstone, Cass Sunstein, and Sam Ori, "The Next Generation of Transportation Policy," The Hamilton Project and Energy Policy Institute at the University of Chicago, March 2017.

efficiency improvements alone do not. Third, automobile manufacturers themselves have all chosen to invest a significant amount of money into the research, development, production, and sales of both battery and fuel cell-powered EVs. There are a variety of reasons for this industry trend, which include technical reasons such as declining battery prices, global regulatory requirements, competitive reasons including the emergence of companies like Tesla, and industry and social trends towards ridesharing and autonomous transportation.

Still, the consumer market lags because the technology cannot yet compete on price with conventional vehicles. The credit multiplier is a means to assist the industry through the early years of this technological change.

A phase-out or elimination of these credits would occur at a critical moment for advanced fuel vehicle adoption and threatens to undermine U.S. leadership in this growing market. The regulatory, technological, and market pressures are increasing just as the industry is ramping up production and sales of these vehicles. The credit multiplier provides an economic value to each automaker beyond the sticker price on the car, while the trading system itself lowers the price to individual consumers—all while serving to achieve long-term strategic objectives, including critical economic and national security goals or reduced oil dependence.

Upstream Emissions

In addition to extending the credit multiplier through 2025, the agencies should eliminate the requirement to account for upstream emissions from electricity, a provision which is slated to include a per-company vehicle sales cap beginning in 2022.[172] Avoiding having to account for emissions will serve as an additional incentive to leverage advanced fuel vehicles to meet the standards set by the EPA and NHTSA, or at least not disincentivize them.

Traditionally, emissions associated with the upstream production and distribution of vehicle fuels have been regulated independently of established motor vehicle GHG and fuel economy standards. Therefore, accounting for their consumption within the vehicle is effectively regulating the production of a given unit of energy twice. Moreover, vehicle manufacturers have no authority or control over the production and distribution of fuels, or by extension their environmental impacts. Fuel producers and distributors are separately regulated entities subject to controls established for their respective industries.

In addition, this policy change is likely to fracture the auto market by pushing automakers to focus only on specific areas of the United States with lower emissions in the generation of electricity to sell EVs to avoid incurring an artificial penalty. This will not advance the national goal of accelerating the sale of advanced fuel vehicles and increased fuel choice for consumers and business. SAFE strongly recommends the administration and EPA to eliminate any accounting for upstream emissions of advanced fuel vehicles while also eliminating the sales cap.

Strategic Minerals Vulnerability

As the United States moves toward achieving a fuel-diverse future, it is important to examine any potential vulnerabilities that would arise from meaningful adoption of advanced fuel vehicles. As a result of oil's dominant role in transportation, the economy is exposed to frequently high and often volatile oil prices. In the short term, American consumers and business have little ability to choose less costly transportation alternatives and pay for this lack of choice. Worse yet, the United States remains

[172] NPRM, 43461.

highly vulnerable to a major oil supply disruption, whether it be accidental or intentional, or commercially or politically motivated. As the agencies acknowledge in this proposed rulemaking, even vastly increased U.S. "…production, and capacity cannot entirely insulate consumers from the effects of price shocks at the gas pump."[173]

Some have expressed concern that the mass production of EVs will require a reliance on several strategic minerals, which could induce a new kind of dependence. Ultimately, the supply chain for the strategic minerals necessary for EV production is much less vulnerable than the oil-motor fuel supply chain and there is little risk of physical minerals shortages preventing automakers from meeting future EV demand. Any implications for vehicle owners and commerce in the United States would therefore be very minor and should not act as a deterrent from achieving great redutions in our nation's oil depdenence.

The minerals needed to produce EVs include cobalt, graphite, lithium, manganese, nickel, and neodymium and dysprosium, among others. The reserves and production of some of these minerals, unlike oil, are widely dispersed around the globe. Several, such as lithium, cobalt, and dysprosium and neodymium, are more narrowly concentrated (in Chile, China and Democratic Republic of Congo, respectively), but there are other factors which make a supply cutoff less likely, and less serious should it happen.

The critical minerals and motor fuels supply chains are fundamentally different because the strategic materials are only necessary for EV manufacturing, not in their operation.[174] The strategic minerals necessary to produce a battery pack or EV magnet are only required once, but gasoline is required daily—or at least every time an internal combustion engine is operated. EV batteries are a storage mechanism for energy that can be charged from a wide range of domestic sources including coal, nuclear, natural gas, hydropower, and other alternatives. Even in a scenario in which automakers were cut off from a needed strategic mineral, the result would mean that new EV production would only be temporarily delayed or that costs could rise.

