Petition for Reconsideration of EPA's Final Rule—The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks

Docket No. EPA-HQ-OAR-2018-0283

June 29, 2020

Via Electronic Delivery[1]

Almost two years ago, the Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") (collectively, "the agencies") jointly proposed to unravel a national program for improving the fuel economy of passenger cars and light trucks and controlling their climate-changing emissions, a program that was working, providing a stable regulatory platform for industry, incentivizing innovation and investment, creating jobs, and saving consumers money on a daily basis. *See* "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks," 83 Fed. Reg. 42,986 (Aug. 24, 2018) ("Proposed Rule" or "Proposal"). The Proposal was a mistake, and scrutiny of the underlying analysis proved it. The agencies took a year and a half to consider the myriad comments that, despite the inadequate comment period, identified numerous and highly consequential errors in the analysis, and realized that the Proposal was unfounded.

The final rule is no better. "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks," published at 85 Fed. Reg. 24,174 (April 30, 2020) ("Final Rule" or "Rule") continues to be premised on an analysis riddled with errors and inconsistencies. The undersigned petitioners ("Petitioners") hereby request that EPA reconsider and administratively stay the Final Rule.

In the Final Rule, EPA and NHTSA finalize greenhouse gas ("GHG") emissions standards and fuel economy standards, respectively, for Model Year ("MY") 2021-2026 light-duty vehicles. EPA dramatically weakens GHG emissions standards that it set in 2012 for MY 2021-2025 that would have achieved critical public health and environmental gains. *See* EPA and NHTSA, "2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards," 77 Fed. Reg. 62,624 (Oct. 15, 2012) ("2012 Rule").

The analysis in the Final Rule compares the effects of the new standards against the previous GHG emissions standards for MY 2021-2025 (the "previous standards"). According to EPA's own analysis, the GHG emissions standards in the Final Rule, as compared to the previous standards, will lead to overall societal net costs of $22 billion at a 3% discount rate, 85 Fed. Reg. at 24,178, meaning that society will be *worse off* under the Final Rule than under the previous standards. Only by employing the steeper 7% discount rate does EPA find net benefits of $6.4 billion, *id*., leading the agency to assert that net benefits "straddle zero" when considering both the 3% and 7% discount rates, *id*. at 24,176. As explained in this petition, this conclusion is

[1] This petition is submitted electronically in part due to the national emergency associated with the COVID-19 pandemic and EPA's related remote work arrangements. Per an email from Sarah Dunham, Director of EPA's Office of Transportation and Air Quality, dated June 25, 2020, EPA's Office of General Counsel confirmed that the agency will accept submission of petitions via email.

wrong. Correcting the flaws in the agency's analysis clarifies that the Final Rule imposes substantial net costs on society.

The Final Rule will also cause GHG emissions to increase significantly—the new GHG standards will increase CO2 emissions by 867 million metric tons over the lifetime of vehicles through MY 2029 as compared to the previous standards. *Id*. at 24,181. The new GHG standards will also lead to "net increases in [criteria air] pollutants and net increases in adverse health effects." *Id*. at 25,111. That means EPA issued the Final Rule in defiance of its statutory directives to protect the public health and welfare, *id*. at 25,105 ("the primary purpose of Title II of the Clean Air Act is the protection of public health and welfare").

We submit this petition for reconsideration pursuant to 42 U.S.C. § 7607(d)(7)(B). Given the central relevance of the issues noted herein to EPA's reasoning and analysis in support of the Final Rule, EPA must grant this petition for reconsideration. *Id*. An objection is of "central relevance" if it provides "substantial support for the argument that the regulation should be revised." *Chesapeake Climate Action Network v. EPA*, 952 F.3d 310, 322 (D.C. Cir. 2020). The issues identified in this petition provide "substantial support" for the fact that EPA's analysis in the Final Rule is unsound in numerous and critical ways that demonstrate that the new GHG emissions standards must be revised. As described in this petition and the attached Appendix, fundamental problems in the Final Rule include:[2]

- EPA made several irrefutable mistakes in the analysis and relied on a number of fatally flawed modeling approaches, as well as unsupported and improper economic and technical assumptions, in attempting to justify the Final Rule, including:
    - Miscalculating the costs of congestion by at least $27 billion at a 3% discount rate by, among other errors, failing to adjust values for inflation, assuming a significant increase in vehicle occupancy over time when the cited data shows a decline, assuming a 53% increase in traffic volumes over time when the cited data show at most an 18% increase, and applying a "car" marginal congestion cost to SUV and van miles when the cited study specifies that the lower "truck" cost should be applied to those miles;
    - Making a computational error in calculating changes in insurance, financing, taxes, and fees;
    - Ignoring real-world technology performance that disproves core assumptions in the agencies' technology analysis;
    - Refusing to allow the model to select cost-effective and available technologies for entire categories of vehicles that already have those technologies in the real world;
    - Assigning off-cycle credits an arbitrarily and insupportably high cost even though they are applied to the modeled fleet before other, less expensive technologies;
    - Failing to include the fuel economy and emission reductions from off-cycle technologies in the cost-benefit analysis;

[2] The errors highlighted in this list are exemplary only. The rest of this petition expands on these errors and provides the full scope of issues for which Petitioners seek reconsideration.

- Relying on factually incorrect assertions to justify ignoring the agency's own data and refusing to model cost-effective technologies, even though EPA has expressly acknowledged those assertions are factually incorrect;
- Failing to account for the ethanol content in retail gasoline when projecting fuel consumption and consumer fuel costs;
- Precluding the use of available technology in its modeling, contrary to explicit statements in the Final Rule that the technology was (and should be) made available in the modeling;
- Inflating the purported benefits of the Final Rule by including costs (but not benefits) of model years outside of the agencies' model year analysis, while conceding that doing so is inappropriate;
- Failing to account for the fact that the Final Rule will increase fuel prices by increasing demand for fuel;
- Erroneously applying the cost of pollution from refineries to power plant emissions;
- Transposing numbers in the equation to estimate the costs of risks due to changes in vehicle mass caused by the Final Rule; and
- Improperly modeling how the Final Rule affects new vehicle sales, including relying on sales projections where the margin of error in the projection swamps the purported sales differences under the Final Rule.

- EPA unlawfully expanded the advanced technology multiplier credit for natural gas vehicles (NGVs).
- EPA failed to adequately respond to key comments submitted after the close of the formal comment period that are of central relevance to the rulemaking and that, if properly considered, would further demonstrate the arbitrariness of the Final Rule.

To the extent objections in this petition have not previously been raised, that is because "the grounds for such objection arose after the period for public comment," and/or it was "impracticable to raise such objection" within the formal comment period, 42 U.S.C. § 7607(d)(7)(B), because (1) the facts underlying the objection only became known publicly after the formal comment period (for example, issues that arose for the first time in the Final Rule), (2) EPA previously failed to provide critical information for the Proposed Rule, which has now become available, (3) the issue was not identified by the agency in the Proposal, as it should have been, and did not appear to play a significant role in the agency's analysis or justification until the Final Rule, and/or (4) because the comment period for the Proposed Rule was wholly inadequate.[3] We also note that EPA committed to consider comments submitted after the close

[3] *See, e.g.*, Comments of the Center for Biological Diversity, et al., Docket #NHTSA-2018-0067-12000, as corrected Docket #NHTSA-2018-0067-12368 ("NGO Joint Legal Comments"), Appendix A at 200-213. Specifically, the comment period did not allow the public sufficient time to provide comment on the extensive actions proposed—including two highly complex, technical rules on fuel economy and GHG standards for light-duty vehicles, NHTSA's preemption regulations, and EPA's proposal to revoke existing state authority to regulate greenhouse gas emissions from motor vehicles. *See id*. at 206-213. The breadth of these proposals, combined with the agencies' pervasive lack of clarity and failure to provide centrally relevant information, *see, e.g.*, Letter from Center for Biological Diversity, et al., dated December 20, 2018, Docket #NHTSA-2018-0067-12371, severely restricted the public's ability to comment on the Proposed Rule. We also note that the formal comment period lasted only 63

of the formal comment period "[t]o the extent practicable." 83 Fed. Reg. at 43,471. Petitioners do not concede that any of the issues discussed in this petition require exhaustion or have not been exhausted. Our submission does not and cannot affect the availability of any issues, facts, and objections to be raised immediately in judicial challenges to the Final Action.[4]

To promote efficient resolution of disputes over the Final Rule, EPA should immediately grant reconsideration based on the issues identified herein, administratively stay the rule, withdraw it, and reinstate the previous MY 2021-25 standards.

All cited materials that are not in the dockets for the Proposed Rule (as well as some docketed materials) are included electronically with this petition.

Respectfully submitted,

Center for Biological Diversity
Chesapeake Bay Foundation
Consumer Federation of America
Conservation Law Foundation
Environmental Defense Fund
Environmental Law & Policy Center
Environment America
Natural Resources Defense Council
Public Citizen
Sierra Club
Union of Concerned Scientists

days, and the agencies denied requests—including requests from automakers—for an additional 57 days, citing a purported need for automakers to have "maximum lead time to respond to the final rule." Yet it took EPA and NHTSA a year and a half to finalize the actions in the Final Rule. The agencies' protracted process demonstrates just how complex the Proposed Rule was, and how unreasonable the arbitrarily short comment period was.

[4] *See* 42 U.S.C. § 7607(b) ("The filing of a petition for reconsideration by the Administrator of any otherwise final rule or action shall not affect the finality of such rule or action for purposes of judicial review nor extend the time within which a petition for judicial review of such rule or action under this section may be filed, and shall not postpone the effectiveness of such rule or action.").

Appendix to Petitioners' Petition for Reconsideration to EPA regarding the Final Rule

I. EPA made several irrefutable mistakes in the analysis and relied on a number of fatally flawed modeling approaches, as well as unsupported and improper economic and technical assumptions, in attempting to justify the Final Rule.

In the Final Rule, the agencies[5] made a host of errors—from basic computational mistakes to deeply flawed and unjustified analytical assumptions—that undermine the cost-benefit analysis and other justifications for the rule. When these errors are corrected, there can be no dispute that the Final Rule will cause tens of billions of dollars of net costs to society, even at a 7% discount rate. Correcting these errors also reveals that rolling back the previous standards to the standards in the Final Rule will not lead to the cost savings, avoided fatalities, and other purported benefits that EPA asserts, further undermining the agency's rationale in the Rule.

EPA must grant reconsideration to address these errors and related analytical failings, withdraw the Final Rule, and reinstate the MY 2021-2025 standards.

A. The Agencies Grossly and Obviously Miscalculated Congestion Costs

EPA must grant reconsideration to reassess the Final Rule in light of at least four obvious errors in the Rule's new calculation of congestion benefits. This calculation—which abruptly departed from the Proposed Rule's assessment of congestion benefits without notice to the public—grossly and inaccurately inflates estimates of marginal congestion costs relative to the Proposal.

The agencies justify this increase on the theory that their earlier estimates, which relied on a 1997 study, did not reflect current conditions. But there are at least four obvious errors in the methodology the agencies used when "updating" that 1997 study: when adjusting the 1997 data, the agencies (1) neglected to adjust for inflation when calculating the value of travel time ("VTT"), (2) miscalculated the increase in vehicle occupancy, (3) miscalculated the increase in congestion, and (4) wrongly calculated the total congestion costs from vans and SUVs by applying to those vehicles the (higher) marginal congestion costs for cars.

Collectively, these errors overestimate the Final Rule's benefits by *at least* $27.6 billion at a 3% discount rate and $17.4 billion at a 7% discount rate. These massive sums fundamentally alter the Rule's cost benefit analysis, rendering the Final Rule net costly at either discount rate. Because the Final Rule was predicated on EPA's weighing of the various costs and benefits of the proposed action and EPA's incorrect conclusion that costs and benefits "straddle zero," 85

[5] While this petition is addressed to EPA, many of the modeling and analytical approaches in the Final Rule are used to evaluate and justify both agencies' standards, so the petition often refers to "the agencies," not just EPA. *See also* 85 Fed. Reg. at 24230 (noting that EPA elected to rely on NHTSA's CAFE model for the analysis of the regulatory alternatives in the Final Rule). Any reference to "the agencies" includes EPA.

Fed. Reg. at 24,176, the mistakes in the agencies' congestion calculations *alone* require that EPA reconsider and withdraw the Final Rule in its entirety.

i. Background

The agencies explain that the Final Rule will, by decreasing fuel economy, make driving more expensive and, as a result, lower the vehicle miles traveled ("VMT") by the future fleet. Reducing VMT, in turn, reduces traffic's negative externalities, such as noise and congestion. Thus, the standards proposed in the Proposed Rule and finalized in the Final Rule are expected to generate congestion and noise benefits relative to the previous standards.

The Proposed Rule addressed congestion benefits in a single paragraph. 83 Fed. Reg. at 43,106. There, the agencies explained that they calculated the Proposed Rule's congestion benefits by multiplying marginal congestion costs "by the annual increases in automobile and light truck use" from increased VMT under the previous standards. *Id*. Together with benefits from reduced noise (which were negligible), this calculation produced $62.5 billion in benefits from the EPA Proposal at a 3% discount rate.

When calculating these benefits in the Proposed Rule, the agencies relied on the marginal costs of congestion from the Federal Highway Administration's ("FHWA's") 1997 Highway Cost Allocation Study (the "1997 Study" or "Study"). The agencies noted that "NHTSA previously employed [the Study's] estimates in [NHTSA's] analysis accompanying the MY 2011 final CAFE [Corporate Average Fuel Economy] rule[,] as well as in [NHTSA's] analysis of the effects of higher CAFE standards for MY 2012-16 and MY 2017-2021." *Id.* "After reviewing the procedures used by [the Federal Highway Administration] to develop [the estimates] and considering other available estimates of these values," the agencies concluded that the 1997 estimates "continue to be appropriate for use in [the Proposal]." *Id.*

Because the agencies used the 1997 Study's calculations without alterations, commenters on the Proposed Rule generally did not address the agencies' estimates for marginal costs of congestion. Instead, "[a]lmost all . . . comments focused on the appropriateness of the estimated magnitude" of the second variable for calculating congestion benefits—VMT, and, in particular, the "fuel economy rebound effect"—rather than the agencies' estimates of marginal congestion costs. 85 Fed. Reg. at 24,736.

Yet the Final Rule abruptly jettisoned the Proposal's estimates of marginal congestion costs. Notwithstanding the agencies' prior determination that the 1997 estimates "continue to be appropriate for use," 83 Fed. Reg. at 43,106, the Final Rule purported to "update[] the . . . estimates to account for current economic and highway conditions," 85 Fed. Reg. at 24,736. According to the agencies, these "conditions" depended on changes to three variables since 1997: "baseline traffic volumes . . . , together with vehicle occupancy and the value of occupants' travel time." *Id.*

Because the agencies concluded that all three variables had increased since the 1997 Study, EPA and NHTSA appear to have updated the Study's marginal costs by (1) summing the percentage change in each of the three variables; (2) multiplying that sum by the marginal costs

presented in the Proposal; and (3) adding the resulting figure to the 1997 inflation-adjusted marginal costs. *Id.* at 24,736-37.

According to the agencies, traffic volume, vehicle occupancy, and the value of time increased by 53%, 18%, and 82%, respectively. *Id.* at 24,737 nn.1939, 1941. Using what appears to be the agencies' new formula, these changes produce per-mile marginal congestion costs *153% larger* than the costs in the Proposal. Specifically, per vehicle-mile marginal costs increased from 6.08 cents (for cars) and 5.43 cents (for trucks) in the Proposal (in 2016 dollars) to 15.4 cents and 13.8 cents, respectively, in the Final Rule (in 2018 dollars). *Id.* at 24,737.

These new marginal costs produce enormous asserted congestion benefits for the Final Rule. EPA acknowledges that, under the Final Rule, VMT from the previous standards is 66% *less* than the agencies had estimated in the Proposal.[6] Nonetheless, congestion benefits are almost identical in the Final Rule relative to the Proposal. Specifically, the Final Rule estimates congestion benefits (net of noise benefits) to be $60.2 billion at a 3% discount rate and $38.2 billion at a 7% discount rate for the EPA standards. *See* 85 Fed. Reg. at 24,203-07 (Tables II-21 and II-23). Equivalent figures in the Proposal were $62.5 billion and $35.0 billion, respectively. *See* 83 Fed. Reg. at 43,314-13 (Tables VII-51 and VII-53).

ii. *Clear Flaws in the Agencies' Methodology*

There are at least four obvious, indisputable errors in the agencies' new methodology. The Final Rule purported to increase the marginal congestion cost to reflect changes in three variables—VTT, vehicle occupancy, and traffic volumes—but relied on obviously inaccurate data in all three instances. The Final Rule also incorrectly treated vans and SUVs as "cars" for purposes of determining marginal congestion costs instead of, as is appropriate, "trucks," an error that inflated those vehicles' monetized contribution to congestion and therefore the overall congestion benefits for the Final Rule.

