ACEEE Regulatory Comments
American Council for an Energy-Efficient Economy

Comments of the American Council for an Energy-Efficient Economy (ACEEE) on NHTSA and EPA's Notice of Proposed Rulemaking "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks" (Docket No. EPA-HQ-OAR-2018-0283 and NHTSA-2018-0067)
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The American Council for an Energy-Efficient Economy (ACEEE), a nonprofit, 501(c)(3) organization, acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. ACEEE has worked for almost its entire 38-year history in support of improving the fuel economy and reducing the emissions of U.S. highway vehicles, engaging in the technical, legislative, and regulatory discussions on these issues.

We offer the comments below on the Notice of Proposed Rulemaking "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks" (NPRM). Topics covered here include the need of the United States to Conserve Energy; cost of technology to comply with existing standards; the effect of the standards on highway fatalities; and changes to the flexibility provisions of the standards.[1] Our joint comments with consumer groups discuss issues related to the consumers and the vehicle market.[2]

I. Need to conserve energy

The NPRM implies that the rulemaking need no longer pay much attention to one of the required considerations, "the need of the United States to conserve energy," because oil price shocks will now be lessened, the US economy is less susceptible to them, consumers can now value fuel savings for themselves, the balance of payments is less important, and the standard will not solve global warming anyway.

This discussion is misplaced. The statute does not ask for a determination on whether the nation needs to save energy. It assumes the need and directs that the need be taken into account along with other considerations. Congress recognized that there were multiple compelling reasons to save energy; that remains true today. We estimate that in 2016 the nation saved roughly 63 quads of energy (or 64% of actual energy use) due to efficiency actions since 1980,[3] savings worth hundreds of billions of dollars. The notice acknowledges that CAFE standards have been effective in reducing the demand for fuel and thus is reducing the risks and negative impacts from oil use. But that success does not mean there is no need for further savings.

[1] These comments address the proposed CAFE and GHG standards. While we discuss some topics in terms of either fuel economy or GHG alone, all comments applicable to both standards programs are addressed to both agencies and their respective standards programs.
[2] Consumers Union, Consumer Federation of America and American Council for an Energy-Efficient Economy. Joint Comments on Vehicle Sales, Ownership Costs, and Consumer Willingness to Pay for Fuel Economy. Submitted to Docket No. EPA-HQ-OAR-2018-0283 and NHTSA-2018-0067.
[3] https://aceee.org/blog/2017/05/doing-more-less-how-us-economy-grows/.

The average US household still spent nearly $2,000 on gasoline and motor oil (directly) in 2017,[4] making oil savings very relevant for consumers. And although the notice dismisses previous rulemakings' concern for consumers as paternalistic, polls as well as public comments have repeatedly shown that a large majority of consumers support higher vehicle standards,[5] presumably seeking help saving energy.

Oil price volatility remains a threat to US consumers and businesses—the price of crude oil has more than doubled since February 2016,[6] belying the theoretical suggestion in the notice that the conditions for oil price shocks may no longer exist (the notice's claim that future increased global demand or lower global demand both would temper oil price shocks is even more extraordinary). While it is true that the reduction in oil intensity of the US economy due to improved efficiency has reduced the economic impacts of oil price volatility, further improvements would further protect consumers and the economy.

Trends in net imports of oil (in part due to vehicle standards) also do not alter the need to save oil. The US imports more oil than it did in 1975, when the Energy Policy and Conservation Act was passed, and almost as much as it did in 2012.[7] Perhaps more relevant, oil prices are determined in global oil markets, so regardless of actual imports, the nation is still affected by what happens to oil worldwide, and oil remains a foreign policy concern (notwithstanding an unsupported claim in the notice). And in contrast to a small overall trade surplus in 1975, the US now runs a large overall trade deficit. The EIA Annual Energy Outlook side cases suggest that reduced oil demand will primarily reduce oil imports, thus improving the overall balance of trade regardless of the narrow balance of trade in petroleum.

The environmental need to save energy is much greater than we realized in 1975. By our analysis, vehicle standards are the single largest step the United States has taken to reduce greenhouse gas emissions and global warming. The notice argues that since improved standards will not by themselves solve global warming, they are not necessary. That logic would equally suggest that since no one soldier will win a war, we should never deploy any troops. No one measure will solve global warming. No one measure was responsible for a significant fraction of our nation's 63 quads of energy savings either. Since burning fossil fuels and energy use are dispersed throughout the nation's $19 trillion economy, many actions are needed to save energy. Of these, vehicle standards have been the most important.

For consumers, the economy, national security, and the environment, the need of the United States to conserve energy is as great as ever.

II. Fuel economy technologies and their costs

The agencies' claim that "[t]echnologies that have played out differently in the fleet from what the agencies assumed in 2012" (NPRM p.42991) is highly misleading. First, the agencies reevaluated and updated the list of compliance technologies from the 2012 rulemaking for the Draft TAR in 2016, so it is disingenuous to suggest that the issue of how technologies may differ from 2012 assumptions is being considered for the first time for the NPRM. The Draft TAR found costs of some technologies were

[4] BLS, Consumer Expenditure Survey https://www.bls.gov/cex/tables.htm#annual.
[5] See eg http://www.lung.org/about-us/media/press-releases/new-poll-voters-support-fuel-efficiency.html, https://consumerfed.org/press_release/new-poll-americans-care-fuel-economy-support-stronger-fuel-economy-standards/, https://news.gallup.com/poll/1615/environment.aspx.
[6] https://www.eia.gov/dnav/pet/hist/RWTCD.htm.
[7] https://www.eia.gov/totalenergy/data/browser/index.php?tbl=T03.01#/?f=A&start=1949&end=2017&charted=10

lower than projected and that additional technologies had become available in the meantime. EPA's MY 2025 cost of compliance in the January 2017 final determination showed further reductions.