Precisely because the impact of a strategic minerals disruption directly burdens the automakers and not end consumers such as drivers or fleet operators, a transportation system with EVs is much more resilient than one wholly reliant on internal combustion engine vehicles. Increased demand for a given strategic mineral may result in price increases for that mineral but not to the owners of existing vehicles. Drivers would continue to recharge and use their vehicles as they had before any adverse event. In contrast, petroleum-fueled vehicles would cease to operate in the event of a supply shortage.

Although EVs are currently sensitive to the supply of strategic materials, they are not highly vulnerable. The costs of adjustment over time are modest compared to the full value of a manufactured vehicle, or the role of the vehicle in the U.S transportation system. Many avenues exist to address any future challenges. These include further exploration of mineral deposits in the United States and around the world, technological advancement, and new markets for recycled materials. These options will help alleviate any future supply crunches. Unfortunately, the same options do not exist with petroleum-based fuels. Ultimately, by reducing oil demand through widespread adoption of EVs, the United States can eliminate its reliance on an unpredictable global oil market and pivot towards less vulnerable commodities.

[173] NPRM, 43214.
[174] Seeking Alpha. Where the Money Is in the Electric Vehicle Supply Chain: Part I. Oct. 2, 2017.

Conclusion

Securing America's Future Energy appreciates the opportunity to offer comments on this rulemaking and hopes that the agencies will fully consider all our ideas and proposed changes. We believe the standards being discussed today play a significant role in insulating the nation from its exposure to an opaque and unfree global oil market. This critical moment allows the United States to reduce its dependence on oil which has undermined the nation's economic sovereignty, constrained our foreign policy options, and burdened our military forces. Improving the fuel efficiency of the U.S. vehicle fleet should remain a top national priority. SAFE looks forward to continuing its dialogue with the administration to develop a fuel economy program that advances the goal of energy dominance while meeting the needs of both consumers and the auto sector.

In summary, SAFE offers the following recommendations to the agencies:

- SAFE believes the agencies should include the true military cost of protecting the global oil supply in their benefit-cost analysis.
- We encourage the agencies to select an alternative that increases the stringency of the program by at least 2 percent per year.
- Rather than focus on mass changes, SAFE urges the agencies to instead incentivize the introduction of advanced driver assistance technologies (ADAS) to reduce overall crash frequencies and fatalities.
- The agencies should retain the off-cycle technology program, while considering a number of potential improvements tailored to accommodate truly innovative technologies.
- SAFE disagrees that the standards have meaningfully contributed to higher vehicle prices and believes that existing data shows that fuel efficiency standards: do not contribute to higher vehicle prices; have not negatively impacted new vehicle sales; and are not keeping consumers in older, dirtier, and less safe vehicles.
- SAFE believes that the agencies should seize this opportunity to enable greater long-term reductions in oil demand by continuing to incentivize advanced fuel vehicles such as those that operate on electricity, hydrogen, and natural gas.

Appendix

Comments from Members of the Energy Security Leadership Council and Other Defense Experts

During the summer of 2018, SAFE interviewed members of its ESLC and several defense budget experts. The purpose was to gather additional information and insights on the costs of oil dependence and to better evaluate the studies which were reviewed.

The overall perspective of those we spoke with was that attempts to quantify the amount of money spent on defending the global oil supply was a worthwhile exercise and that the average $81 billion-per-year figure produced by SAFE's literature review underestimates the costs of this effort.

The primary sources of this underestimation were:

1. Difficulty of estimating the cost and a desire to be conservative;
2. Exclusion from most estimates of the narrower Iraq and Afghanistan budgetary war costs;
3. Failure to focus on the wider, long-term economic costs of the Iraq and Afghanistan wars.

Below are specific questions we asked and their answers. Please note that these interviews were conducted individually, but we are grouping the answers together for ease of presentation.

Question 1: Is it possible and worth trying to produce an estimate for the U.S. military costs for protecting global oil supplies?

Admiral Dennis C. Blair: Supporting the free and unimpeded flow of oil from the Middle East is one of the functions we perform with our multipurpose forces. But it is extremely hard to isolate a cost of one mission from the many other missions that are performed by multi-purpose, military platforms. Take the example of an aircraft carrier. It performs humanitarian operations, demonstrates a show of force, enforces no-fly zones in the Middle East, fights in wars, and lives for 50 years. How do you allocate its cost across those various missions? This is fundamentally a judgment call and that can be criticized either way.