First, the agencies calculated the increase in per hour VTT without accounting for inflation. The agencies calculated the increase in VTT by dividing the VTT value set forth in the 2018 "Benefit-Cost Analysis Guidance for Discretionary Grant Programs" ($16.10, adjusted for 2017 dollars) by the value set forth in the 1997 "Departmental Guidance for the Valuation of Travel

[6] In the Proposed Rule, total additional VMT under the previous standards, in comparison to the proposed standards, was 1,790 billion miles. *See* 83 Fed. Reg. at 43,352 (Table VII-89) (adding the rows for MY's 2017-2029 and MY's 1977-2016). In the Final Rule, total additional VMT under the previous standards, in comparison to the final standards, is 605 billion miles. *See* 85 Fed. Reg. at 25,036 (Table VII-113).

Time in Economic Analysis" ($8.90, in 1995 dollars). *See* 85 Fed. Reg. at 24,737 n.1941. The agencies calculate this increase as 82%.

This calculation ignores two decades of inflation. The numerator in the above equation is expressed in 2017 dollars, while the 1997 figure is expressed in 1995 dollars. Adjusting both the numerator and denominator to reflect 2018 dollars produces only a 21% increase.[7]

Second, the agencies overestimated the increase in vehicle occupancy since 1995. Citing the FHWA's Nationwide Personal Transportation Survey, the Final Rule measures the increase in occupancy from 1995 to 2017 at 18%. 85 Fed. Reg. at 23,737 n.1941. The agencies measured occupancy only for persons older than 16 for the reasons set forth in the Final Rule's calculation of refueling benefits. *See id.* at 24,712-13, 24,737.

It is unclear exactly how the agencies arrived at the 18% increase in vehicle occupancy, as they do not provide their precise methodology or calculations, but the data the agencies cite shows that occupancy *decreased* by 3% between 1995 and 2017. Using the table generators cited in the Final Rule, *id.* at 24,737 n.1941, the ratio of (1) total person miles in privately owned and/or operated vehicles ("POVs") for persons older than 16 over (2) total vehicle miles traveled by POVs *decreased* by 3% between 1995 and 2017.[8] Indeed, the Department of Transportation's 2017 analysis and longitudinal summary of this same data states that "vehicle occupancy estimates, measured as person miles per vehicle mile, seems to have stayed about the same" and that "[w]hile there are small nominal differences between the 2017 and earlier estimates, these differences are all within the margins of error." DOT, Fed. Highway Admin., 2017 Summary of Travel Trends: National Household Survey, at 58, Table 16.

Third, the agencies grossly overestimate increases in relevant vehicle traffic. According to the agencies, "traffic volumes, as measured by the annual number of vehicle-miles traveled per lane-mile of roads and highways nationwide, rose by 53% between 1997 and 2017." *Id.* at 24,737 & n.1939. But the data cited for this proposition—the FHWA's Highway Statistics—documents at most an 18% increase over this period for the metric identified by the agencies, i.e., the increase in lane miles traveled by *all vehicles* across *all highways*. *Id.*[9]

The agencies did not explain or document their methodology, but the 53% increase appears to be plucked from unrepresentative FHWA Highway Statistics data. Specifically, the agencies appear to have arrived at the 53% increase by comparing vehicle miles for *passenger cars* per *interstate* lane miles in 1997 with vehicle miles for *short wheelbase light duty vehicles* per *interstate* lane miles in 2017. This calculation is wrong for two reasons. First, it compares apples to oranges: because "short wheelbase light duty vehicles" includes many more types of

[7] Petitioners have followed the agencies' practice of using the gross domestic product deflation index from the Bureau of Economic Analysis. 85 Fed. Reg. at 24,712 n.1853.

[8] To calculate occupancy in 1995, for example, Petitioners used the table generator at https://nhts.ornl.gov/det/Extraction3.aspx, and, for 1995, generated a table by selecting "combine total" for all characteristics other than age (for which it selected all ages above 15) and mode (for which it selected "POV"). We then divided the resulting person miles by vehicle miles to obtain occupancy for persons older than 16.

[9] Specifically, 18% is the increase between (1) the 2017 ratio of "total urban and rural" vehicle miles (as set forth in Table VM of the FHWA's Highway Statistics) and the grand total of all highway miles (as set forth in Table HM) with (2) the corresponding ratio for 1997 data.

vehicles than simply passenger cars (such as vans and SUVs with short wheelbases), comparing vehicle miles in 1997 from passenger cars with vehicle miles in 2017 from short wheelbase light duty vehicles naturally sweeps in far more vehicle miles for the 2017 measure of volume, inaccurately inflating the increase in traffic.[10] Second, and as the Final Rule acknowledges, passengers experience congestion as a function of *all* traffic across *all* highways, not simply traffic from cars on interstates. *Id.* at 24,737. There is accordingly no conceptual justification for calculating the marginal costs of congestion only with reference to certain, cherry-picked subsets of vehicles and roads. The agencies should have compared all traffic in 1997 with all traffic in 2017, a calculation that produces the 18% figure, above.

Fourth, the agencies improperly calculated the congestion costs from increased van and SUV miles by assigning those miles the marginal per-mile congestion costs for *cars*. But as the 1997 Study clarifies, these vehicles are properly assigned the lower marginal congestion costs for *trucks*. *See* 1997 Study Table V-24 (specifying a single marginal congestion costs for "trucks and vans"); *id.* Table I-1 (describing "[l]ight trucks with 2-axles and 4 tires (Pickup Trucks, Vans, Minivans, etc.)" as "one of the 20 classes of vehicles "used in t[he] study").

Finally, Petitioners disagree with the agencies' conclusion that it is appropriate to add the three categories of impacts on congestion costs (i.e., VTT, occupancy, and traffic) on the theory that "the effects of changes in [congestion] variables on overall congestion costs is approximately additive, as long as changes in the two are relatively modest." 85 Fed. Reg. at 24,737. While this may be approximately true for "relatively modest" changes, *id.*, the magnitudes of the changes set forth in the Final Rule (18%, 53%, and 82%) are most certainly not modest and should only be considered together. Thus, the changes in the relevant variables should be multiplied instead of added.

To correct these errors, Petitioners updated the inflation-adjusted marginal costs from the 1997 Study (7.03 cents for cars and 6.27 cents for trucks, in 2018 dollars) to reflect a 38% increase (the product of a 21% increase in VTT, a 3% decrease in occupancy, and a 18% increase in traffic volume)[11] instead of, as the Final Rule concludes, a 153% increase.[12] Petitioners then assigned SUVs and vans the marginal congestion costs for trucks instead of cars and ran the CAFE model accordingly. Using these correct data, congestion benefits drop from $60.2 billion to $32.6 billion at a 3% discount rate and from $38.2 billion to $20.7 billion at a 7% discount rate. Correcting these errors *alone* renders the Final Rule net costly at both discount rates, producing $49.6 billion in net costs at 3% and $11.0 billion in net costs at 7%.

B. EPA unlawfully relied on NHTSA's CAFE model to estimate compliance costs, instead of its own OMEGA model, leading to grossly inflated costs for the previous standards

[10] A "short wheelbase light duty vehicle" is any "passenger car[], light truck[], van[][,] [or] sport utility vehicle[] with a wheelbase . . . less than or equal to 121 inches." Fed. Highway Admin., Office of Highway Policy Information, Highway Statistics Series, 2018, Table VM1, at 1 n.2.

[11] Here the percentage increase x is determined from the formula $1+x = \text{Product}(1+x_i)$, e.g., $38\% = (1+21\%) \times (1-3\%) \times (1+18\%) - 1$.

[12] Petitioners note that both the Proposed Rule and the Final Rule calculated congestion costs with respect to 1997 estimates of marginal costs that had not been fully adjusted to account for inflation from the original 1994 dollars. Petitioners' recalculation corrects this mistake.

EPA estimated the compliance costs in the Final Rule by utilizing NHTSA's CAFE model instead of EPA's own Optimization Model for reducing Emissions of Greenhouse gases from Automobiles ("OMEGA model"). EPA did so despite having received comments demonstrating that the CAFE model was and still is not designed to model compliance with GHG standards, and that the CAFE model contains flaws that substantially overstate technology compliance costs. *See, e.g.*, NGO Legal Joint Comment at 13-26; *id*. at 20 (noting that interagency review documents indicated that "EPA's OMEGA modeling found costs half that of NHTSA's findings"). EPA's decision to utilize the CAFE model instead of its own OMEGA model in the Final Rule vastly inflated the projected compliance costs for the previous standards, creating the false appearance that a dramatic weakening of those standards was justified in order to avoid those costs.

While Petitioners raised many of these issues in comments on the NPRM, *see, e.g., id*. 13-26, we were not able to use the latest version of the OMEGA model, along with the agency's most updated assessment of technology costs, because EPA had refused to publicly release them.

Natural Resources Defense Council ("NRDC") and Environmental Defense Fund ("EDF") sued EPA to force disclosure of the latest version of the OMEGA model, and, on April 1, 2020, the U.S. Court of Appeals for the 2nd Circuit ruled that EPA had illegally withheld the model and ordered the agency to disclose it. *NRDC v. EPA*, 954 F.3d 150 (2d Cir. April 1, 2020). EPA complied with that directive on June 4, 2020.

While Petitioners have only had access to the OMEGA model for a short period of time, we have now confirmed that the model demonstrates that the technology costs associated with meeting the previous GHG standards are *significantly lower* than the agencies claimed in the Final Rule. For instance, in the Final Rule, the agencies found that average MY 2029 per-vehicle costs (in $2018) to comply with the previous GHG standards were $2,545 and the same costs under the weaker, Final Rule standards were $1,554. 85 Fed. Reg. at 24,260 (Table V-7). But when we ran the version of the OMEGA model now finally turned over under court order, we found that the average MY 2029 per-vehicle costs (in $2018) to meet the previous GHG standards were $1,684—nearly *35 percent lower* than the agencies' estimate in the Final Rule.[13]

[13] The results of this run are included with this petition as an Excel file. We increased the per-vehicle compliance cost results of $1451.54 by 5% to convert them from $2016 to $2018 values; this increased the cost to $1524 per vehicle. This cost does not contain the cost of air conditioning technology to reduce leakage and improve efficiency. Per the agencies' analysis in the Final Rule, this cost is $160 per vehicle in MY 2029 (Compliance_Report.xlsx file for the CO2 reference case, *available at* https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system in the "Central Analysis" download for the 2020 Final Rule for Model Years 2021-2026 Passenger Cars and Light Trucks). Adding this $160 cost to the $1524 per-vehicle costs leads to a total compliance cost of $1684. This OMEGA model run used input files released by EPA with the OMEGA model in response to the lawsuit. The only adjustment made to the model was to eliminate compliance with California's ZEV standards, which had previously been represented in the model, but which the agencies have purported to invalidate. *See* EPA and NHTSA, *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program*, 84 Fed. Reg. 51,310 (Sept. 27, 2019). To do this, we held PHEV and BEV sales constant at their MY 2019 levels. Without this adjustment, projected costs to comply with the previous GHG standards would have been even lower. We note that the baseline MY in the OMEGA model is 2016, while the Final Rule uses MY 2017. We think it is unlikely that this difference would be significant enough to undermine the conclusions

In fact, the per-vehicle compliance costs under the previous GHG standards produced by the now-available OMEGA model exceed the compliance costs the agencies estimate using the CAFE model for the much weaker Final Rule standards by just $130 per vehicle, or 8 percent (compare $1,684 with $1,554). EPA must reconcile and explain its finding that compliance costs of $1,554 per vehicle under the Final Rule are reasonable even though the Final Rule produces vastly larger amounts of harmful GHG and criteria pollutant emissions than the previous standards, and even though EPA's own model shows compliance costs for the previous standards are just 8% higher.

The cost estimates produced by EPA's own modeling tool, which it designed specifically for the task of deriving the most accurate costs for automakers' GHG standard compliance, undermine EPA's justification for flouting its statutory duties under the Clean Air Act, including its determination that the previous standards are somehow inappropriate. Two of the agencies' primary justifications for weakening the previous standards are that "[t]he costs to both industry and automotive consumers would have been too high under the standards set forth in 2012." 85 Fed. Reg. at 24,176. But the new OMEGA model results demonstrate that costs to industry and consumers would actually be very similar to the projected costs for the Final Rule that the agencies deemed reasonable.

EPA's refusal to release the OMEGA model illustrates, once again, the flagrant procedural violations that have marred this rulemaking. Moreover, upon receiving the model and running it, it is clear that it undermines EPA's entire rationale for rejecting the previous GHG standards and adopting those in the Final Rule.

EPA must consider these new costs (which the agency had access to but which they unlawfully withheld from the public). Moreover, the results of our analysis further underscore the arbitrary and capricious nature of EPA's unlawful weakening of the previous GHG standards.

C. The Agencies' Modeling Erroneously Blocked Deployment of High Compression Ratio Technology (HCR0 and HCR1), Contrary to the Agencies' Statements in the Final Rule Regarding the Availability of that Technology

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presented here. For example, when EPA updated the OMEGA model from a MY2014 baseline in the Draft Technical Assessment Report for the Midterm Evaluation of the previous standards to a MY2015 baseline for the original Proposed Determination on the previous standards, compliance costs decreased by $45. *See* EPA, *Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation* (November 2016) at A-125 (finding average per vehicle costs to meet the MY2025 standards of $875 (2015$), while the Draft TAR had estimated the same costs at $920 (2015$)); *id*. at A-113 (explaining that EPA has updated the baseline fleet for the Proposed Determination to MY2015); EPA, NHTSA & CARB, *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), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockey=P100OXEO.PDF ("TAR") at ES-3 (explaining that the GHG analysis used a MY2014 baseline fleet). Additionally, because only a small share of vehicles were redesigned between MY2016 and MY2017, *see* FRIA at 260 (Table VI-9, showing that only 13% of vehicles were redesigned between 2016 and 2017), it is unlikely for any small deviation related to the addition of new technologies and performance characteristics for the MY 2017 fleet to substantially affect total costs.

The agencies also made a clear error in the Final Rule in modeling the uptake of a key efficiency technology: high compression ratio engine ("HCR") technology.[14] Specifically, the Final Rule states that the agencies' modeling "allowed all 4-cylinder engines on the basic engine path to adopt HCR0 and HCR1 technology."[15] The "basic engine path" comprises all engines that have not yet adopted turbocharging, advanced turbocharging, variable turbo geometry, HCR, variable compression ratio, advanced cylinder deactivation, diesel, or alternative fuels technologies.[16] The agencies state that the only "exceptions to this feature" of the modeling are that HCR is not allowed on any pickup trucks or on any engine that is "shared" with a pickup truck.[17] The agencies' asserted reason for these exceptions is that HCR is not suitable for use on pickup trucks.[18] Accordingly, the agencies state that the only four-cylinder-engine vehicles precluded from adopting high compression ratio engines are: (1) pickup trucks; (2) vehicles whose "base engine is shared with a pickup" truck; and (3) vehicles that already have "advanced engine technology . . . such as turbocharg[ing,]" in the baseline (MY 2017) and therefore are not on the basic engine path.[19]

The agencies' modeling shows "SKIPS" in the input files of HCR technology for 28 four-cylinder engines on the basic engine path, and thereby blocks adoption of HCR technology in these engines.[20] However, the market data input files show that only three of these engines are

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[14] In a traditional engine the "compression stroke" (which "compresses" the gasoline and air in the engine before it is ignited) is the same length as the "expansion stroke" (which captures the energy from igniting the gasoline and delivers it to the vehicle's wheels). HCR technology allows the expansion stroke to be longer than the compression stroke, allowing the engine to capture more energy from the ignited gasoline, thereby making the engine more efficient.

[15] 85 Fed. Reg. at 24,427.

[16] *See* Shaulov, M., Bogard, D., Green, K., Jean, B., Keefe, R., & Pickrell, D., *CAFE Model Documentation*, DOT HS 812 934, National Highway Traffic Safety Administration, March 2020, at 25 ("Final Rule CAFE Model Documentation"), available at: https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.

[17] 85 Fed. Reg. at 24,427.

[18] *Id*.