Of course, when technologies are projected into the future, divergences from the projected path are to be expected. This has been the case for example with the dual clutch transmission, which does not play nearly the role in the U.S market today envisioned in the 2012 rule. At the same time, continuously variable transmissions have entered the market in far greater numbers than anticipated in the rule. The important point to note is that the agencies' previous approach to demonstrate the feasibility of a given level of stringency in the rule, the Draft TAR, and the 2016 Proposed Determination was inherently conservative, in that it set out in detail a cost-effective compliance path for manufacturers. Manufacturers inevitably find more and better ways to meet the required improvements, with the result that the cost of compliance will be lower than projected by the agencies. Indeed, the pool of availability technologies has changed steadily and substantially over this period, as documented in the agencies' Draft TAR and elsewhere.[8]

Second, the agencies do not in fact cite important differences from the TAR and EPA's January 2017 final determination in how "technologies have played out," especially with regard to conventional vehicle technologies. These are the primary technologies the agencies relied upon in the 2012 rule to show feasibility of the standards and in the Draft TAR to show a less expensive compliance path.

The statement that "technology to improve fuel economy and reduce CO2 emissions has not changed dramatically since prior analyses were conducted" (NPRM p.42991) is certainly questionable. In any case, asserting that no such dramatic change has occurred does not support the claim that technologies "have played out differently" than assumed in any sense that diminishes the appropriateness or feasibility of the existing standards.

The observation that "[t]here remains no single technology that the majority of vehicles made by the majority of manufacturers can implement at low cost without affecting other vehicle attributes that consumers value more than fuel economy and CO2 emissions" is naïve and irrelevant; the agencies did not assume in 2012 that such a "single technology" existed.

The agencies' optimism about technologies has indeed been tempered, as the NPRM states (p.42991), but for invalid reasons. While any technology forecast will require modification as the technologies are commercialized and brought into the mainstream, a revision such as the one in the proposal that offers adjustments in only one direction (the unfavorable direction) is clearly biased.

The agencies' observation there is no such thing as a free lunch (NPRM p.42991) is entirely out of place in this context, since there is scarcely a better counterexample to this notion than the untapped potential of energy efficiency. This statement is one indication at the outset that the agencies have taken the view that the market for fuel economy is a perfect market. Both conceptually and analytically—through the sales demand model and the technology assessment--the agencies' approach essentially guaranteed a finding that no increase in the stringency of standards would be feasible or appropriate.

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[8] Nic Lutsey, Dan Meszler, Aaron Isenstadt, John German, Josh Miller. Efficiency technology and cost assessment for U.S. 2025–2030 light-duty vehicles. March 22, 2017 https://www.theicct.org/publications/US-2030-technology-cost-assessment.

The case of full-sized pickup trucks illustrates how the CAFE model produces greatly inflated compliance cost estimates.

The CAFE model uses model year 2016 vehicle data as its baseline to model how manufacturers might apply technology to meet fuel economy standards. The agencies' analysis thus includes projections both for model years which have already passed (2017) and upcoming model years for which some fuel economy information is already available (2018, 2019). Technology application and costs for these vehicles are obtained from the "vehicles_report" CAFE model output file. This affords us the opportunity to compare the CAFE model pathways supporting the proposed rule against existing, real-world outcomes in terms of technology application, technology costs, price changes, and achieved fuel economy. Below we compare the technology pathways identified in the NPRM analysis for a few important pickup models to real-world technology improvements manufacturers have already made to these models today, and further improvements that may be on the horizon. Despite longstanding concerns in various quarters regarding the difficulty that the fuel economy and GHG standards pose for this high-profit segment facing stringent performance demands from its customers, these vehicles' progress toward fuel economy goals is impressive—as is the price tag.[9]

GM Sierra/Silverado V6

The CAFE model applied several major technology additions to GM's Silverado and Sierra full-size pickups, including the second level of turbocharging (TURBO2), to the V6 in MY 2019. It projected application of a mild hybrid system to 84% of these MY 2019 V6 trucks, and 4WD models received a 10-speed automatic transmission along with high levels of mass and aerodynamic drag reductions. The cumulative result is a 31% improvement in fuel economy in MY 2019, exceeding the truck's 2019 target by 21%. In fact, it falls short of its 2025 target by only 6%. However, the model's technology package comes at a projected cost of $3,400-$4,000.[10]

GM did in fact redesign the Silverado and Sierra full-size pickups for MY 2019. All versions received cylinder deactivation (some received advanced cylinder deactivation), 8- or 10-speed automatic transmissions, and mass and aerodynamic drag reductions. Moreover, GM's highest-volume "LT" and "RST" trims will replace the prior model year's naturally aspirated (NA) V6 option with a segment-first 2.7L turbocharged I4 with cylinder deactivation as the standard engine option and adds an 8-speed automatic transmission.[11] We estimate the resulting compliance fuel economy improvement for trucks equipped with this engine, based on manufacturer press releases and verified with EPA's Lumped Parameter Model, to be approximately 20% over the outgoing 2018 model, exceeding the MY2019 standard by 20%. If 100% of the "LT" and "RST" trim were to get the I4 in MY 2019, the I4 would displace 2/3 of V6 sales for Silverado and Sierra trucks in MY 2019. And the remaining trims may be close behind – while lower-trim trucks will still offer the existing NA V6 for MY 2019, GM has stated it could soon see the I4 completely replace the V6.[12]

Given GM's realized improvements and announced intentions, the agencies' model should reflect a compliance pathway in which GM uses the 2.7L turbocharged I4 as a replacement for the NA V6. GM

[9] The standards allow manufacturers to average their products' performance, so we do not take a single model's fuel economy performance as indicative of the manufacturers' fleet wide performance or strategy. Nonetheless, comparing the technology pathways identified in the agencies compliance modeling provides important insights into the many shortcomings and implausible outcomes of that modeling.

[10] CAFE Compliance and Effects Modeling System ("The Volpe Model"). 2018 NPRM for Model Years 2021-2026 Passenger Cars and Light Trucks. Output file: vehicles_report.csv. CAFE_ss run.

[11] https://www.freep.com/story/money/cars/mark-phelan/2018/05/18/2019-chevy-silverado-four-cylinder-engine/621465002/.