General Duncan McNabb: There is no best way to produce this estimate. The base budget is for supporting the two-theater war strategy. The Overseas Contingency Operations (OCO) budgets are incremental costs to do specific operations and they can be broken out. If you go back and look through the base and OCO budgets you can parse this any way you want, but there is no question we have a much larger presence in the Middle East to make sure we're defending the oil. All of these things aren't things we would have to do if we were not protecting the oil lanes and this region of the world were not so important to us. The force structure could be different if you took out the Gulf presence…Also, there are many other additional costs to defending oil besides those contained in the Defense Department budget, such as relevant spending by the State Department, Foreign Military Sales (FMS) programs, and other foreign aid programs.

General Charles Wald: Europeans spend about $9 per gallon for gasoline and we spend somewhere around $3 per gallon, but we're really paying a lot more because of all the operations in the Middle East. We were there for the free flow of oil, and secondarily because of Israel. We weren't there for terrorism. There is a direct cost to the United States for securing the oil flow from the Middle East. We should consider that.

Question 2: Do you think that the cost to the U.S. of protecting the global oil supply is "zero?"

General James T. Conway: No, I don't think so, not if you look at what this country has dedicated to protecting the world's oil supply. We tell the troops that we have a presence in the Middle East to protect our national interests but if you scratch that answer just a little bit, then that answer comes up oil. And, if we consider where our last several conflicts have been, we would not be able to justify these missions and deployments otherwise.

General Wald: It costs more money to be deployed forward. Everything costs more. It costs more money to be in the Middle East, period.

General McNabb: We were always worried about retention and about operational tempo, and this was driven by the Persian Gulf. This had to do with how to sustain operations based on the situation we faced and, in this case, this was a rotating presence well beyond anything we had done before. Everyone understands that this is an incremental cost. We had never called up the guard and reserve before Desert Shield and Desert Storm. This was basically tailored.

Question 3: The literature review undertaken by SAFE produced an average of $81 billion, or approximately 16 to 20 percent of the base defense budget per annum, for the cost of protecting the global oil supply. Do you think that number is too high, too low or about right? Do you think the OCO funding should be included in oil defense costs?

Secretary John Lehman: The 20 percent figure is a credible number. Since the end of Cold War, the only real threats we have are threats to the oil supply. People have only begun to worry about Russia and China in the last 10 years. I would make the case that the OCO spending is related to oil protection. More than half the Defense budget is for the security of Persian Gulf oil.

Admiral Blair: I would put all the OCO onto the ledger as we look backwards. It's reduced now, but as applicable to the Middle East, I would add it to the petroleum account. We would not make those deployments otherwise. If you look at other parts of the world with terrorist threats, we don't have nearly the high level of forces deployed as in the Middle East. It's the most expensive global presence.

The underlying objective of the armed forces in quantifying the cost of any mission is how much we might save if we were not there. If you put a number on a particular mission and then you stop doing that mission, you open yourself up to calls for defense budget cuts. However, the place where these costs are most identifiable year over year is OCO spending on missions like Afghanistan or in the Gulf War. OCO funding is the cleanest attempt to calculate an additional burden on the armed forces during a particular contingency.

General McNabb: $81 billion is fairly conservative and it is that additional cost for defense of the oil and freedom of navigation.

Dr. Gordon Adams: My own reading would be that it is a low estimate. I would not leave the OCO expenditures out. They are so integral to the policy—the reason we are there and the reason we fought those wars is connected to this longer trail of history. The second issue is where you go with broader global commitments to protect the oil supply. The Middle East is one piece, even a big one. But historically, looking at other oil suppliers, like Venezuela, there are additional expenditures you need to reference.

Question 4: Should the First and Second Iraq Wars or the Afghanistan War be included in the estimate?

Secretary Lehman: The wars in the Middle East have been related to the balance of power in that region and control over oil states. You don't want to fall into the trap of the left and say that we only went into Iraq for their oil but depending how you phrase it, the costs can be attributed to the strategic dependence we have on Gulf oil.