[19] *Id.* As comments in the rulemaking dockets have demonstrated, these limitations are themselves arbitrary and capricious. *See, e.g.*, Comment of the International Council for Clean Transportation (ICCT), Docket #NHTSA-2018-0067-11741, at I-3 (demonstrating that "[t]he agencies' own data proves" that it is false that "HCR is not suitable for 6- or 8-cylinder engines"); *id.* (demonstrating that HCR technology has been adopted in the real-world on "pickup trucks, performance sedans, all-wheel-drive versions, four-wheel-drive versions, and mid-sized SUVs" and that HCR engines can "deliver high-performance" and high-horsepower); *id*. at I-5 (arguing that "the claim that shifting the CAFE powertrain technology pathways 'requires extensive capital and resources that would be required for manufacturers to shift from other [advanced] powertrain technology pathways (such as turbocharging and downsizing) to standalone Atkinson cycle engine technology' is not reasonable"); *id*. (observing that "engines employing the Miller cycle (essentially a turbocharged HCR1 engine) already exist today"); Supplemental Comment of the ICCT, Docket #NHTSA-2018-0067-12387, at 4 (refuting the notion that HCR engines are less effective when applied to light-duty trucks, including pickup trucks, than when applied to passenger cars). Thus, we reiterate that all of the limitations the agencies place on HCR technologies independently demonstrate that the Final Rule is arbitrary and capricious. Nevertheless, those limitations are beyond the scope of this discussion, which concerns the specific error in the Final Rule of failing to allow HCR technologies on those vehicles that the agencies *admit* should be allowed to adopt that technology. The agencies' arbitrary refusal to allow HCR0 and HCR1 on pickup trucks and vehicles with 6-cylinder and 8-cylinder engines in the Final Rule analysis is discussed elsewhere in this petition.

[20] Final Rule CAFE Model Input File: market_ref_proper_hcr.xlsx, available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system. The four cylinder basic engines with "SKIPS" blocking adoption of HCR technology are engines 111400, 111800, 111801, 112400, 112500, 112501, 211500,

"shared" with pickup trucks.[21] Thus, according to the agencies' description of their approach, only these three engines should be blocked from adopting HCR technologies, leaving the remaining 25 engines free to adopt HCR0 and HCR1 technology whenever it is cost-effective to do so. The "SKIPS" in the model that block HCR technology from these 25 engines directly conflict with the agencies' statement in the preamble that these engines *are not* blocked from adopting HCR technologies. Simply, the agencies did not model what they claimed they had modeled.[22] In other words, the model is wrong.

This error has significant effects on the agencies' analysis. For example, the model input files show that 6,578,136 vehicles in the modeled fleet use four-cylinder basic engines that are not shared with pickup trucks and thus that should be able to adopt HCR technology whenever it is cost-effective to do so. Of these, 2,580,898 vehicles use the 25 engines described above, and are thus improperly blocked from adopting HCR technology. Thus, in the agencies' modeling almost 40% of the vehicles in the modeled fleet that the agencies admit *should be* allowed to adopt HCR technology whenever it is cost-effective to do so *are not allowed* to adopt HCR technology in the standard-setting and compliance modeling. As but one example of the impact of this constraint at the manufacturer level, Honda's vehicles are modeled as using five four-cylinder basic engines that the agencies state should be allowed to adopt HCR in the model, but which the model in fact blocks from adopting HCR.[23] As a result, the model wrongly projects that these vehicles would have to adopt more expensive options to meet the previous standards. Fixing this error and removing the erroneous constraints blocking HCR technology from these Honda engines causes Honda's projected MY 2030 compliance cost savings from the Final Rule GHG standards to drop from $898 per-vehicle (as shown in the agencies' analysis) to $672 per vehicle. In other words, this error alone causes the agencies to overstate the change in Honda's MY 2030 compliance costs from the Final Rule by 34%.[24]

More broadly, this error significantly and materially affects the agencies' societal and consumer cost-benefit analyses. Fixing this error by allowing HCR0 and HCR1 to be adopted on the 25 erroneously "skipped" engines described above causes total net benefits for the Final Rule's GHG standards to decrease by $2.9 billion (from -$22.0 billion to -$24.9 billion) at 3%

211800, 212001, 212400, 212401, 221601, 221801, 222001, 222002, 222501, 222502, 222503, 232701, 241501, 252001, 252401, 252402, 253001, 1316001, 1320001, 1325001, and 1325002. *Id.*

[21] Of the engines listed above, engine 112500 is used on both pickups and non-pickups and engines 222503 and 232701 are exclusively used on pickup trucks. *Id.*

[22] In fact, notwithstanding the agencies' statement in the Final Rule that the modeling "now allow[s] more manufacturers to adopt HCR engine technology," *see* 85 Fed. Reg. at 24,427, the model now inexplicably blocks HCR technology entirely for some manufacturers that had been projected to adopt HCR throughout their fleets in the Proposed Rule. For example, in the Proposed Rule the agencies projected that Nissan and Mitsubishi would add HCR technology to four-cylinder basic engines on non-hybrids comprising 69% of their total sales under the previous standards in model year 2025, and that they would add HCR technology to non-hybrid six-cylinder engines comprising another 16% of their total sales. *See* Proposed Rule CAFE Model Output File: vehicles_report.csv, available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system. Yet in the Final Rule, the agencies have blocked HCR technology from *all* of Nissan and Mitsubishi's engines. *See* Final Rule CAFE Model Input File: market_ref.xlsx, available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.

[23] These are engines 211500, 211800, 212001, 212400, and 212401. Final Rule CAFE Model Input File: market_ref_proper_hcr.xlsx, available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.

[24] ($898/672) - 1 = 33.6%.

and by $2.8 billion (from $6.4 billion to $3.6 billion) at 7%. Thus, this error alone causes EPA to understate the Final Rule's net costs to society at a 3% discount rate by 13%,[25] and to overstate the net benefits at a 7% discount rate by 78%.[26] EPA must remove the erroneous "SKIPS" blocking HCR0 and HCR1 technology from the 25 four-cylinder basic engines described above and reconsider the Final Rule.

Moreover, the agencies' erroneous blocking of HCR0 and HCR1 technology materially impacts the agencies' projections of the costs for automakers to comply with the standards and the impacts of the Final Rule on costs to consumers. Without fixing any of the other errors in the agencies' analysis, fixing this one error reduces the technology cost projection in the Final Rule from -$108 billion to -$103 billion at a 3% discount rate, meaning EPA overstated its GHG compliance cost projection by $5 billion, or 4.9%.[27] Similarly, fixing the error reduces technology cost benefits at a 7% discount rate from -$86 billion to -$82 billion, meaning EPA overstated GHG program technology cost benefits of the GHG standards in the Final Rule by $4 billion or 4.9%.[28]

As is the case with the other errors discussed in this petition, these effects on technology and consumer costs are centrally relevant to EPA's analysis. EPA cites technology costs as a central justification for the Final Rule, overriding the Final Rule's negative impacts on air pollution. *See* 85 Fed. Reg. at 24,176 (emphasizing the "scale of reduced required technology costs" and the "equally important" impacts on "purchase prices costs to U.S. consumers"). But the agencies' technology cost calculations are manifestly, irrefutably, and materially incorrect, in part because the agencies' modeling fails to reflect their determination that HCR0 and HCR1 should be available as compliance pathways for all 4-cylinder, basic engines in the fleet that are not shared with pickup trucks. EPA must withdraw and reconsider the Final Rule, correcting the fact that the model erroneously blocks HCR technology from four-cylinder basic engines that the agencies state *should be* allowed to adopt that technology.

D. The Agencies Improperly Excluded the Effects of Increased Gasoline Prices Caused by the Large Increase in Gasoline Demand

Using the CAFE model, the agencies project that the Final Rule will increase gasoline demand in 2050 by 13-15 billion gallons (an increase of about 15-20 percent for that year).[29]

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[25] (-$24.9 billion/-$22 billion) - 1 = 13.2%.
[26] ($6.4 billion/$3.6 billion) - 1 = 77.8%.
[27] (-$108 billion/-$103 billion) - 1 = 4.9%.
[28] (-$86 billion/-$82 billion) - 1 = 4.9%.
[29] Annual_Effects_Summary_Report.xlsx files for the agencies CAFE model runs for the CO2 reference case (15%) and the CAFE standard setting reference case (20%), published by the agencies with the publishing of the web version of the Final Rule, column K, lines 608 and 3056 of both files, *available at* https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system. Under the MY1977-2029 analysis, the CAFE standards in the Final Rule are expected to increase fuel consumption by 84 billion gallons. 85 Fed. Reg. at 24,180 (Table I-5).

The agencies acknowledge that, in accord with basic economics, increases in gasoline demand will increase gasoline prices.[30]

Commenters argued that the agencies should account for these increased gasoline prices in assessing the impacts of the weakening, or "rollback," of the previous standards—in other words, that the rollback will cause consumers to buy more fuel and that fuel will be more expensive.[31] But the agencies declined to do so, concluding that any such effects on gasoline price would be insignificant[32] and proceeding to use the same gasoline prices when assessing the previous standards and the standards in the Final Rule.[33]

The agencies justified this approach based on an analysis using the Energy Information Agency's ("EIA") "NEMS" Model.[34] Specifically, the agencies compared gasoline price projections from two NEMS model runs:

> (A) EIA's Annual Energy Outlook ("AEO") 2019 reference case, which assumes compliance with the previous MY 2021 and augural MY2022-2025 Corporate Average Fuel Economy (CAFE) standards issued by NHTSA and the previous MY 2021-2025 GHG emissions standards,
> (B) a run with three changes to the 2019 reference case: 1) fuel economy standards held flat at 2020 levels; 2) substantially decreased ZEV costs; and 3) accounting for the agencies' prior actions purporting to invalidate California's ZEV standards.

The agencies found that the resulting gasoline prices from the "(B)" modified NEMS run never differed by more than 2 percent when compared to the reference "(A)" analysis and declared that "the agencies' modifications to NEMS did not significantly affect its projections of future prices for transportation fuels."[35]

There are two fundamental problems with this conclusion.

First, the agencies' own analysis showing a change in gasoline prices of up to 2 percent—or up to 7 cents per gallon—would result in consumers spending billions of additional dollars on gasoline due to the Final Rule, which the agencies erroneously ignored. Petitioners analyzed this impact by using the gasoline prices in the agencies' AEO 2019 Reference "(A)" run to analyze the previous standards and the gasoline prices in the agencies 2019 modified NEMS "(B)" run to analyze the Final Rule. Because of the agencies' inconsistent assumptions about battery costs between these two runs, discussed below, the price differences between the "(A)" and "(B)" NEMS runs understate the true gasoline price impacts associated with the Final Rule, which our own NEMS runs show to be far greater. Regardless, applying the agencies' own gasoline price

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[30] 85 Fed. Reg. at 24,722–24. *See also* EIA 2018, Projections Tables for Side Cases, All year-by-year tables by case for the "No new efficiency requirements, Reference case," *available at* https://www.eia.gov/outlooks/archive/aeo18/tables_side.php (finding that the proposed freezing of standards would raise gasoline prices by 10 cents per gallon by 2050).
[31] 85 Fed. Reg. at 24,722-24.
[32] *Id*. at 24,591.
[33] *Id.* at 24,593.
[34] *Id.*
[35] *Id.*

increases in their NEMS runs to gasoline consumption under the Final Rule GHG standards would reduce the net benefits of the Final Rule by $33.6 billion at a 3 percent discount rate and $22.0 billion at a 7 percent discount rate. Including this effect alone—which the agencies admit is real, but inexplicably dismiss as "not significant[]"[36]—would result in the cost benefit analysis showing that the Final Rule imposes net costs on society under both 3 percent and 7 percent discount rates.

Second, the agencies also clearly erred in their analysis of the magnitude of the gasoline price increases due to the Final Rule. As described above, the agencies project that gasoline demand under the Final Rule will be approximately 15-20 percent higher in 2050. However, the agencies' AEO 2019 modified modeling "(B)" run showed only about 2% higher gasoline demand in 2050. This is because of the second change the agencies made in their modified NEMS "(B)" analysis: decreasing ZEV costs. This change had the effect of substantially increasing the use of zero emission vehicles (ZEVs), which reduced gasoline demand and *offset a significant portion* of the increased fuel demand otherwise attributable to the Final Rule. Of course, changing both ZEV costs and the level of the standards between the two NEMS runs makes it impossible to isolate the effect of the change in standards and therefore makes the agencies' comparison between the two NEMS runs apples to oranges. The agencies should have (but failed to) hold ZEV costs constant across both NEMS runs to isolate the gasoline price effects of the Final Rule.

Petitioners corrected this error by performing several additional NEMS runs to isolate the effects of the Final Rule. These runs retained all of the agencies' assumptions with the following modifications to inputs related to 1) the standards, and 2) battery costs.[37] The first set of runs models the previous standards in one case and the Final Rule standards in the second case and across both cases uses the lower battery costs reflected in the agencies' modified NEMS "(B)" run ("low battery cost scenarios"). The second set of runs similarly models the previous standards in one case and the Final Rule standards in the second case but across both cases uses the higher battery costs reflected in the agencies' AEO 2019 reference "(A)" run ("high battery cost scenarios"). These scenarios correctly analyze the effects of the actual change in standards the agencies adopted (as opposed to the flat MY2020 standards in the agencies' modified NEMS "(B)" run) but isolate the effects of that change in standards by holding battery costs constant.

Irrespective of the battery cost scenario, the results show greater gasoline price impacts due to the Final Rule than the agencies' modified NEMS run suggested. For example, the low battery cost scenario shows differences in gasoline prices up to 3.5%, or 9 cents per gallon, due to the Final Rule and shows that these price differences are more sustained than reflected in the agencies' analysis. Petitioners analyzed the impacts of these fuel price changes on EPA's cost-benefit analysis by again applying the gasoline price increases projected in these NEMS runs to the gasoline consumption under the Final Rule standards. The higher gasoline prices under the Final Rule substantially reduce the net benefits of the Final Rule as shown in the below table. EPA must withdraw and reconsider the Final Rule to correct this material error.

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[36] *Id*. at 24,591.

[37] The results of these runs are included with this petition as Excel spreadsheets.

Impact of Gasoline Price Changes on the Net Benefits of the GHG Standards in the Final Rule ($ billion)[38]				
	1977-2029 MY Analysis		2017-2050 CY Analysis	
	3% Discount	7% Discount	3% Discount	7% Discount
Low Battery Costs	-$55.5	-$35.0	-$119.1	-$56.8
High Battery Costs	-$49.4	-$29.8	-$113.9	-$53.6

E. The Agencies' Model Year Analysis is Arbitrarily Flawed

The agencies assessed the impacts of the Final Rule using both a model year 1977-2029 ("model year") analysis and a calendar year 2017-2050 ("calendar year") analysis.[39] The agencies explained that the model year analysis was intended to isolate the impacts that "might eventually be attributable to vehicles produced before 2030," while the calendar year analysis was intended to assess impacts between the present day and 2050.[40]

The agencies did not include the calendar year analysis in the Proposal but did so in the Final Rule.[41] The agencies also claimed to adjust their model year analysis in response to Environmental Defense Fund's ("EDF's") critiques that the model year analysis accompanying the Proposal improperly inflated the Proposal's benefits by including some (but not all) impacts attributable to vehicles sold after 2030.[42] For instance, in the Proposed Rule, the agencies' analysis assumed that there would be differences between vehicles sold under the proposed and previous GHG standards *after* 2030 and allowed those differences to influence the vehicle miles traveled of cars sold *prior* to 2030. In the Final Rule, the agencies conceded this was wrong: "agree[ing] that allowing persistently higher prices and fuel economies of future MYs to impact the scrappage of the on-road fleet but not considering the costs and benefits of those MYs is inconsistent."[43]

Despite the agencies recognizing this problem and claiming to have fixed it,[44] their concededly "inconsistent" approach to conducting a model year analysis remains in the Final Rule. Petitioners determined that this error persists in the Final Rule by running the CAFE model and ending compliance modeling after MY 2029 (the last model year included in the agencies' model year analysis) and again running the model through 2050 (without ending compliance modeling after MY 2029) and comparing the results. Ending compliance modeling after MY 2029 eliminates MY 2030 and later vehicles from the analysis. If 2030 and later model year vehicles did not impact the analysis, as the Final Rule says they did not, the results of these two runs should have been identical. However, allowing the model to run compliance modeling

[38] The impacts shown in this table exclude the increased cost of gasoline used outside the light-duty vehicle fleet, such as by heavy-duty trucks and a multitude of nonroad equipment, such as lawn mowers, leaf blowers, small tractors, recreational boats, etc.
[39] 85 Fed. Reg. at 24,188.
[40] *Id.* at 25,098.
[41] *Id.* at 24,642.
[42] *Id.* (quoting EDF's comment noting that the agencies' model year analysis included scrappage effects caused by model year 2030 and later vehicles).
[43] *Id.*
[44] *Id.*

through 2050 increased the net benefits of the Final Rule relative to the model run where compliance modeling stopped after MY 2029.[45]

Eliminating compliance modeling after Model Year 2029 reduced the net benefits of the Final Rule for GHG standards from -$22.0 billion to -$29.4 billion using a 3% discount rate and from $6.4 billion to $1.8 billion using a 7% discount rate. EPA must withdraw and reconsider the Final Rule to correct this material error.