[12] https://autoweek.com/article/trucks/2019-chevrolet-silverado-gets-turbo-four-engine.

has already announced that the MSRP of the redesigned “LT” trim will decrease by $700 compared to the outgoing MY 2018 model, which had not received any fuel economy improvements over the MY 2016 model appearing in the CAFE model baseline. The achieved fuel economy for this redesigned truck, including some benefit from off-cycle and A/C efficiency technology credits, should meet or exceed its 2025 target.[13]

RAM V6

The CAFE model made technology additions to the RAM V6 in MY 2019 similar to those on the GM trucks, including cooled EGR -- the final and most-expensive technology level in the turbo-downsized pathway.[14] Also applied to the V6 is a 48-volt belt-integrated starter generator (BISG) mild hybrid system, and high levels of mass and aero drag reduction. This modeled truck exceeds its 2019 fuel economy target[15] by 36% and in fact meets its 2025 target, but at a modeled cost of $4,100 over the baseline vehicle.[10]

RAM did redesign its full-size pickups for model year 2019. RAM’s entry-level V6 models will come standard with a belt-integrated starter generator 48-volt mild hybrid system. All RAM 1500 trucks will receive mass reduction and aerodynamic drag reduction, and some will gain improved 8-speed automatic transmissions.[16]

Official fuel economy values are now available in EPA’s Fuel Economy Guide for MY2019 RAM trucks. Trucks equipped with the standard mild hybrid V6 will exceed their 2019 fuel economy target by about 18%. MSRP for the MY2019 truck will increase by $1,500 over the comparable MY2018 truck.[17] It is worth noting that MSRP is supplied by the manufacturer, excludes consumer discounts which may have changed year-over-year, and includes not only the cost of fuel economy improvements, but all improvements made to the redesigned truck, including accessories such as infotainment.

The resulting compliance fuel economy of MY 2019 RAM trucks with this engine, based on official certification data and including A/C efficiency and off-cycle credits,[18] will exceed its augural target through MY 2023. This leaves the V6 mild hybrid RAM with only a 6% (2WD) or 10% (4WD) deficit from its MY 2025 target. RAM could eliminate this gap by replacing the V6 mild hybrid with FCA’s new 2.0-liter 25 Bar I4 mild hybrid engine. This engine was recently introduced in the redesigned Jeep Wrangler, a $1,000 upgrade over the standard NA V6. The Jeep’s standard NA V6 is the same engine as in the RAM, but without mild hybrid. Our estimates, aligning with technology effectiveness estimates by the agencies in previous rulemakings, indicate that replacing the mild hybrid V6 with this mild hybrid I4 would allow the RAM V6 to exceed the 2025 target. Based on FCA pricing for this optional engine in its redesigned Jeep products, this engine could come with a net cost savings relative to the 2019 V6 mild hybrid. Doing so would require no additional technology, including those eligible for off-cycle credits. And because this final step comes at a potential cost-savings, the total incremental cost for RAM to upgrade its MY 2018 model to meet the 2025 standards is at most $1,500.

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[13] The CAFE model Standard Setting run includes adjustments to fuel economy resulting from off-cycle technology credits. However, off-cycle and A/C efficiency credits claimed for pickups are likely to be more than double what the agencies assumed in its modeling. Citations and assumptions shown in Attachment 1.

[14] In the CAFE model, it is not clear why cooled EGR is applied. The technology is not required for the model to apply other technologies and provides no improvement to fuel economy. It appears to only add cost.

[15] Target fuel economy throughout this discussion corresponds to the footprint of the crew cab, standard bed truck, a high-volume option for all manufacturers.

[16] http://media.fcanorthamerica.com/newsrelease.do?id=18758&mid=1.

[17] https://www.ramtrucks.com/2019/ram-1500.html

[18] ACEEE estimate. Citations and assumptions shown in Attachment 1.

These real-world examples demonstrate that the CAFE model overestimates the cost for high-volume GM and RAM trucks to reach existing MY 2025 targets by at least $2,500. This is due at least partly to the CAFE models' application of technology in excess of what would be needed to meet these targets. While additional A/C efficiency and off-cycle credits may factor into these trucks' meeting their 2025 target, the notable point is that both are likely to reach the target without a large price increase, in contrast to the CAFE model's prediction of a several thousand dollar (upwards of 10%) increase in price. The agencies' cost projections are thus contrary to outcomes that have already been realized in the real world, and are thus wholly unreasonable.

Ford F-150 and Toyota Tundra

Because neither the Ford F-150 nor the Toyota Tundra has undergone a redesign in the years since MY 2016, these trucks do not lend themselves to a comparison of current real-world improvements and CAFE model technology pathways in the same way that the GM and RAM trucks do. Nonetheless, CAFE model inputs and outputs for the F-150 and Tundra raise other questions about the validity of the agencies' technology analysis and exemplify concerns raised by other commenters.

1. Baseline (MY 2016) technologies

The CAFE model's assumptions of baseline (MY 2016) vehicle technology appear to contain errors, which in effect reduces the amount of technology available to meet future standards. For example, the model assumed aerodynamic improvement (AERO10) and advanced accessories (IACC) for the MY 2016 Tundra pickup. Tundra pickups truck have had similar specs from MY 2011 to today and have seen no improvement in fuel economy in that time.[19] The drag coefficient (Cd) for all Tundra models has been 0.37 or 0.38 for 2WD and 4WD, respectively, since MY 2011. This is higher than the AERO10 Cd cut off value of 0.355 for pickups as shown in the 2016 Draft TAR and referenced in the PRIA (p.428). EPA-tested fuel economy was also unchanged during these model years, indicating no introduction of fuel economy technologies. Improved accessories and aero (IACC and AERO10), if implemented as the CAFE model claims, would have resulted in more than 3% fuel economy improvements, as calculated by EPA's lumped parameter model, but no change in fuel economy materialized.[20] Nor was there any change in rated power and torque to offset the fuel economy benefit that such improvements would have provided.

Similarly, the CAFE model shows advanced aero (AERO10 or AERO15) on 3.5L NA F-150 models for MY 2016. Cd values calculated from road-load coefficients available at EPA test data for 2014 and 2015 MY 3.5L NA models showed less than 10% Cd reduction in 2015 from 2014, on average (see Attachment 1). There was no change in 2016 as Ford didn't make any updates on 3.5L NA models in 2016. The 2018 PRIA reported 0.37 Cd for one F-150 that was tested at Canada's National Research Council (NRC) wind tunnel. Therefore, assuming AERO15 for 3.5L NA models overstates the use of technology in the baseline.