Admiral Blair: I would add all those costs and our continuing presence in the region into the oil accounts. Oil was the major factor for leading a coalition into the Iraq War in 1991. Iraq would have owned 33 percent of the world's oil reserves had it not been challenged. Out of that war, predominantly caused by oil considerations, the U.S. maintained a heavy footprint in the Middle East. Previously it had not done so. This provided an impetus for Osama Bin Laden and the Taliban to prosper. This gave him and his followers the money to go after the distant enemy and attack us on 9/11. We then invaded Afghanistan to throw the Taliban out, and then we invaded Iraq in the second Iraq War under the same calculus. You can draw a thread through the whole thing with oil. Had one country invaded a neighbor anywhere else except in the oil-rich part of the world, such as South Africa invading Mozambique or Bangladesh invading Myanmar, the U.S. would not have gathered an international military coalition. We did so because the Middle East is where the oil comes from and it is a supply we depend on.

General Conway: Our presence in the Middle East, some would say, is what agitated Islamic fundamentalism. If you approach it from that perspective, while Afghanistan doesn't have oil, the war is a result of what has happened in the wider Middle East for oil. Afghanistan is indirectly related to oil.

General McNabb: Some can still argue that Iraq and Afghanistan were much more about the war on terrorism than the defense of oil, but the first Iraq Gulf War was about oil and the subsequent experiences in the region would not have occurred if the first war had not happened. In a way, we can trace 9/11 back to oil, too.

Question 5: Is the methodology utilized by Bilmes and Stiglitz for their larger economic estimates valid?

Admiral Blair: We should add the cost of those killed and wounded in those wars to the total bill. We can say that's the additional cost U.S. taxpayers pay for oil above what they are paying at the pump or directly through the Defense budget. These costs are on top of regular Veteran's Administration budgets of what we would incur under normal death and injury rates in the armed force. The long stream of costs was directly caused by those wars and it would not have taken place had the oil not been in the Middle East. This is a check the U.S. government writes and the American people have to fund it.

General Conway: We could look back through all the U.S.-Middle East wars and we could say these all are attributed to protecting the oil supply lines. We have to ask what the costs of those fights are. It makes one curious about the unobserved costs. These aspects have been addressed by this approach.

Secretary Lehman: This makes common sense, but we will never have agreement on the figures.

Dr. Adams: It is valid because it is carefully defined. As Americans, we don't think of the unintended consequences of pure military commitments.

Question 6: If the Middle East did not have oil, would the U.S. be spending its blood and treasure to stay so deeply involved in the region?

Secretary Lehman: Our existential threats are what we should be concentrating on. We should concentrate on East Asia and an increasingly revanchist Russia. Defending Persian Gulf oil is a major distraction from those existential defense issues. We want to be strongly supportive of increasing our defense capability, but the fact is that oil dependency complicated the military equation beyond our comprehension.

Admiral Blair: From the military's point of view, there are three areas we have to worry about: East Asia, the Middle East, and to a lesser extent, the Atlantic Russia-Europe region. If the Middle East didn't have oil, it wouldn't be one of the top three priorities. The U.S. would not need to be so deeply involved.

General Wald: We are not in the Persian Gulf because we are benevolent. We want oil to flow out of there. If the region were stable, without threats to close the Strait of Hormuz or threats to Aramco facilities, we would not be there.

General Conway: I don't think we would. Indeed, in many places, we are protecting the oil supply of actors that do not share U.S. interests. Why should we protect the oil that is going from Iran to China?

Question 7: Do you think we can have an honest discussion about the costs of protecting the global oil supply?

Secretary Lehman: The military is overwhelmingly sympathetic to energy independence, but they haven't given much thought to auto mileage. However, energy independence is so essential to our national security and the lack of it has driven us to mass expenditures and unnecessary wars.

Senior military leaders need to get political clearance to comment on policy issues like this. They have to clear speeches and testimonies. Everyone is reluctant to take on anything that involves domestic political issues. Senior officials, including the Secretary of Defense, are never anxious until in their last tour to get involved with anything political. They avoid contentious topics because they have enough problems getting budgets through. But the issue of energy independence is crucial and important, and if you get them into a dialogue in a congressional hearing, for example, they will respond in the right way. But to give testimony, that has to be cleared and that makes it harder.

General Conway: Yes. Defense Secretary Mattis is a pragmatist, but it won't happen so long as we keep raising the defense budget. This would only come to pass if there was a crunch. So, do we build more amphibious ships or focus on the operational function of guarding the sea lanes?

Admiral Blair: This is not a gradual, linear function and we can only recognize military savings when we hit a certain point. If we reduced our oil consumption by half we would act differently. We would certainly not incur those OCO expenses…These are not small, incremental gains. You would make huge savings.