F. The Agencies Used the Wrong Harm Values for Power Plant Emissions

The agencies likewise utilized demonstrably erroneous values to monetize the health harms associated with upstream power plant emissions, an approach that incorrectly inflates the net benefits of the Final Rule.

In the Final Rule, the agencies use an EPA analysis to value the benefits of reduced human exposure to PM2.5 and its precursors.[46] The EPA analysis on which the agencies rely, in turn, sets forth dollar-per-ton values associated with reducing PM2.5 and its precursors from 17 different source categories—values that vary both by source and by pollutant.[47] The categories include separate estimates for the petroleum refining, electricity generation, and on-road mobile sources, among others. As the EPA analysis notes, these estimates differ based on proximity to impacted populations, the geographic distribution of sources, and other source parameters (for example, stack height).[48]

The agencies' analysis of upstream emissions changes due to the final GHG standards includes impacts from two different sectors—petroleum refining *and* electricity generation. But to value the impacts of those upstream emissions changes, the analysis erroneously uses only the value of emissions from the petroleum refining sector. Specifically, the agencies' impact analysis shows that the rollback will cause higher emissions from refining (due to increases in gasoline demand relative to the previous standards) and lower emissions from electricity generation (due to fewer electric vehicles relative to the previous standards). To value those impacts, the agencies first subtract power plant emissions from refinery emissions and then monetize the difference in emissions using only the health damages per ton for refinery emissions.[49]

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[45] While the effect of post-2029 model year vehicles on the scrappage of pre-2030 model year vehicles is diminished in the Final Rule version of the CAFE model, the impact of these vehicles on the operation of vehicles in the onroad fleet is not and may actually be greater than in the Proposal.

[46] NHTSA and EPA, *Final Regulatory Impact Analysis* ("FRIA") at 1281 (citing EPA, *Technical Support Document, Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors*, U.S. Environmental Protection Agency Office of Air and Radiation, Office of Air Quality Planning and Standards (February 2018) ("2018 PM2.5 Benefits Per Ton")).

[47] *See* FRIA at 1281 (recognizing that "EPA quantifies health impacts and damage costs for emissions from 17 separate sectors of U.S. economic activity, and reports values for increases in premature mortality and the combined costs of damages from premature mortality and various other health impacts per ton of PM2.5, nitrate, and sulfate emissions").

[48] 2018 PM2.5 Benefits Per Ton at 6.

[49] *Id.*

This approach treats the health damages from refineries and power plants as identical, when they are not. The EPA analysis on which the agencies rely provides different, and often substantially lower, monetized impacts associated with emissions from power plants based on the different characteristics of those sources.[50] As they did when they separately monetized the impacts associated with tailpipe pollution, the agencies should have first monetized the health damages stemming from power plants and from refineries separately, using the distinct benefit-per-ton values for these sources, and then taken the difference of those monetized values. The agencies' approach in the Final Rule is plainly arbitrary and inconsistent with the EPA document on which it relies.

This clear error had the effect of substantially inflating the net benefits of the Final Rule. Correcting this error would reduce the net benefits of the GHG standards for MY1977-2029 by $4.1 billion at a 3 percent discount rate and $2.4 billion at a 7 percent discount rate. EPA must withdraw and reconsider the Final Rule to correct this material error.

The magnitude of this error results in part from EPA's assumption—made for the first time in the Final Rule—that electric vehicles would significantly penetrate the market under both the previous and Final Rule standards. Indeed, in the Proposal, EPA assumed that sales of battery electric vehicles ("BEV") reached 1% in MY 2032 (the last year of compliance modeled by the agencies in the Proposal) under the previous standards, and only 0.5% under the proposed, flatline standards.[51] As a result, the impacts associated with upstream electricity emissions in the Proposal were not substantial. However, in the Final Rule, EPA assumes that in 2032 BEV sales will be 4% and 6% under the final standards and previous standards respectively, rising to 37% under the previous standards and 26% under the final standards in 2050—many times what the agency projected under the Proposal.[52] This change substantially increased the impacts associated with upstream electricity generation in the Final Rule and the importance of EPA accurately assessing those impacts.

G. The Agencies Used the Wrong Emission Factors for Electricity Generation

The agencies made other errors in their analysis of upstream power plant emissions that further skewed the benefits of the Final Rule. In particular, when assessing the increased refining and crude oil production required to meet additional gasoline demand due to the rollback, the agencies performed an incremental analysis, meaning they considered the source of the *additional* gasoline that would be needed to meet the additional demand.[53] In that analysis, the agencies concluded that 95% of the additional oil and 50% of the additional refined gasoline would be imported from abroad.[54] Evaluating the incremental impacts on oil production and refining (as opposed to average impacts) made the net benefits of the rollback appear greater

[50] *Compare* 2018 PM2.5 Benefits Per Ton at 16 (setting forth 2020 benefits per ton values from Krewski *et al* for electricity generating units of $150,000 (PM2.5), $42,000 (SO2), and $6,200 (NOx)) *with id.* (setting forth 2020 benefits per ton values from Krewski *et al* for refineries of $360,000 (PM2.5), $77,000 (SO2) and $7,700 (NOx)).
[51] Technology_Utilization_Report.xlsx file for the CO2 standards published by the agencies with the Proposed Rule, column H, lines 95352-95355 and 286092-286094.
[52] 85 Fed. Reg. at 25,052.
[53] FRIA at 1268-1280.
[54] 85 Fed. Reg. at 24,729. Neither of these assumptions are well grounded.

because the agencies excluded the air pollution impacts from the oil production and refining that it concluded would occur overseas.

However, the agencies used an irreconcilably different approach to assess the impacts of the Final Rule on upstream electricity generation. The agencies concluded that, relative to the previous standards, the Final Rule would result in fewer electric vehicles and therefore fewer emissions from power plant generation needed to propel those vehicles. To quantify those emissions, the agencies used average electricity generation emission rates, i.e., the average emission rate of electricity generators—rather than the emission rate associated with the generators that would supply the difference in electricity demand between the previous standards and the rollback.[55] This approach— employed without explanation—is the opposite of the agencies' approach for oil production and refinery emissions, which assessed emissions associated with the oil production or refining that would be the source of the change in oil usage or refining resulting from the change in the standards. It also improperly increases the rollback's net benefits because incremental electricity demand would be met largely by renewables with low or no emissions, whereas average electricity emissions include a substantial portion of higher-polluting coal and natural gas sources.

This inconsistent approach to upstream refining and power sector emissions inflates the net benefits of the Final Rule. Petitioners corrected this error by performing an incremental analysis of power plant emissions using the U.S. Energy Information Administration Annual Energy Outlook ("AEO") 2019 projections for incremental electricity feedstocks and the Greenhouse gases, Regulated Emissions, and Energy use in Transportation ("GREET") model for projections of emissions factors for the individual electricity feedstocks, as well as the same EPA study that the agencies use for dollar-per-ton health damages for PM2.5 and its precursors from various pollutant sources.[56] Correcting this inconsistency reduces the net benefits of the final GHG standards by $3.7 billion at a 3 percent discount rate and $2.2 billion at a 7 percent rate. EPA must withdraw and reconsider the Final Rule to correct this material error.

The effect of correcting these two errors in the agencies' treatment of power plant emissions is larger than the agencies' projected PM-related emission damages for the Final Rule of $4.9 billion with a 3% discount rate and $2.7 billion with a 7% discount rate.[57] This is because these net values represent the difference between damages due to increases in upstream gasoline emissions of $7.8 billion (3%) and $4.7 billion (7%) and reductions in upstream emissions from power plants and tailpipe emissions of $10.8 billion (3%) and $6.4 billion (7%). Correcting the two errors in monetized power plant emissions reduces projected damages by $7.8 billion (3%) and $4.6 billion (7%), due to much lower SOx emissions from the mix of natural gas fired power plants and renewables projected to largely supply marginal changes in electricity demand in the AEO2019 projections relative to the emissions from coal fired power plants embedded in the agencies' use of average electricity generator emissions, which are unlikely to supply the incremental energy reflected in the Final Rule analysis.

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[55] FRIA at 1267-1269.

[56] *See* FRIA at 1281 (citing 2018 PM2.5 Benefits Per Ton as the source of the dollar-per-ton health damages for PM2.5 and its precursors).

[57] *See* 85 Fed. Reg. at 24,203-04 (Table II-21) and 24,207-08 (Table II-23). The agencies value emissions of PM2.5, including NOx and SOx as PM2.5 precursors. *See* 85 Fed. Reg. at 24,883-84.

H. The Agencies Used the Wrong Mass Reduction Coefficient

Mass reduction is a method for improving fuel economy and GHG emissions. In the Proposed Rule and Final Rule, the agencies include an analysis of the effects of mass reduction in the vehicle fleet on safety. In addition to other flaws in their methodology and statistical analysis, the agencies have miscalculated one of the mass-safety coefficients at the heart of this analysis. Correcting this error would reduce the net benefits of the GHG emissions standards in the Final Rule by $1.0 billion at a 3% discount rate and $0.6 billion at a 7% discount rate. In addition, it would reduce the number of projected fatalities avoided under the final GHG emissions standards by 62.

The agencies' mass reduction safety analysis is based on five coefficients that seek to represent the change in the fatality rate for each 100 pounds of mass reduction for each of five different vehicle types: cars less than 3,201 pounds; cars greater than 3,201 pounds; CUVs and minivans; truck-based LTVs less than 5,014 pounds; and truck-based LTVs greater than 5,014 pounds. In the agencies' analysis, mass reduction does not always lead to fatalities, because some coefficients are negative (e.g., 100 pounds of mass reduction in a truck-based LTV greater than 5,014 pounds will purportedly lead to a 0.61 percent decrease in fatalities for accidents involving such vehicles, according to the agencies' coefficients), while others are positive (e.g., 100 pounds of mass reduction in a car less 3,201 point will purportedly lead to a 1.20 percent increase in fatalities for accidents involving such cars).

Each of these five coefficients is critical because, under the agencies' analysis, mass reduction in a given type of vehicle translates to an increase or decrease in projected fatalities for accidents involving that type of vehicle, along with associated fatality and crash costs in the cost-benefit analysis.

Commenters noted that, among other issues,[58] the agencies did not provide any documentation for the derivation of the five coefficients used in their analysis, contrary to previous rulemakings.[59] The agencies still have not released these materials.[60] However, in the Final Rule, the agencies provide some limited information regarding two of the five coefficients. Based on that information, which was not publicly available until the Final Rule, it appears that at least one of the coefficients has been miscalculated—the coefficient for truck-based LTVs less than 5,014 pounds should be 0.13 rather than 0.31.

The agencies state in the Final Rule that coefficients for the mass reduction safety analysis were derived by summing the products of the change in fatality risk from 100 pounds of mass

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[58] *See, e.g.*, California Air Resources Board ("CARB") Comments, Docket #NHTSA-2018-0067-11873 ("CARB Comments"), at 266-70 (objecting to the agencies' mass reduction safety analysis due to the lack of statistical significance of the agencies' mass reduction coefficients, as acknowledged by the agencies).

[59] *See, e.g.*, FOIA request from CARB to EPA and NHTSA, September 11, 2018, Docket #NHTSA-2018-0067-4166, at 5.

[60] The California Air Resources Board initiated a lawsuit in the District Court for the District of Columbia seeking the documentation underlying the agencies' mass reduction coefficients. CARB v. EPA et al., No. 1:19-cv-00965-CKK. NHTSA is withholding its reports containing that documentation under the auspices that the reports are still drafts and have not been finalized or adopted by the agency.

reduction for each crash type by the share of fatalities caused by that crash type. 85 Fed. Reg. at 24,746. For the first time in the Final Rule, the agencies provided the data for each crash type required to calculate the coefficient for truck-based LTVs less than 5,014 pounds. *Id*. at 24,747-48 (Table VI-202). Performing that calculation according to the agencies' methodology, using the data provided by the agencies, yields a coefficient for truck-based LTVs less than 5,014 pounds of 0.1321, not 0.31 as the agencies claim. The agencies' erroneous use of 0.31 is therefore either the result of a typo—transposing the "1" and "3"—or a simple arithmetic error. Either way, it is manifestly incorrect.

Using the correct coefficient for truck-based LTVs less than 5,014 pounds would reduce the net benefits of the GHG emissions standards in the Final Rule by $1.0 billion at a 3% discount rate and $0.6 billion at a 7% discount rate. It would also reduce the avoided accident-related fatalities that the agencies project under the final GHG emissions standards by 62. EPA must withdraw and reconsider the Final Rule to correct this substantive error.

The existence of a plain error in one of the agencies' mass reduction safety analysis coefficients also highlights the need for the agencies to provide the documentation and data behind these calculations. In the Final Rule, the agencies included limited data for two of the five mass reduction safety analysis coefficients, and only then to purportedly respond to comments criticizing the agencies' classification of vehicles in that analysis. *See* 85 Fed. Reg. 24,746-49. But unlike in past rulemakings, the public has had no opportunity to verify the agencies' computation of the other three coefficients, much less the methodologies and data sources used in the mass reduction safety analysis underlying all five of the coefficients. Especially considering that the limited data provided for two coefficients shows one is clearly wrong, the agencies must disclose the rest of this information.

I. The Agencies Used the Wrong VMT Estimates in the Sales and Scrappage Models

EPA must grant reconsideration to reassess the Final Rule in light of a new error in the modeling of new vehicle sales and the "scrappage" of used vehicles due to the rollback. The sales and scrappage models in the Final Rule discount new vehicle prices by the fuel savings generated in the first 2.5 years of ownership. In estimating the value of that 2.5 years of fuel savings, the agencies simplistically assume that each vehicle will accrue 35,000 miles of use during that time, instead of using the vehicle miles traveled ("VMT") estimates the agencies generated and used in all other elements of the analysis in the Final Rule. If the agencies had used their own VMT estimates,[61] the VMT projected for the first 2.5 years of ownership in the sales and scrappage models would have been much greater—thereby increasing the 2.5-year fuel savings, further offsetting any new vehicle price increases, and ultimately decreasing the sales and scrappage effects estimated in the Final Rule. Fixing this error would decrease the net benefits of the GHG emissions standards in the Final Rule by $2.2-6.2 billion at the 3% discount rate and by $1.2-3.6 billion at the 7% discount rate.

[61] This petition does not concede the correctness of the agencies' VMT estimates, nor the validity of the agencies' sales and scrappage models.

The Final Rule uses sales and scrappage models to estimate the change in new vehicle sales and the "scrappage" of used vehicles resulting from changes in vehicle prices projected to flow from weakening the previous standards. In both the sales and scrappage models, the agencies discount the vehicle price change by the value of 2.5 years of fuel savings, which is the amount of fuel savings that the agencies assume consumers value at the time of purchase.[62] The agencies did not so reduce new vehicle prices in the Proposed Rule.

As discussed below, the agencies' assumption that consumers value only 2.5 years' worth of fuel savings at the time of purchase is unfounded. However, even assuming that valuation, the agencies err in how they quantify those 2.5 years' worth of fuel savings. The agencies conclude that the "equivalent to 2.5 years of vehicle usage" is 35,000 miles of driving,[63] explaining only that, "[b]ased on odometer data, 35,000 miles is a good representation of typical new vehicle usage in the first 2.5 years of ownership and use—though the distribution of usage is large."[64]

However, elsewhere in the Final Rule, the agencies develop detailed estimates of VMT by vehicle type (car, SUV, and pickup truck) and age.[65] The agencies also use these detailed VMT estimates in other parts of the Final Rule analysis, including the assumption in vehicle compliance modeling that automakers will voluntarily apply any technology that pays for itself within the first 2.5 years of ownership.[66] There is no justification for the agencies' failure to use those same VMT estimates in the sales and scrappage models. Nor did the agencies attempt to explain this failure. If the agencies had been consistent and used the same VMT estimates used in every other phase of analysis, VMT would have been higher in those first 2.5 years. For example, the average VMT for the first 2.5 years in the CAFE model is 38,552 for cars, 39,543 for vans and SUVs, and 45,243 for pickup trucks.[67]

The higher VMT produces lower new vehicle net price differences and thus lessens the sales and scrappage effects projected in the Final Rule. Petitioners ran the sales and scrappage models using the agencies' VMT estimates, rather than 35,000 miles. The agencies' average VMT estimates depend on the mix of cars, SUVs/vans, and pickup trucks, and that mix changes by

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[62] *See, e.g.*, 85 Fed. Reg. at 24,617 (noting with respect to the sales model, "the price to which the unit elasticity is applied in this analysis represents the residual price change *between scenarios* after accounting for 2.5 years' worth of fuel savings to the new vehicle buyer") (emphasis original); *id*. at 24,633 ("the agencies have adjusted the new vehicle price series in both [the sales and scrappage] models by the amount of fuel savings consumers are assumed to value at the time of purchase (30 months of fuel savings)").