These examples illustrate the observation by the International Council on Clean Transportation (ICCT) that "from the model year 2015 baseline to the 2016 baseline, the agencies have deemed

[19] https://pressroom.toyota.com/releases/2015+toyota+tundra+product+specs.download, https://pressroom.toyota.com/releases/2014+toyota+tundra+specs.download, https://pressroom.toyota.com/releases/2013+toyota+tundra+product+specs.download, https://pressroom.toyota.com/releases/2012+toyota+tundra+product+specs+features.download, and https://pressroom.toyota.com/article_display.cfm?article_id=2688

[20] EPA LPM v3.10. This model supports the 2016 Draft TAR. https://www.epa.gov/regulations-emissions-vehicles-and-engines/lumped-parameter-model-lpm-light-duty-vehicles.

approximately three times as many vehicles to have pre-existing aerodynamic improvements…. but none of the quantifiable mpg or CO_2 benefits that would be associated with these additional aerodynamic improvements were reflected with any real-world evidence in the model year 2016 fleet."[21] The CAFE model also assumes significant baseline penetration of secondary axle disconnect (SAX) that we have not been able to corroborate from F-150 product information brochures.

2. Mild hybrid technology cost and effectiveness

In the CAFE model compliance package, two-thirds of F-150s will have a 48-volt belt-driven starter generator (BISG) mild hybrid system in MY 2021, as well as advanced engine and vehicle technologies. The 5.0L F-150 will achieve approximately 32 mpg in 2021, a 10-mpg increase from 2016 baseline values, at a cost of $4,600. While the fuel economy improvement is substantial, the incremental cost is very high for a high-volume truck. Indeed, as discussed above, the real-world 2019 MY RAM 5.7L pickup has already achieved about 32 mpg with advanced transmission (AT8), mild hybrid (BISG), mass reduction, and aero improvements, at an incremental cost of only $1,500 from the baseline model.[22] Such a large difference in costs for comparable fuel economy in competing models is not plausible.

While overstating costs, the CAFE model also underestimates benefits of technology packages it applies to the F-150. For example, using a multiplicative approach to technology package effectiveness, we estimate that the agencies' technology package in MY 2021 5.0L trucks would improve fuel economy by 57%; the CAFE model estimates a 41% gain. Since the multiplicative approach does not capture any negative synergies between technologies, we put a similar set of engine (TURBO2, GDI, and CEGR), vehicle (AERO10, ROLL20), transmission (AT8), and hybrid technologies (SHEVP2) into the EPA Lumped Parameter Model (LPM) and found a combined effectiveness of 45%,[23] compared to 43% using a multiplicative approach, indicating no evidence of negative synergies in this package.

Similarly, the CAFE model shows that F-150 2.7L Ecoboost trucks with cooled exhaust gas recirculation (CEGR), 10-speed transmission (AT10), BISG, advanced tires (ROLL20), AERO15, low drag brakes (LDB), SAX technologies would improve their FE by 19-20% in 2021 from 2016. Using the CAFE model individual technology effectiveness values, we estimated a combined fuel economy benefit of these technologies of 31%.[24]

These large shortfalls in package effectiveness reported by the CAFE model suggest that the model underestimates the combined benefits of technologies. One potential source of the CAFE model's low package effectiveness is the use of some of the technologies' benefits to increase the performance of these pickups. Argonne National Laboratory's Autonomie model results used for the NPRM analysis show a 10% decrease in 0-60 times from MY 2016 to MY 2029 Ford F-150 trucks.[25]

3. Full hybrid cost and effectiveness

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[21] ICCT Comments to the NPRM docket, p.I-34.
[22] Unadjusted fuel economy extracted from 2019 EPA Fuel Economy Data, available at https://www.fueleconomy.gov/feg/download.shtml .
[23] EPA Lumped Parameter Model for Light-Duty Vehicles V3.10, https://www.epa.gov/regulations-emissions-vehicles-and-engines/lumped-parameter-model-lpm-light-duty-vehicles
[24] Fuel consumption benefit of the combined technology packages in multiplicative approach is calculated as follows: [% FCRpackage = 100 [1 – (1 – {% FCRtech1/100}) (1 – {% FCRtech2/100)} … (1 – {% FCRtechN/100})].
[25] Information extracted from Autonomie model simulation data and the Vehicle Market Report file from CAFE Model outputs.

In the CAFE model compliance scenario for the augural standards, all F-150 3.5L Ecoboost pickups would be full hybrids by 2021. The fuel economy of these trucks would be 40% higher than baseline MY 2016 fuel economy, at an incremental cost of about $5,500. For a hybrid system alone, the CAFE model shows an incremental cost of $3,100; the remaining cost apparently come from the addition of TURBO2, CEGR, AT10 transmission, ROLL20, and AERO15. Yet the CAFE model shows no fuel economy benefit for these engine and transmission technologies beyond the benefit from the hybrid system alone, while they add $2,400 to the total cost of the package. The ICCT commented more generally on this issue, noting that it could be an error or a deficiency of the Argonne's Autonomie modeling system.[26] Furthermore, the ICCT notes that even the $3,100 price tag for the hybrid system is too high. The ICCT estimates a maximum cost premium for hybrid technology of $2,500 in 2017, declining linearly to $1,400 in 2025.[27] This would imply hybrid costs in 2021 of less than $2,000.

Another reason to doubt the cost estimate for the 3.5L package is that the 5.0L model compliance package, with 97.6% BISG (2.4% SHEV2), costs less than the full hybrid for the 3.5L Ecoboost but attains similar fuel economy of about 32 mpg in 2021.

CAFE model technology packages for the Tundra raise the same issues. The compliance scenario for the augural standards shows 100% of Tundra trucks in 2021 as full hybrids, overshooting even their MY 2025 target by 10%. They will also have TURBO2, CEGR, 8-speed transmission (AT8), LDB, secondary axle disconnect (SAX) for 4WDs, 100% advanced tire (ROLL20), advanced aerodynamic drag reduction (AERO15), and 15% reduction in curb weight (MR4).[28] CAFE targets call for a 41% fuel economy improvement in MY 2021 for the Tundra double cab standard bed 4WD; these technologies would improve their fuel economy by 69% in 2021. And this huge improvement comes with a price increment of about $7,700. A truck with an additional $7,700 cost will be hard to sell when rival models will offer similar fuel economy at a much lower cost.