General McNabb: When we talk about military readiness and say only 50 percent of the force are available to fight, this means we are robbing Peter to pay Paul. You can say that reducing activities in the Persian Gulf would free up resources to be utilized elsewhere. If we can reduce our dependence on oil, we could reduce our presence in the Gulf and use the funds for different military purposes, like cybersecurity or hypersonic weapons. The same funds could be spent but we would make different choices.

General Wald: I don't understand why there are these delicacies in talking about this. This is the way it is. We either have a military and pay for it, or we don't. The issue we might get into is how much are other countries spending for the security of this oil-supply system that they are benefitting from. This is the global commons issue. Is it in our interest to pay for this, even though others are beneficiaries?

Methodological Considerations and Issues

One of the difficulties with this type of analysis is that it is hard to know what missions and forces are used for securing the global petroleum supply. Military forces are largely multipurpose and fungible, and there is much ambiguity about assigning exact expenditure estimates to specific missions. As the RAND study noted, "Forces designed primarily for use in one theater or in one scenario can typically be brought to bear in another as well."[175] This methodological concern was acknowledged by almost all the studies reviewed.

Even something seemingly obvious, such as U.S. naval forces patrolling against pirates in the Indian Ocean is ambiguous. How does the United States allocate the cost of protecting oil tankers in that area as opposed to container ships plying the same trade route? Even if the petroleum protection mission were eliminated, not all forces earmarked for this role would be eliminated.

What about non-Defense Department-related expenditures such as military and economic aid to energy-rich states or their neighbors? Annual aid to countries such as Colombia, Iraq, Jordan, Kazakhstan, and Nigeria are in the tens of billions of dollars. These dollars go to support political and economic stability in some of the most volatile regions of the world. Would all of this aid flow to these countries if they did not have petroleum or some relationship to petroleum?

Should the cost of the Strategic Petroleum Reserve be included? What about the financial and opportunity costs of the diplomatic corps' focus on problems in places that few Americans would care to visit, and where even fewer (outside the petroleum industry) have any business?

Other more specific modeling Issues are: Should the cost be spread-out over all petroleum products or just gasoline and diesel fuel? Should the cost be spread over total consumption or just imported petroleum or gasoline or diesel fuel?

[175] Ibid. P. 59

RAND Top-Down Calculations, Adjusted for 2017

Table 10: Steps to Calculate the Military Cost of Defending Oil

Step 1: Take 2017 DOD Budget Numbers and Recalculate.

Budget Area	Budget (Million $, FY 2017)	Core Share (%)	Core Share (Million $, FY 2017)
Personnel	146,144	0.33	48,228
Operations and Maintenance	146,144	0.25	36,536
Research, development, testing, and evaluation	74,129	0.25	18,532
Procurement	124,339	0.25	31,085
Construction	68,93	0.50	3,447
Housing	13,16	0.75	987
Other	14,701	0.75	11,026
Total	513,666		149,840

Step 2: Apply non-core spending to CoCom.

	Estimated Share of Noncore Regular Budget	Implied Noncore Regular Budget (million 2017 dollars)
CENTCOM	0.35	127,339
PACOM	0.20	72,765
EUCOM	0.15	54,574
AFRICOM	0.05	18,191
SOUTHCOM	0.05	18,191
NORTHCOM	0.05	18,191
STRATCOM	0.10	36,383
SOCOM	0.05	18,191
Total	1.00	363,826

Step 3: Apply Non-Core CoCom Budget to Energy Security Related-Budget.

Combatant Command	Estimated Share of Energy Security Costs	Implied Energy Security Share of Budget (million 2017 Dollars)
CENTCOM	0.50	63,670
PACOM	0.10	7,277
EUCOM	0.10	5,457
AFRICOM	0.30	5,457
SOUTHCOM	0.05	910
NORTHCOM	0.00	0
STRATCOM	0.00	0
SOCOM	0.25	4,548
	Total	87,318

Step 4: Take total and divide by U.S. petroleum or gasoline consumption.

EIA 2017 Total U.S. Petroleum Consumption (bbl)	7,284,569,000
EIA 2017 Total U.S. Petroleum Consumption (gal)	305,951,898,000
Implied DoD Budget	87,318,295,200
$/gallon	0.29

EIA 2017 Finished Motor Gasoline (bbl)	3,401,309,000
EIA 2017 Finished Motor Gasoline (gal)	142,854,978,000
Implied DoD Budget	87,318,295,200
$/gallon	0.61