[63] 85 Fed. Reg. at 24,617.

[64] *Id*. n.1643.

[65] *See* 85 Fed. Reg. at 24,677-98.

[66] The compliance modeling of the 2.5-year payback assumption utilizes the "CalcFuelSavings" function, which considers all of the relevant information ("[t]he cost-per-mile of the reference or baseline case[; t]he cost-per-mile of the alternative case[; t]he period, specified in years, over which to accumulate the vehicle miles traveled[; and t]he style of the vehicles for which to compute the fuel savings[, to return] the undiscounted fuel savings, based on the vehicle miles traveled over the specified period" [Effects.cs ln 79-84]). In contrast, the sales and scrappage models utilize the "CalcAssumedFuelSavings" function, which "Calculates the *estimated* fuel savings in the specified calendar year, resulting from the specified reference and alternative on-road fuel economy and fuel share values, and based on the *assumed* number of miles during which an added investment in fuel improving technology is expected to pay back" [Effects.cs ln 39-56] (emphasis added).

[67] These values represent expected values for each class based on the mileage schedule and survival table found in the CAFE Model parameters file. For partial years, vehicle mileage was assumed to accrue evenly over the course of the year, while survival was assumed to be a constant rate throughout the year, for a given age.

year and by scenario. As a result, Petitioners ran the model with car VMT to represent a lower bound and with truck VMT to represent an upper bound; the correct average fleet VMT using the agencies' estimates would be somewhere in between.[68] Using the agencies' estimates of car VMT decreased the net benefits of the Final Rule by $2.2 billion at the 3% discount rate and $1.2 billion at the 7% discount rate. It also reduced the avoided accident-related fatalities that the agencies project under the final GHG standards by 60. Using the agencies' estimates of truck VMT decreased the net benefits of the Final Rule by $6.2 billion at the 3% discount rate and $3.6 billion at the 7% discount rate. It also reduced the avoided accident-related fatalities that the agencies project under the final GHG standards by 175.

The agencies' failure to use their own estimates of VMT by vehicle type (car, SUV, and pickup truck) and age when projecting sales and scrappage impacts is a clear error in the Final Rule that skews the analytical results in favor of weaker fuel economy and GHG standards. This error is central to the analysis in the Final Rule, as it undermines both the cost-benefit analysis and the agencies' arguments regarding the impact of the weaker fuel economy and GHG standards on fleet turnover (i.e., new vehicle sales and used vehicle scrappage). EPA must withdraw and reconsider the Final Rule, correcting the analysis to use the Final Rule's VMT estimates for the amount of VMT driven in the first 2.5 years, rather than arbitrarily assuming that amount to be 35,000 miles contrary to the remainder of the agencies' own analysis.

J. The Agencies Made a Computational Error in Calculating Changes in Insurance, Financing, Taxes and Fees

As a part of their analysis of the impacts of the standards on consumers, the agencies project changes in consumer costs for insurance, financing, and taxes/fees (IFT) that will result from projected costs of compliance.[69] Specifically, because the agencies assume the automakers' cost of compliance will cause a corresponding change in vehicle purchase prices, the agencies also calculate resultant increases in "taxes and registration fees" because those costs "are calculated as a percentage of vehicle price."[70] And since "[i]ncreasing the price of new vehicles also affects the average amount paid on interest for financed vehicles and the insurance premiums for similar reasons," the agencies calculate the impact that the costs of compliance will have on financing and insurance costs, too.[71]

To project these IFT cost changes, the agencies first calculate IFT costs for each car and each truck in the rollback and previous standards fleets using algorithms and methodologies presented in the CAFE model documentation.[72] Then the agencies use those per-car and per-truck IFT cost changes to project "aggregated" (or average) fleet-wide IFT costs for passenger cars, trucks, and the combined fleet in the rollback and previous standards scenarios. Finally, the agencies

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[68] While it would be difficult for us to reprogram the sales and scrappage models to calculate the VMT average based on fleet mix, which changes by year and scenario, we note that the agency did just this in the compliance modeling for the 2.5-year payback assumption in using the "CalcFuelSavings" function instead of the "CalcAssumedFuelSavings" function used in the sales and scrappage models.

[69] *See* 85 Fed. Reg. at 24,706; *see also id*. at 24,991-98 (Tables VII-80 through VII-87); FRIA at 1541-57 (Tables VII-248 through VII-271).

[70] 85 Fed. Reg. at 24,706.

[71] *Id*.

[72] Final Rule CAFE Model Documentation at 154-58.

calculate the difference between these fleet-specific average IFT costs and present that difference as the purported change in average IFT costs projected to result from the compliance costs incurred as a result of the final standards. In effect, the agencies' mathematical approach is[73]:

$$(Average\ Rollback\ IFT\ Costs) - (Average\ Augural\ IFT\ Costs) = IFT\ Cost\ Impact\ of\ Final\ Rule$$

This approach is fundamentally flawed. Specifically, the agencies have failed to properly account for changes in the makeup of the fleets under the previous standards and the rollback in their methodology. More precisely, the agencies ignore their own projections that both total vehicle sales and the distribution of those sales between passenger cars and light-duty trucks will be different in the previous standards and rollback scenarios. In other words, there is not a one-to-one relationship between vehicles purchased in the two scenarios, and the effect of this differential fleet makeup is not captured in a simple subtraction of the average costs for one fleet (apples) from the average costs for another (oranges).

The most obvious evidence that the agencies made an error in their calculations is that the agencies' values yield fleet-wide percentage-increases in total per-vehicle average IFT costs relative to fleet-wide per-vehicle average technology costs (that is, relative to vehicle price increases) that are greater than the percentage-increases for the truck and passenger categories considered individually. Specifically, the agencies' projected insurance cost increases for passenger cars and trucks separately each equal 11 percent of projected technology cost increases, yet the agencies' projected fleet-wide average insurance costs increase by 14 percent of fleetwide average technology costs. Similarly, the agencies' projections for finance costs equal about 8 percent of technology costs for passenger cars and trucks individually, but the fleet-wide average equals 11 percent of technology costs. And tax costs equal about 5 percent of technology costs for cars and trucks, but the fleetwide average equals 7 percent of technology costs. If these values had been correctly calculated, the ratio between each category of IFT costs and technology costs would have been identical for all of the passenger car, truck, and fleet-wide calculations.[74] These discrepancies thus demonstrate that the agencies committed an obvious mathematical error.

The error is this: instead of comparing average *total* costs in each scenario, the agencies should have compared the per-vehicle cost *changes* that occur in each scenario when the fleet moves from baseline vehicle prices (assuming zero cost of compliance) to projected vehicle prices (incorporating the agencies' projected costs of compliance) in each scenario. In other words, they should compare the per-vehicle *change* in IFT costs for the rollback standards to the per-vehicle *change* in IFT costs for the previous standards. This method properly accounts for the agencies' projected sales, fleet mix, and compliance costs changes in calculating the IFT cost impacts. Instead of the equation above, the agencies mathematical approach should be:

[73] The agencies do not describe this methodology in any of the rulemaking documents. Nevertheless, the only way we were able to replicate the agencies' figures was to use the methodology described here.

[74] The percentages cited are for a 3% discount rate. The values for a 7% discount rate vary marginally, but show the same discrepancy between car- and truck-specific and fleetwide ratios.

$$(Average\ Rollback\ IFT\ Cost\ Change) - (Average\ Augural\ IFT\ Cost\ Change) = IFT\ Cost\ Impact\ of\ Final\ Rule$$

For example, the average (per-vehicle) insurance costs estimated for the previous standards fleet are $3,788.[75] The average insurance costs for that same fleet at baseline vehicle prices (*i.e.*, assuming the cost of compliance is zero) are $3,522. Thus, the previous standards add $266 ($3,788 - $3,522) to the average consumer's insurance costs.

The average (per-vehicle) insurance costs estimated for the final rule standard fleet are $3,656. The average insurance costs for that same fleet at baseline vehicle prices (i.e., assuming the cost of compliance is zero) are $3,494. Thus, the final rule standards add $162 ($3,656 - $3,494) to the average consumer's insurance costs.

Thus, accepting the agencies' underlying insurance cost estimates, the Final Rule results in a net change in the average consumer's insurance cost of -$104 ($162 - $266)—that is, the average consumer will save $104.

In contrast, as described above, the agencies calculate the savings using only *total* costs and thus fail to recognize the changing sales and class mix in the fleet. Specifically, they calculate the difference between the total IFT costs in the final rule scenario ($3,656, per above) and the total IFT costs in the previous standards scenario ($3,788, per above), and calculate a purported net change of -$132 ($3,656 - $3,788)—that is, they show that the average consumer will save $132.[76] This miscalculation causes the agencies to overstate the impact of relaxing the standards on insurance costs by $28 or 28%.[77]

Moreover, the agencies' methodology for calculating IFT impacts diverges from their methodology used to calculate per-vehicle price impacts, even though the two calculations should be methodologically identical. There, the agencies *do* include the effects of fleet size and mix changes in calculating the increase in average per-vehicle price impacts from the Final Rule. Specifically, using the agencies' projections of compliance costs, the average price for a MY 2030 vehicle in the previous standards fleet is $35,690. The average baseline price for that same fleet (*i.e.*, assuming the cost of compliance is zero) is $33,185. Thus, the change in the average consumer's purchase price in the previous standards scenario is $2,505 ($35,690 - $33,185). Likewise, the average price for a vehicle in the final rule standard fleet is $34,440 and the average baseline price for that same fleet is $32,913. Thus, the change in average consumer's

[75] All example calculations are based on cost projections from the CAFE Model Central Analysis CO_2 runs, and are for model year 2030 and a 3% discount rate. The values for the CAFE standard-setting runs and for other model years and a 7% discount rate are different, but the underlying errors in the agencies' methodology are the same. Also, while the errors in the insurance cost calculation is discussed in detail here, the same errors exist in the agencies' calculations of tax and finance costs.

[76] The agencies actually calculate a value of $133 (*See* 85 Fed. Reg. at 24,995 (Table VII-84); FRIA at 1545 (Table VII-257)). The difference from $132 is due to round-off. For convenience, the example values presented herein are rounded to the nearest dollar. However, the more precise values are $3,788.35 ($3,788 in whole dollars) and $3,655.65 ($3,656 in whole dollars), so that the agencies calculate a difference of $3,655.65 minus $3,788.35 equals -$132.70 (or a savings of $133 in whole dollars). In the absence of the round-off error, the savings illustrated by the example calculation and the savings assigned to the Final Rule standards by the agencies are identical.

[77] ($132/$104) – 1 = 26.9%, or more precisely ($132.69/$103.74) – 1 = 27.9%.

purchase price in the final rule scenario is $1,527 ($34,440 - $32,913). Therefore, the Final Rule causes a net change in the average purchase price of -$978 ($1,527 - $2,505) relative to the previous standards. And, indeed, this is the value the agencies report as the impact of the Final Rule on vehicle prices.[78] The agencies thus used the correct methodology to calculate the vehicle price impacts but switched to an incorrect methodology to calculate IFT cost impacts. This discrepancy further demonstrates that their failure to consider their projections of sales and fleet mix impacts in projecting IFT costs is a clear error.

The agencies' failure to properly and consistently account for the changes in sales and fleet mix in their calculations significantly impacts the agencies' projections of fleet-wide IFT cost changes and total consumer impacts. The first table below shows both: (1) EPA's projections of MY 2030 IFT cost impacts as reported in the Final Rule for the GHG standards; and (2) the MY 2030 IFT cost impacts that EPA would have reported for the GHG standards had the agency properly accounted for the fleet changes inherent in each scenario.[79] And the second table presents the impact of correcting this error on EPA's projections of total consumer costs and benefits. As shown in these tables, correcting the IFT calculations—without fixing any other errors in the agencies' analysis—demonstrates that the agency's error inflated average fleet-wide IFT costs in MY 2030 under the previous standards as compared to the final GHG standards by between $60 and $67 per vehicle—meaning that EPA over-estimated average fleet-wide IFT costs of the Final Rule GHG standards by 28% and overestimated total consumer impacts by more than 5%.

These errors are material to EPA's analysis. EPA emphasizes that the impact of the Final Rule on consumer costs is a central justification for rolling back the previous standards. But EPA's consumer cost calculations are irrefutably and materially incorrect, as described above. EPA must withdraw and reconsider the Final Rule, correcting its projections of IFT cost impacts on consumers.

[78] *See* 85 Fed. Reg. at 24,181 (Table I-6). As with the example insurance calculation, the one dollar difference in the agencies' value (-$977) versus the example calculation (-$978) is due to round off. The precise values are $1527.37 minus $2504.76 equals -$977.39, or -$977. In the absence of round-off error, the example calculation is identical to the agencies' calculation.

[79] The tables present results of the correct calculations to project IFT impacts in MY 2030 from rolling back the previous standards to the Final Rule standards. However, the agencies' error in calculating IFT cost impacts is present in the agencies' IFT projections for every model year and every alternative set of standards in the agencies' analysis.

Model Year 2030 Finance, Insurance, and Tax Impact Estimates (GHG)[80]

Impact Parameter	Passenger Car		Light Truck		Average Vehicle	
	FRIA Impact Estimate	Correct Impact Estimate	FRIA Impact Estimate	Correct Impact Estimate	FRIA Impact Estimate	Correct Impact Estimate
3 Percent Discount Rate						
Increase in Financing Cost	-72	-71	-93	-91	-104	-81
Increase in Insurance Cost	-92	-91	-119	-117	-133	-104
Increase in Taxes/Fees	-47	-47	-61	-60	-68	-53
Total	-211	-209	-273	-268	-305	-238
Amount Final Rule Overstates IFT Costs	2		5		67	
Amount Final Rule Overstates IFT Costs (%)	1.0%		1.9%		28%	
7 Percent Discount Rate						
Increase in Financing Cost	-66	-65	-86	-84	-95	-75
Increase in Insurance Cost	-78	-77	-101	-99	-113	-88
Increase in Taxes/Fees	-47	-47	-61	-60	-68	-53
Total	-191	-189	-248	-243	-276	-216
Amount Final Rule Overstates IFT Costs	2		5		60	
Amount Final Rule Overstates IFT Costs (%)	1.1%		2.1%		28%	

Model Year 2030 Consumer Cost Impact Estimates (GHG)

Impact Parameter	Passenger Car		Light Truck		Average Vehicle	
	FRIA Impact Estimate	Correct Impact Estimate	FRIA Impact Estimate	Correct Impact Estimate	FRIA Impact Estimate	Correct Impact Estimate
3 Percent Discount Rate						
Vehicle Price Increase	-856	-856	-1098	-1098	-977	-977
Implicit Opportunity Cost	0	0	0	0	0	0
Increase in Financing Cost	-72	-71	-93	-91	-104	-81
Increase in Insurance Cost	-92	-91	-119	-117	-133	-104
Increase in Taxes/Fees	-47	-47	-61	-60	-68	-53
Lost Consumer Surplus	-4	-4	-4	-4	-4	-4
Total	-1071	-1069	-1375	-1370	-1286	-1219
Amount Final Rule Overstates Consumer Costs	2		5		67	
Amount Final Rule Overstates Consumer Costs (%)	0.2%		0.4%		5.5%	
7 Percent Discount Rate						
Vehicle Price Increase	-856	-856	-1098	-1098	-977	-977
Implicit Opportunity Cost	0	0	0	0	0	0

[80] In the tables, the "FRIA Impact Estimates" are for the agencies' CO_2 central analysis scenario. *See* FRIA at 1541-1557 (MY 2030 column in Tables VII-249, VII-251, VII-261, and VII-263 for passenger cars, Tables VII-253, VII-255, VII-265, and VII-267 for light trucks, and Tables VII-257, VII-259, VII-269, and VII-271 for the fleetwide average). As shown in the tables in this petition, the agencies' error has smaller impacts on individual passenger car and truck fleet values than on combined fleet values. This is because the average price of a car or truck is not impacted by the change in fleet mix. That is, the number of trucks in the fleet does not directly impact the average price of those trucks. But the number of trucks in the fleet does impact the average price of trucks and cars considered together.