As in the case of the F-150, there is no need for the additional engine technologies in the agencies' Tundra package, because hybridization along with vehicle technologies would be enough to meet or exceed the 2025 fuel economy targets.[29] Tundra fuel economy could be doubled from 2016 levels with a hybrid system accompanied by tire and aero improvements, AT8, and 10% mass reduction (MR3) but at a cost of about $3,800, about half what the CAFE model has estimated. The CAFE model also appears to have underestimated the effectiveness of the combined technology package.

Alternatively, it appears that the Tundra could achieve its 2025 targets without hybridization using advanced engine and vehicle technologies, level 3 mass reduction, and mild hybridization as shown in Attachment 1. This package would cost less than half of what the CAFE model estimated for 2025.

The technology analysis reflects other implausible assumptions.

Product cycles

In the pickup examples discussed above, the CAFE model applied technologies in MY 2021 more than sufficient to reach these models' 2021 targets, and in some cases sufficient to meet targets for several

[26] ICCT Comments to the NPRM docket. P.I-25
[27] ICCT Comments to the 2018 NPRM docket, p.I-77
[28] Cooled EGR is at the end of technology pathway for turbocharging. It implies that the engine is also turbocharged (TURBO2).
[29] While the CAFE model appears to require the use of TURBO and EGR with a P2 hybrid, adding to package costs, real-world examples do not support that constraint. P2 hybrid could be used with other technologies including high compression ratio engine.

years beyond 2021. Given that the model's compliance scenario serves to estimate the cost of meeting the standards, it should represent a low-cost pathway to doing so. We believe that these pickup trucks' fuel economies in excess of their targets are a byproduct of the CAFE model's assumptions regarding the frequency of model redesign and refresh. Using unrealistically long cycles or inappropriately constraining technology options during refresh could force the model to apply technologies too far in advance of when they are required for compliance. While adding technologies early is not in itself problematic, combined with the agencies excessive estimates of the cost of those technologies, it contributes substantially to the agencies' inflated estimate of the overall cost of meeting the current standards for MY 2021-2025. Importantly, these inflated cost estimates also mean that early compliance adds artificially to the tally of fatalities the agencies attribute to the standards as a result of delayed scrappage rates. As an example, even though the augural and proposed standards coincide in MY2020, fuel economy is higher in the augural scenario, presumably due to overcompliance in that year. This generates rebound fatalities: 40% of MY 2020 fatalities are due to rebound, which results entirely from early compliance.

Performance

The NPRM suggests a need to temper fuel economy gains to accommodate performance increases, stating: "Technology that can improve both fuel economy and/or performance may not be dedicated solely to fuel economy" (NPRM p.42991). The agencies have no such obligation. Moreover, as the agencies discussed in the Draft TAR, technologies being used today to increase fuel economy in some cases improve performance as well.[30] This point is discussed at greater length in a subsequent Society of Automotive Engineers technical paper authored by EPA staff.[31]

"Diminishing returns"

The agencies' observation that "[i]ncremental additional fuel economy benefits are subject to diminishing returns" (NPRM p. 42991) is irrelevant at best. The evaluation of the cost-effectiveness of improving fuel economy and reducing emissions has always involved comparing the cost of available efficiency technologies to the fuel savings they deliver. These are absolute dollar costs and savings to which the notion of diminishing returns is not applicable. The NPRM itself claims that even if fuel economy and GHG standards remain flat after 2020, fuel economy will continue to rise as manufacturers add new, cost-effective technologies, acknowledging that the list of such technologies continually regenerates itself.

Prior to this NPRM, agency analyses consistently showed the availability of many cost-effective technologies that could be used to improve fuel economy. The agencies' new suggestion that we are nearing the end of the line on cost-effective improvements is both incorrect and indicative of an unwarranted lack of confidence in the auto industry's engineering prowess.

III. Economic and safety analysis of fuel economy and GHG standards

A major component of the agencies' rationale for rolling back the standards is their claim that vehicles are increasingly unaffordable and that the existing standards would result in "increased vehicle prices

30 Draft Tar, p.4-26.

31 "Representing GHG Reduction Technologies in the Future Fleet with Full Vehicle Simulation," SAE Technical Paper 2018-01-1273, 2018, Andrew Moskalik, Kevin Bolon, Kevin Newman, Jeff Cherry. https://www.epa.gov/regulations-emissions-vehicles-and-engines/representing-ghg-reduction-technologies-future-fleet-full. Pp.7-9.

[that] keep consumers in older, dirtier, and less safe vehicles" (NPRM, p.42993). These assertions are incorrect and misleading.

The fact is that, when adjusted for inflation, vehicle prices have been essentially flat since the early 2000s.[32] This is confirmed by the agencies' own CAFE model input file, which shows historical vehicle transaction prices.[33] Average price shown is roughly the same today ($33,883) as it was in 1997 ($33,865); prices peaked in 2003 ($35,936). This is in spite of major, ongoing additions to features and quality upgrades. In fact, when adjusted for quality, the price of vehicles has trailed inflation by a large margin. These issues are discussed further in our joint comments with Consumers Union and Consumer Federation of America.[34]

As also described in those comments, there are multiple inconsistencies and flaws in the economic elements of the CAFE model. Those elements strongly affect the agencies' analysis of the safety impacts of the rule, because their fatalities analysis is driven almost entirely by alleged changes in the amount of driving that occurs when vehicle standards increase. The rest of this section addresses the agencies' analysis of fatalities.

Neither the agencies' fatality analysis, nor their interpretation of its results, is credible.

The agencies' analysis purports to show that thousands more fatalities would occur under the existing standards than the proposed standards. The analysis is riddled with errors, however. In fact their analysis provides no reason to believe that any additional fatalities at all should be attributed to the existing standards.