Increase in Financing Cost	-66	-65	-86	-84	-95	-75
Increase in Insurance Cost	-78	-77	-101	-99	-113	-88
Increase in Taxes/Fees	-47	-47	-61	-60	-68	-53
Lost Consumer Surplus	-4	-4	-4	-4	-4	-4
Total	-1051	-1049	-1350	-1345	-1257	-1197
Amount Final Rule Overstates Consumer Costs	2		5		60	
Amount Final Rule Overstates Consumer Costs (%)	0.2%		0.4%		5.0%	

K. The Agencies' New "Implicit Opportunity Cost" Assessment is Baseless, as is Their Focus on "Upfront Costs"

In their cost-benefit analysis, the agencies correctly concede that private market failures exist, *see* 85 Fed. Reg. 24,612-13, and count consumers' full lost fuel savings, *see*, *e.g.*, 85 Fed. Reg. 24,201-8. However, as the Final Rule erases the significant consumer benefits of the previous fuel economy and GHG emissions standards, the agencies attempt to distract from that fatal problem by suggesting reasons they could, in theory, ignore these lost consumer benefits. The agencies repeatedly deny the existence of relevant market failures,[81] speculate about unproven opportunity costs from supposedly lost or foregone vehicle features,[82] and selectively emphasize "upfront costs" over consumers' long-term fuel savings as justification for the rule.[83] At every step, that postulated line of thinking is wrong.[84] As evident from public comments,[85] academic literature submitted into the record,[86] the agencies' prior analyses,[87] other portions of

[81] *See e.g.,* 85 Fed. Reg. at 24,608, 24,610-13, 24,701; *see also* FRIA at 116, 1011.
[82] 85 Fed. Reg. at 24,177 n.10, 24,612, 24,701-02; *see also* FRIA at 116, 1011.
[83] 85 Fed. Reg. at 24,214, 24,604, 24,612, 25,109, 25,110-11, 25,120, 25,141, 25,171.
[84] The following summary of the flaws is drawn from *Shortchanged: How the Trump Administration's Rollback of the Clean Car Standards Deprives Consumers of Fuel Savings* (Institute for Policy Integrity Report, 2020) ("*Shortchanged*"), *available at* https://policyintegrity.org/files/publications/Clean_Car_Standards_Rollback_and_Fuel_Savings_Report.pdf, which we attach and incorporate into this petition.
[85] In addition to the various public comments cited below as well as in the attached *Shortchanged* report, *see also* Supplemental Comments from the Institute for Policy Integrity (Dec. 21, 2018), Docket #NHTSA-2018-0067-12362; Response Comments from the Institute for Policy Integrity (May 31, 2019), Docket #NHTSA-2018-0067-12407.
[86] In addition to the various literature cited below as well as in the attached *Shortchanged* report, *see also generally* Nat'l Res. Council, *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles*, at 312, 314, 317, 319, 360 (2015), http://nap.edu/21744.
[87] In addition to the Midterm Evaluation—including EPA, NHTSA & CARB, *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), at 12-74, 13-102—*see also* Sections V.B-V.E of the attached *Shortchanged* report, which reviews how EPA, NHTSA, the Department of Energy, and other agencies have consistently valued the full benefits of energy savings, and taken private market failures seriously, through over 40 years of regulation across administrations of both political parties.

the agencies' analysis in the SAFE Rule itself,[88] and other sources,[89] the agencies' central cost-benefit analysis was correct to value the full amount of lost fuel savings, and any suggestion to the contrary in the Final Rule is inappropriate.

First, the agencies' novel hypothesis as an explanation for the energy efficiency gap—that it might largely reflect a hypothetical tradeoff with other vehicle features, like horsepower or acceleration, that consumers supposedly value more than energy savings—assumes away the existence of the market failures that cause consumers to miss out on fuel savings.[90] But the economics research is clear that market failures—including information costs, myopia, loss aversion, and supply-side failures like technology spillover effects and market power, among others—play a substantial role in consumers' failure to purchase vehicles with optimal levels of fuel economy.[91] The agencies' speculation that it could be rational for consumers to selectively

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[88] In addition to the sections of the FRIA cited below as well as in the attached *Shortchanged* report, *see also, e.g.*, EPA & NHTSA, Preliminary Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule, Docket #EPA-HQ-OAR-2018-0283-3041 (July 2018, updated August 23, 2018 and October 16, 2018) ("PRIA"), at 943 (explaining that parts of the model that overestimate compliance costs would at least partly if not completely offset any possible underestimated opportunity costs); *id.* at 1091, 1097 (explaining that any possible attribute tradeoffs that manufacturers might make "cannot be estimated").

[89] *See e.g.*, EPA Science Advisory Board, Consideration of the Scientific and Technical Basis for the EPA's Proposed Rule Titled *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks* (Feb. 27, 2020) ("SAB Final Report"), at 21, https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebReportsLastMonthBOARD/1FACEE5C03725F268525851F006319BB/$File/EPA-SAB-20-003+.pdf. *See also Shortchanged* at Section V.A. (detailing how OMB's *Circular A-4*, EPA's *Guidelines for Preparing Economic Analysis*, and DOT's *Benefit-Cost Analysis Guidance for Discretionary Grant Programs* all make clear that fully valuing energy savings is the best practice for cost-benefit analysis).

[90] *See Shortchanged* at Sections II & IV.

[91] *See* TAR at 6-5 to 6-9; NHTSA, CAFE Model Peer Review (revised July 2019), at 211, B-34, Docket #NHTSA-2018-0067-0055; SAB Final Report at 20-21; Nat'l Res. Council (2015) at 312, 314, 317, 319, 360; David Greene, Anushah Hossain, Julia Hofmann, Gloria Helfand & Robert Beach, *Consumer Willingness to Pay for Vehicle Attributes: What Do We Know?*, 118 TRANSP. RES. PART A: POL'Y & PRAC. 258 (2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6260949/; Gloria Helfand & Ann Wolverton, *Evaluating the Consumer Response to Fuel Economy: A Review of Literature*, 5 INT'L REV. ENVTL. & RES. ECON. 103, 124-40 (2011), https://www.nowpublishers.com/article/Details/IRERE-0040; Todd D. Gerarden et al., *Assessing the Energy-Efficiency Gap*, 55 J. ECON. LITERATURE. 1486, 1487-90, 1503 (2017); James Sallee, *Rational Inattention and Energy Efficiency*, 57 J. LAW & ECON. 781, 782-85 (2014); Gloria Helfand & Reid Dorsey-Palmateer, *The Energy Efficiency Gap in EPA's Benefit-Cost Analysis of Vehicle Greenhouse Gas Regulations: A Case Study*, 6 J. BENEFIT COST ANALYSIS 432, 438 (2015); David L. Greene, *Consumers' Willingness to Pay for Fuel Economy and Implications for Sales of New Vehicles and Scrappage of Used Vehicles*, Environmental Defense Fund 5 (Oct. 21, 2018), https://www.edf.org/sites/default/files/CARB_Report_Greene_UTenn_Consumer_Behavior_Modeling.pdf; Carolyn Fischer, *Imperfect Competition, Consumer Behavior, and the Provision of Fuel Efficiency in Light-Duty Vehicles* (Resources for the Future, Discussion Paper DP 10-60, 2010), https://www.rff.org/documents/1472/RFF-DP-10-60.pdf; Kenneth Gillingham, Sebastian Houde, & Arthur van Bentham, *Consumer Myopia in Vehicle Purchases: Evidence from a Natural Experiment* (Nat'l Bureau of Econ. Research, Working Paper No. 25845, 2019), https://www.nber.org/papers/w25845, *available at* https://environment.yale.edu/gillingham/GillinghamHoudevanBenthem_ConsumerMyopia.pdf (finding significant empirical evidence of consumer myopia); Antonio Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards* (Nat'l Bureau of Econ. Research, Working Paper No. 26309, 2019), https://www.nber.org/chapters/c14288; Sebastian Houde & C. Anna Spurlock, *Minimum Energy Efficiency Standards for Appliances: Old and New Economic Rationales*, 5 ECON. ENERGY & ENVTL. POLICY 65 (2016); Sébastien Houde & Erica Myers, *Heterogeneous (Mis-) Perceptions of Energy Costs: Implications for Measurement*

discount fuel savings at an astronomically high rate[92] is unsupported and contradicted by these well-documented effects.[93] This rollback will cause consumers to lose out on valuable fuel efficiency improvements that they would have benefited from but may not have purchased on their own due to these well-documented factors.

Second, the agencies have not justified their speculation that requiring fuel economy improvements could necessarily lead manufacturers to reduce existing or future vehicle features to the detriment of consumers.[94] The wide availability of vehicle financing means that the cost of fuel economy improvements can be "paid for" out of the savings consumers save at the pump, and therefore consumers can save money from fuel economy improvements from the moment they purchase a vehicle.[95] Thus, consumers wishing to purchase any additional features such as performance are not adversely affected financially as a result of the standards. If consumers are not willing to access affordable financing to purchase fuel economy technologies that will pay for themselves, or if manufacturers do not offer vehicles that combine fuel economy with other features that consumers are willing to pay for, that would represent additional market failures, and the solution would be efficient regulation. Furthermore, recent research suggests—and the agencies also admit—that many fuel economy improvements may result in technology development that will also either automatically or cheaply provide other features that consumers value.[96] As such, there is no inherent tradeoff between so-called "upfront costs" and longer-term fuel savings.

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and Policy Design 2-3 (Nat'l Bureau of Econ. Research, Working Paper No. 25722, 2019), http://www.nber.org/papers/w25722; Hunt Allcott, *Paternalism and Energy Efficiency: An Overview*, 8 ANN. REV. ECON. 145 (2016); Benjamin Leard, Joshua Linn & Yichen Zhou, *How Much Do Consumers Value Fuel Economy and Performance? Evidence from Technology Adoption* (Res. for Future Report, June 2017), https://media.rff.org/documents/RFF-Rpt-WTP_FuelEconomy26Performance.pdf; Antonio M. Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards*, in Environmental and Energy Policy and the Economy, vol. 1 (Matthew J. Kotchen et al., eds., 2020); D. Neil, *Toyota RAV4 Hybrid: Great Performance, Even Better Fuel Economy*, Wall St. J., Apr. 19, 2019; D. Duncan et al., *Most Consumers Don't Buy Hybrids: Is Rational Choice a Sufficient Explanation?* 10 J. BENEFIT-COST ANALYSIS 1 (2019); Comments from the Institute for Policy Integrity (Oct. 26, 2018) ("Policy Integrity Comments"), at 38-40, Docket #NHTSA-2018-0067-12213 and #EPA-HQ-OAR-2018-0283-5083.

[92] 85 Fed. Reg. at 24,605.

[93] *See Shortchanged* at Section IV, criticizing the agencies' "bald assertion that it is, perhaps, not irrational for consumers to discount future fuel savings at a rate as high as 24%—a rate eight times higher than the 3% discount rate usually applied to assess how private consumers trade off their consumption over time," and explaining that applying a discount rate as high as 24% specifically to future fuel savings would be further inconsistent with the 4.25% average interest rate that consumers are willing to accept on their future loan payments.

[94] *See Shortchanged* at Sections II-III.

[95] *See* Comments from University of California, Berkeley's Environmental Law Clinic (Sept. 5, 2018), at 16-17, Docket # EPA-HQ-OAR-2018-0283-0879; Memorandum from Hsing-Hsiang Huang & Gloria Helfand to EPA, Lending Institutions That Provide Discounts for More Fuel-Efficient Vehicles (Nov. 2016), *available at* https://www.regulations.gov/document?D=EPA-HQ-OAR-2015-0827-5832.

[96] FRIA at 239, 317, 320, 322-27, 329; TAR at 4-35 to 4-36; *id.* at 4-32 to 4-34 (on the role of regulation-induced innovation); EPA, *Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation* (2016) ("Proposed Determination"), at 26, A-49, A-55, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3DO.pdf; EPA, *Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Standards under the Midterm Evaluation: Technical Support Document* (2016) ("TSD"), at 2-247 to 2-249, 4-6 to 4-7, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf (explaining that even if there were historical evidence

Third, the agencies' suggestion that "meeting the more demanding baseline standards may have required manufacturers to make significant sacrifices in other attributes, rather than simply holding those other features at or near their current levels"[97] is plainly inconsistent with the agencies' evaluation of the cost of complying with the standards.[98] The agencies analyze the costs of the vehicle standards by comparing the price of vehicles under the previous standards against the cost of identical vehicles without the fuel economy or emission improvements.[99] The cost estimates assume that key vehicle features other than fuel economy will be unaffected by the standards.[100] The agencies cannot both rely on a cost analysis that assumes the vehicle fleet will be identical except for the change in fuel economy, while at the same time theorizing that the vehicle fleet will be different and that the difference will cause consumers to experience a welfare loss. If the agencies want to assume that manufacturers will trade off other vehicle features to achieve fuel economy and GHG improvements, then the agencies would have to significantly lower their estimates of compliance costs for the previous standards to reflect the fewer features in the vehicles, as well as model how much manufacturers would charge to install those other vehicle features and how much consumer benefit those features would provide—all of which would ultimately show that their rollback will not achieve the cost savings the agencies attribute to it.[101]

Fourth, the literature that the agencies cite to support their particular theory of opportunity costs is sparse[102] and does not provide sufficient justification for departing from past regulatory

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of a tradeoff, it is much less likely for advanced technology engines, and also that there may be technical limits and decreasing returns to consumers of continuing to increase features like acceleration); *see also* Comments by the ICCT (Oct. 25, 2018) at II-11 to II-16, Docket #NHTSA-2018-0067-11741 and #EPA-HQ-OAR-2018-0283-5456. On the importance of learning by doing and knowledge spillovers, *see also* Antonio M. Bento, Kenneth Gillingham, Mark. R. Jacobsen, Christopher R. Knittel, Benjamin Leard, Joshua Linn, Virginia McConnell, David Rapson, James M. Sallee, Arthur A. van Benthem, & Kate S. Whitefoot, *Flawed Analysis of U.S. Auto Fuel Economy Standards*, 362 Sci. 1119, 1119 (2018), https://doi.org/10.1126/science.aav1458; Erik Hille & Patrick Möbius, *Environmental Policy, Innovation, and Productivity Growth: Controlling the Effects of Regulation and Endogeneity*, 73 ENVTL. & RES. ECON. 1315, 1316, 1328 (2019).

[97] 85 Fed. Reg. at 24,706.

[98] *See Shortchanged* at Sections III.B. & VI.A.

[99] FRIA at 303, 318-327; *id.* at 317 (explaining that the model's assumption "eliminates the need to assess" any possible opportunity costs); *id.* at 316 (explaining that any attribute changes not already accounted for by the model would be "de minimis," and that unaccounted for *improvements* are as likely as degradations).

[100] In fact, the agencies admit that it is "unavoidable" and "expected" that their model's assumption about holding attributes constant will actually lead to performance *improvements* in other vehicle attributes. FRIA at 317, 319-20, 324; *see also id.* at 323 (citing comments that explain how the agencies' model overcorrects and therefore includes performance improvements that the agencies do not value). *See generally Shortchanged* at Section VI.A.

[101] David Cooke, Union of Concerned Scientists, *The Trade-Off Between Fuel Economy and Performance: Implications for the Mid-Term Evaluation of the National Program* (2016); Kate S. Whitefoot, Meredith L. Fowlie & Steven J. Skerlos, *Compliance by Design: Influence of Acceleration Trade-Offs on CO_2 Emissions and Costs of Fuel Economy and Greenhouse Gas Regulations*, 51 Envtl. Sci. & Tech. 10,307, 10,312-13 (2018), *available at* https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11903&attachmentNumber=1&contentType=pdf; Helfand & Dorsey-Palmateer (2015) at 450; Bento et al., *Flawed Analysis of U.S. Auto Fuel Economy Standards,* at 1121.

[102] 85 Fed. Reg. at 24,702 (citing just two papers). *See, e.g.*, Thomas Klier & Joshua Linn, *The Effect of Vehicle Fuel Economy Standards on Technology Adoption*, 133 J. PUB. ECON. 41, 49, 50, 51 (2016) (finding "no evidence that the standards affected the direction" of technology adoption for U.S. cars; finding mixed evidence over time, with

approaches that were based on robust administrative records.[103] The agencies have also ignored contrary evidence,[104] including studies commissioned by EPA that have found that increased fuel economy is not associated with negative evaluations of vehicle performance or other attributes.[105]

Fifth, it is not even clear that consumers would benefit, on net, if other attributes like acceleration continued to increase indefinitely across the entire fleet, because consumers may value only their own vehicle's *relative* acceleration as compared to the rest of the fleet, and do not necessarily benefit from an absolute increase in fleetwide acceleration.[106] In fact, increasing the overall level of acceleration among new vehicles likely would increase the seriousness of accidents and cause other negative externalities—costs that would have to be taken into account

periods of statistical insignificance, for the rate of technology adoption for U.S. trucks and cars; and finding "relatively small" magnitude effects for European cars); *see also id.* (never making any connection between opportunity costs and the energy efficiency paradox). *See generally Shortchanged* at Sections III.C, III.D & IV (on the limitations of the literature the agencies cite).