<u>Mass reduction</u>

In the Draft TAR, the agencies estimated that 61 fatalities would be *eliminated* by the MY 2022-2025 augural CAFE standards and 74 by the GHG standards.[35] One significant difference between the Draft TAR and NPRM is that the compliance scenario for the NPRM includes more mass reduction in smaller vehicles than the TAR found, and this results in more fatalities according to the analysis. There is no evidence that this will actually occur, however. A recent National Research Council report on fuel economy stated: "It is the committee's view that mass will be reduced across vehicle sizes with proportionately more mass removed from heavier vehicles."[36] Furthermore, higher levels of mass reduction in smaller vehicles is not consistent with manufacturers' actual application of mass reduction.[37]

In addition, the NPRM itself notes that of the estimates of fatality increase per 100-pound mass reduction for the five vehicle classes considered in the fatality analysis, none is significant at the 95% confidence level (p.43111). The NPRM also recognizes, but does not account for, the fact that "the

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[32] See https://aceee.org/blog/2017/11/fuel-economy-going-vehicle-prices-are.
[33] See file "2018_NPRM_parameters_ref," tab "Scrappage Model Values."
[34] Consumers Union, Consumer Federation of America and American Council for an Energy-Efficient Economy. Joint Comments on Vehicle Sales, Ownership Costs, and Consumer Willingness to Pay for Fuel Economy. Docket No. EPA-HQ-OAR-2018-0283 and NHTSA-2018-0067.
[35] EPA and NHTSA, Draft Technical Assessment Report: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025. 2016. pp.8-60-8-61, using indirect cost multipliers.
[36] National Research Council of the National Academies. "Cost, effectiveness, and deployment of fuel economy technologies for light-duty vehicles." 2015. p.12.
[37] Natural Resources Defense Council. October 2018. *Appendix A: Evaluation of Mass Reduction Assumptions in NHTSA Volpe Model.* Submitted to Docket No. EPA-HQ-OAR-2018-0283 and NHTSA-2018-0067.

light-duty vehicle fleet in the MY 2021–2026 timeframe will be different from the MY 2004-2011 fleet analyzed here" (p.43112). In fact, the fatalities reported in the safety analysis for the NPRM reflect crashes that occur decades into the future, when the fleet with which any remaining MY 2021-2026 vehicles interact will presumably have entirely different crash behavior than any vehicles in the agencies' analysis. For all of these reasons, the NPRM analysis results for mass reduction should be rejected.

Economic analysis within the CAFE model

The flaws in the agencies' current approach to estimating fatalities go well beyond the treatment of mass reduction. The NPRM offers a fatalities analysis based on several economic model components that are either entirely new, or applied differently here. The result is that thousands of fatalities are attributed to the current standards (12,680 for CAFE standards and 15,648 for GHG standards; NPRM Tables II-74 and II-77), of which those attributed to changes in vehicle crashworthiness (via mass reduction) are under 3%. Other elements of the modeling that affect the fatality estimates are: doubling of rebound rate; introduction of sales response and scrappage models, and application of a dynamic fleet share model.[38]

That the NPRM would make assertions about vehicle fatalities, which play a substantial role in weighing the appropriateness of the standards, based on approaches and methods that are experimental and ill-supported is startling and evidence of poor policy-making. The agencies' requests for comments on these topics are appropriate given the speculative nature of the approaches employed. While it is essential that the agencies improve upon the current approach to estimating the safety impacts of changing fuel economy standards, the importance of the topic, both from a regulatory perspective and in the real world, requires that any replacement methodology trigger a supplemental NPRM and an adequate opportunity for public comment.

As an example of the speculative elements of the CAFE model's economic elements, its treatment of vehicle scrappage impacts and associated effects on vehicle miles traveled (VMT) could be delivering entirely fictitious results. Invoking the Gruenspecht effect to claim extensive delayed scrappage as a result of increased vehicle prices, the agencies assume, implausibly, that the vehicles saved from scrappage follow the same miles-per-year schedule as the average vehicle of the same model year. This produces an increase in fleetwide VMT per year that has no economic or travel-demand-based explanation.

Add to this the fact that, according to the model, vehicles in model years affected by the standards travel roughly 3% more per year due to rebound under the augural standards than under the proposed standards. NHTSA has not allowed this increased annual mileage to affect the scrappage schedule for these vehicles. That is, rebound causes them to be driven more each year than they would be driven without the augural standards, but they are not retired any sooner as a result. Quite the contrary: the delayed scrappage effect in the augural scenario only adds to the lifetime miles of these vehicles, compounding the implausible treatment of lifetime VMT under rebound. It is as if vehicle durability had no role in vehicle lifetime miles.

In addition, the agencies explain scrappage decisions in terms of vehicle value versus operating and maintenance cost. Yet in the scrappage model, only operating cost (via cost per mile) is included, because NHTSA has no reliable information on maintenance costs (PRIA p.979). Yet maintenance and

[38] The fleet share model was used in NHTSA's analysis for the Draft TAR, but only in a sensitivity case (NPRM p.43076).

repair costs are presumably the proximate cause for much old vehicle scrappage. Leaving this out naturally understates scrappage rates.

Even the agencies' flawed analysis does not support the claim that current standards "keep consumers in older, dirtier, and less safe vehicles."

ACEEE used the CAFE model output sheets to break out the fatalities that the agencies attribute to the current standards into the effects of rebound, mass reduction, sales response, fleet share, and scrappage. The results and methodology for this analysis are explained in Attachment 2. Attachment 2 also shows a breakdown of fatalities projected by the CAFE model into those allegedly due to increases in vehicle miles traveled (VMT) and those due to a decline in average vehicle safety (measured by fatalities per mile). The mass reduction fatalities clearly relate to changes in fatality rate, per the agencies' analysis. Given the agencies' assumption that fatality rates decline with increasing model year, another possible source of fatalities that could be characterized as worsening vehicle safety is an increase in the percentage of total VMT being driven by vehicles with a higher fatality rate, driven by the retention of older vehicles (with higher fatality rates) projected by the scrappage model. We investigated this phenomenon in order to evaluate the agencies' claim that current higher standards "keep consumers in older, dirtier, and less safe vehicles" (NPRM at 429930). As shown in Attachment 2, we found that the number of fatalities attributable to change in fatality rate is far fewer than the number attributable to mass reduction, even though mass reduction fatalities are a subset of those fatalities. In other words, fatalities due to changes in the various model years' shares of total VMT are negative. Thus the agencies' own analysis is inconsistent with their narrative of the current standards causing additional fatalities by increasing the share of driving done by older vintage, less safe vehicles.

IV. Credits and flexibilities

The agencies request comment on a wide range of possible changes to the off-cycle credit provisions and other incentives and flexibilities in the standards program. These changes stem largely from industry requests to add technologies to the pre-defined off-cycle credit menu, increase the number credits that can be claimed from the menu, and to simplify the process for which automakers can request off-cycle credits for technologies not on the menu. EPA also requested comment on extending and expanding the full-size pickup truck advanced technology incentives to other types of vehicles, and for adding new credit incentives for automated and communications technology. Our comments on these issues are discussed in Attachment 3. We provide a brief summary here.

Some changes to credits and incentives under the program may be appropriate and could ultimately increase the emissions reductions and fuel savings achieved under the program. However, as we show below, some of the ideas put forth have the potential to greatly reduce the emissions reductions and fuel savings of the standards programs, which would be in tension with the agencies' respective statutory mandates to mitigate dangerous air pollution and conserve energy. Consequently, any change to the proposed rule that would expand the availability of such flexibilities would require a supplemental NPRM and an opportunity for public comment.

The off-cycle credit program was developed to provide credit for technologies that decrease real-world emissions and fuel consumption, but are not detectable using the regulatory (2-cycle) test procedure. In a joint response to a NHTSA notice regarding a petition for rulemaking submitted by the Alliance of

Automobile Manufacturers and the Association of Global Automakers, ACEEE and other NGOs articulated three principles for the award of off-cycle credits (Attachment 4):[39]

1. Demonstration of off-cycle benefits must be rigorous and fully documented.
2. Off-cycle credits should be limited to new and innovative technologies.
3. To be eligible for credit, a technology must reduce emissions from the vehicle receiving the credit

These principles continue to be applicable and should be applied to consideration of any changes to the off-cycle credit program as well.

Other incentives are fundamentally different. For example, the advanced technology incentives for pickup trucks, which provide credits for technology whose real-world CO2 reductions have already been captured, were designed to address technology introduction barriers specific to these vehicles. Extending such credits to all light-duty trucks or passenger cars would be entirely inappropriate and unwarranted. Other changes would provide incentives for adopting automated technologies, which on their own may provide no reduction in greenhouse gas emissions, and may in the short- or long-term even increase emissions.

We respond to the agency's request for comments in Attachment 3. In summary, we recommend that:

- Any changes to the off-cycle credit program should conform to the principles listed above to ensure emissions reduction benefits from the program.
- Any streamlining of the process by which automakers petition for off-cycle credits must maintain the requirement that a thorough methodology show real-world benefits and ensure adequate opportunity for public review.
- EPA should correct the error in its calculation of stop-start credits.
- The off-cycle credit menu cap should not be increased or modified without the agency first defining any other changes it might consider making to the off-cycle credit program. This should be done through a separate NPRM and public review process.
- EPA should not extend or expand the full-size pickup advanced technology credits to other types of vehicles, and should maintain the current sales thresholds and technology requirements.
- EPA should not provide credits for automated vehicle technologies that do not provide a measurable real-world benefit to the vehicle for which the technology is installed.
- EPA should not incentivize technologies such as autonomous vehicle technology or ridesharing services, unless and until can demonstrate that such an incentive will result in emissions reduction benefits and will not undermine the existing standards.
- EPA should not extend or expand multipliers for alternative fuel vehicles.
- Any consideration of an extension or expansion of credit provisions under the greenhouse gas or CAFE standards program should take as a starting point the assumption that the additional credits will allow the stringency of the standards to be increased.

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[39] "Grant of petition for rulemaking submitted by the Alliance of Automobile Manufacturers and the Association of Global Automakers." Docket ID No. NHTSA—2016—0135.

The changes to technology incentives on which EPA requests comment have the potential to reduce substantially the savings of CAFE and GHG emissions standards, as shown in figures 1 and 2. We find that, based entirely on the projected fleet under agency modeling for this NPRM, such incentives would increase real-world CO2 emissions by 320 MMT over the lifetimes of MY 2021-2029, eliminating nearly 30% of the benefit of the augural standard. For reasons explained elsewhere in these comments, we do not believe the agencies' compliance scenario to be a realistic portrayal of the technology mix that would be required to achieve the augural standard but it serves nonetheless to demonstrate the magnitude of possible effect of ill-considered changes to the credit programs. If these potential incentives worked as intended to increase penetration of the included technology beyond that shown in the agencies' compliance scenario, an even greater share of the total benefits could be lost.