[103] *See* TAR at 4-29 to 4-32; *see also* Proposed Determination at A-49 to A-50; TSD at 4-4 to 4-7; Gloria Helfand et al., EPA, Power and Fuel Economy Tradeoffs, and Implications for Benefits and Costs of Vehicle Greenhouse Gas Regulations at 7 (Powerpoint Presentation, 2018), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2018-0283-6963&attachmentNumber=17&contentType=pdf; Whitefoot, Fowlie, Skerlos (2018) at 10,308.

[104] *See* Comments from Jeremy J. Michalek & Kate S. Whitefoot (Oct. 26, 2018), at 9-10, Docket #NHTSA-2018-0067-11903; Comments from Environmental Defense Fund (Oct. 26, 2018), Appendix A at 86-89, Docket # NHTSA-2018-0067-12108; Policy Integrity Comments at 13-98, NHTSA-2018-0067-12213 and EPA-HQ-OAR-2018-0283-5083; Bento et al., *Flawed Analysis of U.S. Auto Fuel Economy Standards,* at 1119.

[105] Hsing-Hsiang Huang et al., *Re-Searching for Hidden Costs: Evidence from the Adoption of Fuel-Saving Technologies in Light-Duty Vehicles*, 65 TRANSP. RES. 194 (2018); Gloria Helfand et al., *Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles*, 98 ENERGY POL'Y 590 (2016); Hsing-Hsiang Huang, Gloria Helfand & Kevin Bolon, EPA, Consumer Satisfaction with New Vehicles Subject to Greenhouse Gas and Fuel Economy Standards (Powerpoint Presentation, 2018), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2018-0283-6963&attachmentNumber=1&contentType=pdf; Hsing-Hsiang Huang et al., Re-Searching for Hidden Costs with Producer Heterogeneity (Powerpoint Presentation, 2017), https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11768&attachmentNumber=2&contentType=pdf. *See also* EPA, *Consumer Willingness to Pay for Vehicle Attributes: What is the Current State of Knowledge?*, 7-1 (2018), https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=OTAQ&dirEntryId=339388; EPA, 2019 *Automotive Trends Report* at 30 (2020), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100YVFS.pdf (showing graphical evidence that since 2008, there has been no obvious tradeoff between fuel economy and horsepower).

[106] *See generally Shortchanged* at Section VI.C. (explaining that many vehicle features, like acceleration, are positional goods, and citing the relevant literature).

along with any alleged benefits of increasing vehicle features.[107] As the agencies' discussion of opportunity costs does not address these issues, it is incomplete and misleading.[108]

Finally, the agencies' asserted emphasis on upfront costs in their justification for the rule belies their economic analysis of the rule. The agencies gloss over the fact that for 85% of consumers, the so-called "upfront cost" of the purchase price is actually spread over the course of future loan payments.[109] Moreover, the agencies' cost-benefit analysis accounts for present and future consequences using discount rates, which convert the value of future costs and benefits into a present value based on the assumption that future costs and benefits are worth less to an individual than those that accrue today. That analysis demonstrates that the Final Rule imposes net costs on consumers, despite alleged upfront savings on new vehicle purchase prices.[110] To the extent the agencies cite upfront vehicle costs as a justification for the Final Rule in the face of their own cost-benefit analysis, that reasoning is akin to selectively applying different, higher discount rates to consumer fuel savings than new vehicle costs, which would be arbitrary.

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[107] Externalities associated with performance features like acceleration, horsepower, and vehicle weight include increased accidents, increased severity of accidents, road congestion, road and parking construction and maintenance costs, the space used for parking, and pollution. *See generally Shortchanged* at Section VI.B. *See also* Thomas Tietenberg & Lynne Lewis, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 375-376 (11th ed. 2018); Ins. Inst. for Highway Safety & Highway Loss Data Inst., *Flexing Muscle: Sports Car Ratings Show Range of Performance*, 52 STATUS REPORT, no. 5, 2016, at 1, https://perma.cc/4RDD-34RQ; Leon Robertson, *Road Death Trend in the United States: Implied Effects of Prevention*, 39 J. PUB. HEALTH POL'Y 193, 200 (2018); Anne T. McCartt & Wen Hu, *Effects of Vehicle Power on Passenger Vehicle Speeds*, 18 TRAFFIC INJ. PREVENTION 500 (2017); Wen Hu & Jessica B. Cicchino, *An Examination of the Increases in Pedestrian Motor-Vehicle Crash Fatalities During 2009–2016*, 67 J. OF SAFETY RES. 37 (2018); NHTSA, *How Vehicle Age and Model Year Relate to Driver Injury Severity in Fatal Crashes, Traffic Safety Facts: Research Note* (2013), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811825 (showing increased speed increases fatalities); Hong Sok Kim, Hyung Jin Kim, Bongsoo Son, *Factors Associated with Automobile Accidents and Survival*, 38 ACCIDENT ANALYSIS & PREVENTION 981, 981 (2006); Jeff Bartlett, *Tesla Model S Aces Government Crash Test*, CONSUMER REPORTS (Aug. 21, 2013), https://perma.cc/64RE-9YM8; Anwaar Ahmed et al., *Estimating the Marginal Cost of Pavement Damage By Highway Users on the Basis of Practical Schedules for Pavement Maintenance, Rehabilitation and Reconstruction*, 11 STRUCTURE AND INFRASTRUCTURE ENGINEERING 1069, 1080 (2015); Jack N. Barkenbus, *Eco-Driving: An Overlooked Climate Change Initiative*, 38 ENERGY POL'Y 762, 763 (2010); Gerarden et al. (2017) at 1498; Jason D. Lemp & Kara M. Kockelman, *Quantifying the External Costs of Vehicle Use: Evidence from America's Top-Selling Light-Duty Models*, 13 TRANSP. RES. PART D: TRANSPORT & ENV'T 491, 493-94 (2008); Ian W. H. Parry & Kenneth A. Small, *Does Britain or the United States Have the Right Gasoline Tax?*, 95 AM. ECON. REV. 1276 (2005).

[108] *See also Shortchanged* at Section VI, for other flaws with the agencies' estimate of opportunity costs, including the flawed selection of 42 months' of fuel savings as the proxy value.

[109] 85 Fed. Reg. at 24,706.

[110] *Id*. at 24,991-92 (Tables VII-80 to VII-81). Note also that whether the overall cost-benefit analysis shows net benefits or net costs for the rollback hinges on the discount rate applied. *Id*. at 24,201-08, Tables II-20 to II-23. As OMB Circular A-4 notes, when the sign (negative or positive) of the regulatory analysis is so sensitive to a key assumption, like the choice of discount rate, agencies are required to "conduct further analysis" using "alternative plausible assumptions," and then determine which assumption "is more appropriate," while also making "any hidden assumptions explicit." Circular A-4 at 42; *see also id.* at 3 (requiring analysts to disclose the choice of discount rates and conduct sensitivity analyses "to reveal whether, and to what extent, the results of the analysis are sensitive to plausible changes in the main assumptions and numeric inputs"). Yet in the Final Rule, the agencies neither tested the sensitivity of their cost-benefit results to a different discount rate other than 7% or 3%, nor did they explain why either 7% or 3% would be an appropriate choice of discount rate for this particular rulemaking. As the agencies have not undertaken any of this analysis, the Final Rule is arbitrary and capricious.

These arguments and the relevant citations are all discussed in greater detail in *Shortchanged: How the Trump Administration's Rollback of the Clean Car Standards Deprives Consumers of Fuel Savings* (Institute for Policy Integrity Report, 2020), which is attached; the arguments and relevant citations from that report are hereby incorporated by reference into this petition.

L. The Agencies' New Sales Modeling Approach is Deeply Flawed

In the Proposed Rule, the agencies attempted to estimate the impact of the proposed standards on new vehicle sales. As noted in comments submitted during the formal comment period, such an estimate is subject to extreme levels of uncertainty, due to both limitations in modeling such effects, as well as uncertainty regarding key assumptions that drive such modeling, as both agencies have previously acknowledged.[111] As a result, even the direction of the sales impact of the standards is uncertain.[112] In addition, numerous commenters, as well as the peer reviewers for the sales and scrappage models and EPA's Science Advisory Board, criticized the agencies' sales model in the Proposed Rule.[113]

In the Final Rule, the agencies change from the national time-series model utilized in the Proposed Rule to a simpler approach. They estimate a "baseline" sales trend that they claim represents the sales projected to occur under the previous standards. They then apply a price elasticity of -1.0 to the difference in new vehicle prices that they project will occur under the standards in the Final Rule. In quantifying the new vehicle price, they deduct the fuel savings that are expected to occur in the first 2.5 years of ownership, which is the amount of fuel savings that they say consumers value at the time of purchase.

As discussed below, the agencies are wrong in assuming that consumers value only 2.5 years' worth of fuel savings at the time of purchase. And as discussed above, the agencies also err in estimating the value of 2.5-years of fuel savings. But even leaving aside these two mistakes, the sales modeling approach in the Final Rule suffers from other significant flaws.

First, the agencies' baseline sales trend is fatally flawed. The margin of error for its estimates grossly outweighs the degree of sales changes that the agencies project, fatally undermining the statistical significance of this analysis. In addition, the agencies' baseline sales trend omits the previous standards that the agencies purport to model, artificially inflating the size of the sales effect.

Second, the choice of a -1.0 sales elasticity for new vehicle sales is arbitrarily high and unsupported by the literature cited by the agencies. The agencies have used what is, at best, a high end estimate of short-term sales elasticity. In fact, the appropriate measure to use in evaluating the standards is a long-term sales elasticity, because while consumers may be able to delay the purchase of a vehicle for a short period of time, they generally cannot put that purchase

[111] *See, e.g.*, NGO Joint Legal Comments at 164-75.
[112] *See, e.g., id*.; *see also*, Comment from Consumer Union, et al., Docket #NHTSA-2018-0067-11731, at 16-21.
[113] *See id*.; SAB Final Report at 22-23; CAFE Model Peer Review (revised July 2019) at B-3 – B-8, Docket #NHTSA-2018-0067-0055.

off forever. The agencies have previously acknowledged as much but inexplicably adopt a high short-run elasticity in the Final Rule. An extensive review of the relevant economic literature, discussed below, finds a long-run elasticity of -0.3 to -0.6. Using an elasticity in that range would significantly lower the sales effects in the Final Rule—undermining both the cost-benefit analysis, as well as the agencies' assertions that weaker standards will significantly increase fleet turnover and related fatalities.

All of these flaws are discussed in more detail below.

i. Baseline Sales Trend

First, the uncertainty in the sales model dwarfs the projected sales increases from the Final Rule. As a result, the alleged sales benefit of the Final Rule reported by the agencies is misleading because it is in fact statistically inconsequential. Specifically, the sales projection curves for each regulatory alternative fall well within the baseline sales trend's range of uncertainty. Unlike the sales model in the Proposed Rule, the sales model in the Final Rule consists of a baseline sales projection based solely on macroeconomic inputs and a price elasticity of sales (i.e., how a change in prices changes sales).[114] To estimate differences in sales between regulatory alternatives, the agencies take the baseline sales trend and apply an assumed price elasticity of sales to alleged net price differences between the regulatory alternatives.[115] The uncertainty in this new approach renders it inappropriate for use in rulemaking.[116]

The baseline sales trend, being an empirical projection from a statistical model estimated using input data, necessarily has statistical uncertainty associated with it. Contrary to the guidelines in OMB Circular A-4, the agencies do not disclose information about the statistical confidence of the sales model's projections in the Final Rule. To investigate this question, estimation of the agencies' baseline sales model was replicated using the agencies' methodology and data.[117] This was then used to calculate an estimate of the prediction error associated with the agencies' baseline sales trend. Specifically, the Root Mean Square Error (RMSE) from the estimation was about 3.8 times larger than the maximum projected sales difference between the

[114] 85 Fed. Reg. at 24,613-16.
[115] *Id*. at 24,617.
[116] As discussed in comments on the Proposal, modeling the impacts of the standards is fraught with uncertainty, and for this reason, the agencies have declined to include such modeling in their previous cost-benefit analyses. *See, e.g.*, EPA Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation, Response to Comments, EPA-420-R-17-001, at 120-21; *see also* NGO Joint Legal Comments at 164-75.
[117] The model estimation results in Table VI-152 (*Id.* at 24,615) exclude the Root Mean Square Error (a standard result in most estimation result printouts). This is the square root of the average of squared residuals, a measure of spread between the model's predicted and observed values. Obtaining this value required replication of the estimation results. This was done by obtaining the input values the agencies report using, however this was complicated by the agencies' omission of information on the source of historical vehicle sales they used. Using Figure VI-64 (*Id.* at 24,614) it was possible to determine that the source was almost certainly the same as data from https://fred.stlouisfed.org/series/ALTSALES. However, these data only go back to 1976. We were forced to fill in missing values by direct manual measurement of VI-64. Results were close but not perfectly identical. We produced identical R^2 values (both regular and adjusted). Coefficients for most terms were the same (given the number of reported significant digits) with the exceptions being the GDP terms and the intercept, which showed some minor differences that did not affect the outcome of the analysis. The RMSE value obtained was 0.00774, and was replicated using both SPSS and Stata.

baseline case and the final standards.[118] This demonstrates that the sales differences between the previous standards and the final standards predicted by the agencies' modeling are not meaningful compared to the uncertainty inherent in the agencies' sales projections. This is consistent with the observation that the projected sales difference between the previous and final standards from the agencies' own analysis is objectively very small, and inconsequential for purposes of supporting a change in policy having large negative societal consequences in other areas. These findings also undermine the agencies' justification for the rule, as the sales model results influence many other aspects of the modeling, such as the composition of the future vehicle fleet and distribution of vehicle miles traveled among those vehicles, which in turn impact crash fatalities and other results cited by the agencies.

Notably, the agencies state that they abandoned the modeling approach in the Proposal because it suffered from similar problems. Responding to comments and peer reviewers' comments that the Proposal model lacked statistical significance, the agencies attempted to revise the model to address these concerns. However, the agencies found that "[t]he updated econometric models of light duty vehicle sales … did not provide clear, significant or robust insight into the magnitude of the price elasticity of demand." 85 Fed. Reg. 24,602. The agencies explained that "[t]hese results strongly suggest that the relationship between sales and price is not adequately estimated with the macro-level data used in this analysis. … Even assuming a theoretically and econometrically correct model was possible, this relationship is impossible to evaluate at the current data aggregation level." *Id*. at 24,602-03. Despite these conclusions, the agencies then put forward a sales model that has the same flaw: the Final Rule sales model cannot project sales differences between the regulatory alternatives with any degree of certainty.

Second, the sales model uses an inappropriate baseline that omits the previous standards that the agencies purport to model. This error inflates the net benefits of the final GHG emissions standards by $2.7 to $2.8 billion.

As noted above, the agencies attempt to estimate the change in new vehicle sales in response to the Final Rule standards by first projecting forward a "baseline" sales trend to model future sales under the previous standards.[119] Based on this previous standards baseline, the agencies

[118] CAFE Model output and information on the source of household projections was used to compute the new vehicle sales per household for 2017 to 2050. Differences between the reference and preferred scenarios were computed. The maximum and average sales differences were 0.00205 and 0.00121 new vehicle sales per household respectively, which can be contrasted to the RMSE of 0.00774. It is important to note that the RMSE is a conservative estimate of modeling error computed within the estimation sample (and is associated with the term "prediction error"), and would only be a lower bound as an estimate of "forecast error." It does not include the effect of error in estimating the parameters, nor any errors associated with projecting the future values input variables (GDP and Consumer Sentiment). Finally, the RMSE does not represent a confidence interval, e.g., one would look at the predicted value plus-or-minus 1.96*RMSE for a 95% confidence interval, which almost doubles the prior comparisons.

[119] 85 Fed. Reg. at 24,614-15.

then increase vehicle sales under every other regulatory alternative using an assumed vehicle sales price elasticity and the modeled decline in net average vehicle prices.[120]

The validity of this methodology depends on whether the baseline sales trend is a reasonable projection for vehicles sales under the previous standards. However, the agencies erroneously developed a baseline sales trend that does not take into account any standards. The agencies estimate the baseline sales trend using only macroeconomic indicators, such as gross domestic product and consumer sentiment.[121] No variables relating to the level of the previous standards are included, and the estimation includes data over a time period (1970-2016), for several decades of which standards were largely unchanging. As a result, the baseline sales trend used in the analysis represents a projection with largely unchanged standards, rather than a projection corresponding to the previous standards, which increase in stringency each year.

If the agencies want to start with what is effectively a "no standards" baseline, they should have then applied the vehicle sales elasticity to this baseline to project the change in vehicle sales under each of the regulatory alternatives, including the previous standards, to see what impact each set of standards would have on the baseline. This correction would lower projected total new vehicle sales in the previous standards scenario because the standards would allegedly reduce new vehicle sales relative to the baseline. Reducing the projected number of total new vehicle sales would also scale down the costs and benefits of the rulemaking.