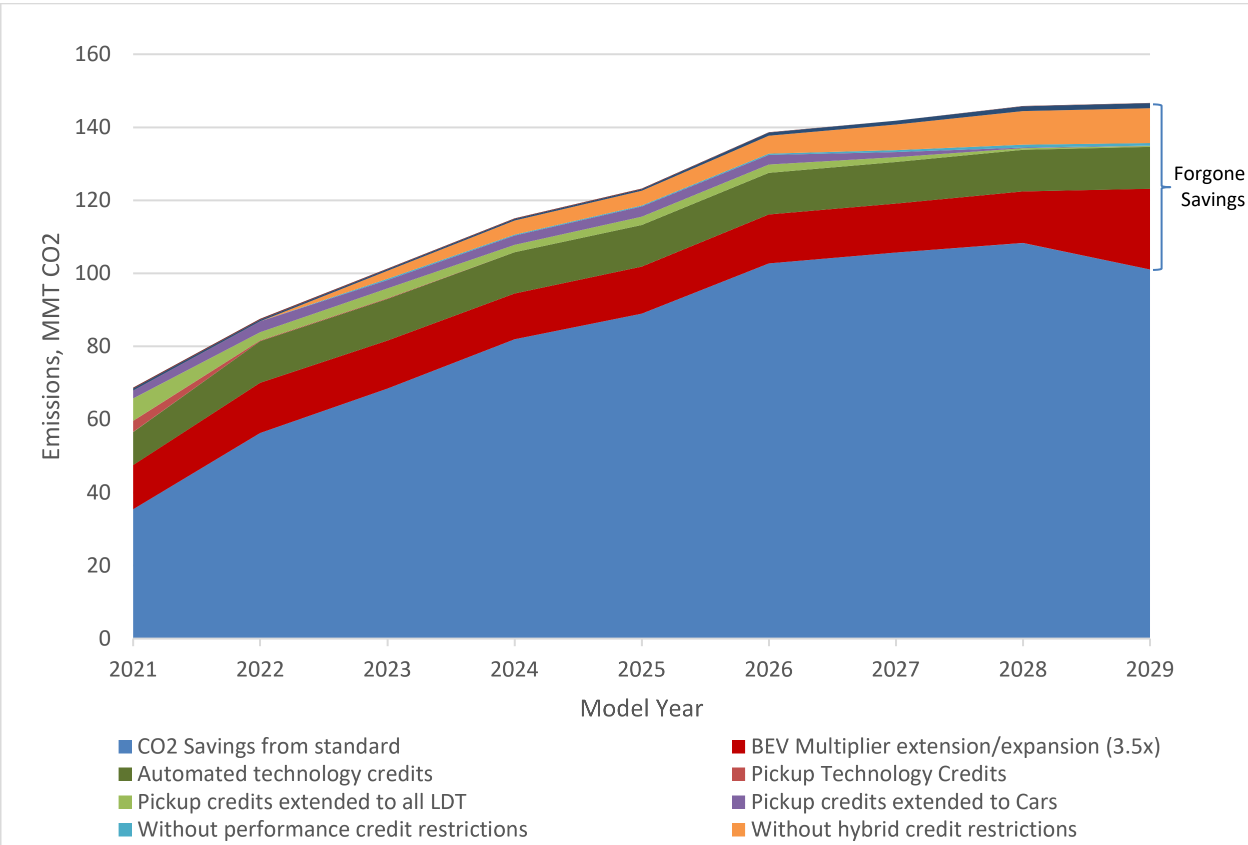

Figure 1. Augural standard CO2 benefits lost by adopting technology incentives

Under the agencies proposed alternative, providing these technology incentives would lead to an increase in CO2 emissions in addition to that realized by rolling back the standard, as shown in figure 2.

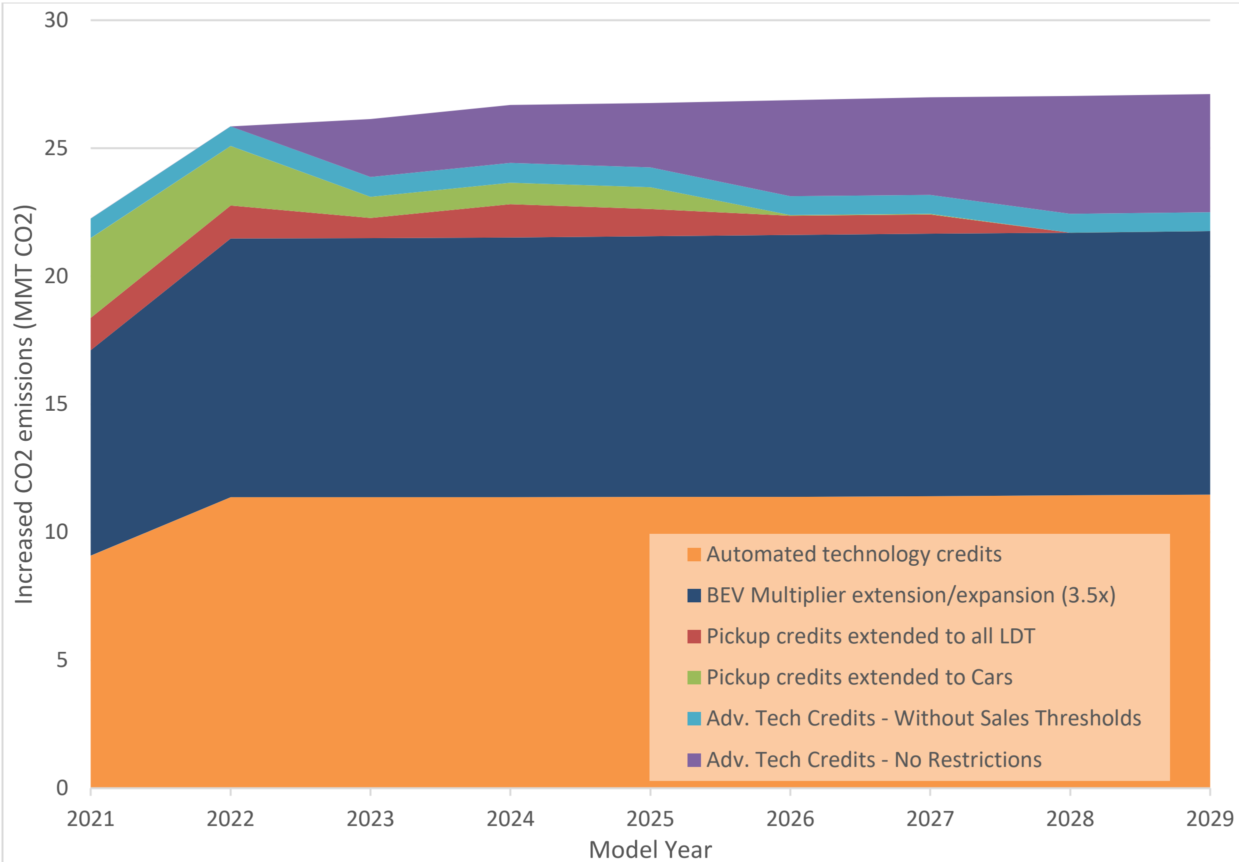

Figure 2. Increased CO2 emissions due to new credits awarded under 0% per year proposed alternative scenario in CAFE model.

V. Conclusion

We find the NPRM and the associated analysis to be deeply flawed and in direct conflict with much sound earlier analysis conducted by the agencies, as well as many other knowledgeable parties. The agencies did extensive and robust analyses on the original rule for MY 2017-2025 standards, and updated those analyses for the Draft TAR in 2016 and for the subsequent EPA final determination in January 2017. The new analysis underlying the current NPRM, by contrast, has many, significant errors and unsupported assumptions that have led to incorrect conclusions, and to the proposal to roll back the existing fuel economy and GHG standards for MY 2021 and beyond to MY 2020 levels. The proposed standards should be rejected. NHTSA should instead finalize the Augural CAFE standards now in place through MY 2025 and EPA should issue a new final determination reaffirming the appropriateness of the current GHG standards through MY 2025.