Alternatively, the agencies could have used a baseline sales trend for the previous standards that takes into account the impact of the standards on sales. There is a model readily available to do just this. The U.S. Energy Information Administration's Annual Energy Outlook (AEO) 2019 uses the National Energy Modeling System model, which creates a baseline sales projection that models the previous standards. This baseline sales projection is substantially lower than the projection used by the agencies, likely in part because it includes the previous standards, unlike the agencies' analysis. Using the AEO 2019 estimates can thus correct for the error in the agencies' analysis because the AEO 2019 estimates reflect what the agencies' methodology intended to do.

Using the AEO 2019 vehicle sales estimates for the previous standards has notable effects on the final costs and benefits of the regulatory alternatives. Correcting the agencies' error[122] causes the net benefits of the Final Rule to drop to -$24.7 billion at a 3% discount rate (from -

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[120] *Id*. at 24,617. To calculate the net average vehicle price, the model deducts 2.5-years' worth of fuel savings from the average change in new vehicle prices. *Id*. Note that the modeled decline in vehicle prices assumes that all technology costs are fully passed on to consumers, which may not be so. *See, e.g.,* Policy Integrity Comments, Docket #NHTSA-2018-0067-12213, at 27-31; Comment from Consumer Union, et al., Docket #NHTSA-2018-0067-11731, at 10; *see also* TAR at 13-93 (NHTSA stating: "Since we do not have sufficient information to model the way in which manufacturers actually price their current and future fleets, we cannot make credible assumptions about what share of increased technology costs will be passed directly onto the buyer of a specific vehicle, absorbed by the manufacturer, and/or subsidized by the purchase of other vehicles. Without the information to establish representative assumptions about how each manufacturer will allocate increased costs, we track the increase in technology costs associated with a vehicle, but do not project the change in vehicle price to the consumer.").

[121] 85 Fed. Reg. at 24,614-15.

[122] Specifically, the Dynamic Fleet Share module (of which the sales model is a part) within the CAFE Model software code was adjusted to replace the function of Equation 2 with the AEO 2019 values shown in Table VI-153 at 85 Fed. Reg. 24,616.

$22.0 billion) and to $3.6 billion at a 7% discount rate (from $6.4 billion). In addition, the agencies' estimated increase in new vehicle sales under the final CAFE standards decreased from 2.2 million to 2.1 million through MY 2029, and the agencies' estimated avoided fatalities under the final CAFE standards decreased by 66 for the lifetime of vehicles through MY 2029.

ii. Price Elasticity

The agencies err in the Final Rule by adopting a new price elasticity that is unsupported and inappropriate, thereby drastically inflating the purported costs of the rule.

Price elasticity refers to the relationship between vehicle prices and sales. Basic principles of supply and demand counsel that as the price of a good rises, demand for that good normally decreases. Price elasticity measures the strength, or elasticity, of this relationship, and is measured as the percentage decline in sales from a 1% price increase (to illustrate, a price elasticity of -0.5 means that sales decline by 0.5% when prices increase by 1%). This is a critical parameter in estimating the costs and benefits of the Final Rule, as without an input for price elasticity, the agencies would be unable to quantify the rule's effect on vehicle purchases.

Some key principles about vehicle price elasticity are generally undisputed. For one, the demand for new vehicles is fairly inelastic with respect to price, as vehicles are essential goods in most areas of the United States.[123] This inelasticity is particularly true in the medium- and long-run. As EPA and NHTSA have previously recognized, elasticity is "smaller in the long run" than in the short run, because "though people may be able to change the timing of their purchase when price changes in the short run, they must eventually make the investment" and purchase a needed vehicle even if higher prices remain long-term.[124] EPA's Science Advisory Board has recognized the same effect, noting that while "a consumer can easily hold on to their existing vehicle a bit longer[,] . . . an old vehicle will not be functional forever, and thus the long-run price elasticity for new vehicles is likely to be smaller than the short-run price elasticity."[125] Reflecting this effect, a recent study that the agencies cite in the Final Rule finds a long-run vehicle price elasticity of -0.61 and a short-run elasticity of -0.79.[126] Other studies likewise support a much higher elasticity in the short-run versus the long-run, as detailed below.

Given the important differences between short-run and long-run elasticity—and the effect that this has on the entire sales model—the agencies should be expected, at minimum, to select an elasticity that is consistent with the timeframe of their analysis. But the agencies fail to take this basic step. Instead, they claim that there is "broad consensus in the economic literature that

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[123] *See, e.g.*, Patrick L. Anderson et al., *Price Elasticity of Demand* (1997), https://scholar.harvard.edu/files/alada/files/price_elasticity_of_demand_handout.pdf.
[124] 77 Fed. Reg. at 63,102 n.1300 (NHTSA discussing sales elasticity); *see also* Proposed Determination at A-40 to A-41.
[125] SAB Final Report at 22; *see also* Robert S. Pindyck & Daniel L. Rubinfeld, Microeconomics 32–33 (1989) (explaining that, for durable goods such as automobiles, "the short-run income elasticity of demand will be much larger than the long-run elasticity").
[126] Sean P. McAlinden et al., *The Potential Effects of the 2017-2025 EPA/NHTSA GHG/Fuel Economy Mandates of the US Economy*, Center for Automotive Research at 27 (2016) ("CAR Report"), cited in 85 Fed. Reg. at 24,617 n.1642.

the price elasticity of demand for automobiles is approximately -1.0"[127]—suggesting, contrary to the evidence and their prior acknowledgements, that either the short-run and long-run price elasticities are effectively the same or the economic literature coalesces around a long-run price elasticity of -1.0. Accordingly, the agencies model a price elasticity of -1.0 throughout their analysis—meaning that for every 1% price increase, the agencies assume a 1% sales decrease.

But no such "consensus" exists. For one, as noted above, there is a vast distance between short-run and long-run price elasticities, as even the agencies recognize in the Final Rule.[128] Moreover, estimates of long-run elasticity—which supplies the appropriate elasticity value for a long-term analysis such as this one—are significantly lower than -1.0. For instance, as noted above, the CAR Report, which the agencies cite in the Final Rule, reports a long-run elasticity of -0.61 based on its own analysis and literature review.[129] Another study, which the agencies highlighted in their 2012 joint rulemaking, found this effect to be even more inelastic, with "a long-run elasticity of [-]0.3 to [-]0.46" with respect to vehicle expenditures.[130] Similarly, the long-run estimates in a 1983 literature review support a long-run elasticity of -0.5 to -0.6 when using the median estimate or taking the mean without the outlier estimate.[131] Several recent studies estimate an even lower long-run elasticity. Specifically, three estimates from the past two years—Gillingham & Stock (2018),[132] Leard (2020),[133] and Bento et al. (2020)[134]—find a long-run vehicle price elasticity of between -0.13 and -0.4, with an average elasticity in the three studies of -0.27.[135]

[127] 85 Fed. Reg. at 24,617.
[128] *See id.* at 24,617 n.1642 (highlighting differences in short-run versus long-run elasticities in one study).
[129] CAR Report at 27. In the Final Rule, the agencies only acknowledge the CAR Report's central mean estimate of -0.72, 85 Fed. Reg. at 24,617 n.1642, but this estimate is prejudiced by an "extreme outlier," and when this outlier is "excluded from consideration, the average long-run elasticity in the survey of prior work falls to -0.61," CAR Report at 28.
[130] 77 Fed. Reg. at 63,102 n.1300 (citing Saul H. Hymans, Consumer Durable Spending: Explanation and Prediction,'' Brookings Papers on Economic Activity (1970), *available at* https://www.brookings.edu/wp-content/uploads/1970/06/1970b_bpea_hymans_ackley_juster.pdf).
[131] F. Owen Irvine, *Demand Equations for Individual New Car Models Estimated Using Transaction Prices with Implications for Regulatory Issues*, 49 S. Econ. J. 764, 766 tbl. 1 (1983).
[132] Comments of James H. Stock et al. (Oct. 26, 2018) at 20, Docket #EPA-HQ-OAR-2018-0283-6220 (short-run elasticity estimate of -0.27).
[133] Benjamin Leard, *Estimating Consumer Substitution Between New and Used Passenger Vehicles*, Resources for the Future Working Paper 19-02 (2019) (estimate of -0.4).
[134] Antonio M. Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards*, 1 Envtl. & Energy Policy & the Econ 129 (2020) (estimate of -0.13).
[135] Such estimates are consistent with the price elasticity that the agencies used in the Proposed Rule, as well as earlier estimates provided by Anderson et al. (1997).

The chart at the end of this subsection provides a thorough review of long-run and short-run elasticity estimates.[136] Viewed in totality, both the mean and median of all compiled long-run elasticity estimates is -0.6—far lower than the -1.0 value that the agencies call a "consensus" estimate. And, again, those estimates drop even further when looking only at more recent research: the median of studies published since 2000 (including a high outlier estimate) is approximately -0.5, and the median of studies published since 2010 is approximately -0.4. As these findings demonstrate, there is voluminous evidence for a long-run price elasticity of roughly -0.5 or lower, and the agencies have no basis to claim that -1.0 represents a consensus estimate.

And importantly, it is this long-run elasticity rate, not the short-run price elasticity, that supplies the more appropriate value to assess the sales impacts of the Final Rule. This is because the short-run price elasticity rate projects sales only about a year into the future.[137] The agencies project sales out through 2050 in the Final Rule,[138] and so, while the agencies should ideally model a short-run to long-run transition over the first few years of this analysis, it is the long-run elasticity that is applicable throughout the overwhelming majority of the analysis. Indeed, EPA previously recognized in its Proposed Determination on the appropriateness of the MY 2022-2025 GHG standards, that a "short run elasticity estimate . . . may not be appropriate for standards that apply several years into the future."[139] And in the 2012 rule that set the previous standards, NHTSA similarly recognized that a "short-run elasticity" is applicable only "for the initial years of the program," and that "over time, a long-run elasticity may better reflect behavior" for sales projections.[140]

Accordingly, as one of the model's peer reviewers and EPA's own Science Advisory Board advised the agencies, the use of a -1.0 price elasticity to model long-term sales impacts is unjustified, and the agencies should instead use a lower number in line with long-run elasticity estimates. Specifically, Dr. John Graham, one of the model's peer reviewers, advised the agencies that the relevant "literature, with a proper focus on long-term price elasticity of demand, provides support for a price elasticity of demand that is well below -1.0 (in absolute value)."[141] Dr. Graham further advised that "the -1.0 elasticity figure does not have a solid grounding in economic evidence."[142] Additionally, EPA's Science Advisory Board, while not endorsing a particular long-run elasticity estimate, recognized that the long-run elasticity supplies the appropriate value for assessing the Final Rule's impacts, explained that -1.0 has no empirical basis for a long-run elasticity, and suggested that the agencies conduct "sensitivity analysis with

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[136] This review included the sources cited by the agencies in the Final Rule, as well as other sources in the record (in particular those in National Research Council, *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles* (2015), and previous EPA rules) and more recent studies.
[137] *See* Robert S. Pindyck & Daniel L. Rubinfeld, Microeconomics 30 (1989) (describing short-run elasticity as measuring "one year or less"). Long-run elasticity, in contrast, models impacts starting approximately five years in the future. *See* Thomas Klier & Joshua Linn, *The Effect of Vehicle Fuel Economy Standards on Technology Adoption*, Resources for the Future 3, 6 (2015) (noting that long-run impacts measure across engine design cycles, and that "models contain redesigned engines about once every five years in the United States")
[138] *See* 85 Fed. Reg. at 24,617 (Table VI-154).
[139] Proposed Determination at A-40.
[140] 77 Fed. Reg. at 63,102 n.1300.
[141] CAFE Model Peer Review at B-35 (revised July 2019), Docket #NHTSA-2018-0067-0055.
[142] *Id.* at B-33.

alternative price elasticities—both larger and smaller than -0.2 to -0.3."[143] The agencies' approach—using only an elasticity of -1.0—blatantly disregards this advice.[144]

The agencies fail to rationally justify their approach. The agencies cite three papers for their conclusion of a price elasticity of -1.0,[145] but these three studies provide estimates of *short-run* elasticity, which, as detailed above, is not the appropriate metric for modeling the Final Rule's impacts over thirty years. In addition, only one of the three studies cited by the agencies actually estimates elasticity—McCarthy (1996)[146]—providing only a short-run elasticity estimate.[147] Bordley (1994)[148] simply assumes a short-run elasticity of -1.0; it does not actually estimate an elasticity itself.[149] And the third cited study—Kleit (1990)[150]—bases its elasticity on another paper (from 1983), which in turn predominantly relies upon short-run estimates.[151] Thus, the elasticity estimate that the agencies provide is effectively a short-run estimate: indeed, the agencies have previously recognized that -1.0 "is generally considered to be a short-run elasticity," with elasticity likely "smaller in the long run."[152] And as detailed above, a short-run elasticity estimate is not appropriate to capture the rule's long-term impacts.

Furthermore, the three studies that the agencies cite do not adequately support -1.0 as a short-run elasticity and appear to show that this is a high-end estimate. For one, these studies provide wildly outdated evidence, as EPA has acknowledged.[153] Not only are the three studies themselves between 24–30 years old, but they mostly rely on data from the 1960s and 1970s, with some data even dating back to the 1920s.[154] The agencies do not explain why they relied on such old data when more recent data is available, and their approach here is inconsistent with their approach in analyzing vehicle scrappage and rebound in which the agencies relied on newer estimates.[155] Additionally, the data that the agencies cite appears to indicate a range of about -0.8 to -1.0 for short-run price elasticity—making -1.0 a high-end rather than a central estimate. For instance, McCarthy (1996) presents a short-run elasticity estimate of -0.87, and as the

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[143] SAB Final Report at 23.
[144] Elsewhere in the Final Rule, the agencies tout their alleged adherence to the Science Advisory Board's recommendations. *See, e.g.*, 85 Fed. Reg. at 24,177. Yet with price elasticity, they do not even mention the Science Advisory Board's findings.
[145] 85 Fed. Reg. at 24,617 n.1614.
[146] Patrick S. McCarthy, *Market Price and Income Elasticities of New Vehicle Demands*, 78 Rev. Econ. & Stat. 543 (1996).
[147] *See* CAR Report at 64 (summarizing findings of the study).
[148] Robert Bordley, *An Overlapping Choice Set Model of Automotive Price Elasticities*, 28 Transp. Research Part B: Methodological 401 (1994).
[149] *See* CAR Report at 64 (summarizing findings of the study).
[150] Andrew N. Kleit, *The Effect of Annual Changes in Automobile Fuel Economy Standards*, 2 J. Reg. Econ. 151 (1990).
[151] *See* F. Owen Irvine, *Demand Equations for Individual New Car Models Estimated Using Transaction Prices with Implications for Regulatory Issues*, 49 S. Econ. J. 764 (1983), cited in Kleit (1990). Of the sixteen elasticities cited in Irvine, thirteen are short-run.
[152] 77 Fed. Reg. at 63,102 n.1300.
[153] Proposed Determination at A-40 ("this assumption [of a -1 sales elasticity] is old (stemming from studies conducted two or more decades ago)").
[154] *See, e.g.*, Irvine (1983) at 766 tbl. 1, cited in Kleit (1990); McCarthy (1996) at 543–44 (collecting underlying data). Kleit (1990) cites an elasticity of -1.0 based exclusively on Irvine (1983).
[155] *See* 85 Fed. Reg. at 24,638.

agencies recognize, the CAR Report "found a –[0].79 short-run elasticity."[156] Moreover, a 2015 analysis by the National Academies of Sciences—cited in the Proposal—found a short-run elasticity range of -0.8 to -1.0.[157] Another paper that the agencies have previously cited—Goldberg (1998)[158]—likewise finds a short-run price elasticity of -0.9.[159] And while Bordley (1994), one of the papers cited in the Final Rule, does claim a short-run elasticity of -1.0, it does not provide evidentiary support for this claim.

Even leaving aside its validity as a short-run estimate, -1.0 is far too high as a long-run estimate, and for the reasons noted above, is therefore entirely inappropriate for analyzing the Final Rule's cumulative impacts. The agencies' newfound use of this elasticity in analyzing the Final Rule is not only arbitrary and baseless, but also substantially overestimates the decline in long-term vehicle sales.

Petitioners ran the CAFE Model using an elasticity of -0.6, which is the mean and median long-run elasticity of all the studies shown below, as well as an elasticity of -0.4, which is a central estimate based on the literature published since 2000. Under the -0.6 elasticity, the net benefits of the GHG standards were reduced by $5.3 billion at a 3% discount rate and $3.7 billion at a 7% discount rate. In addition, the agencies' estimated increase in new vehicle sales under the final GHG standards decreased from 2.2 million to 1.3 million. The agencies' estimated avoided fatalities under the final GHG standards also decreased by 185. Under the -0.4 elasticity, the net benefits of the GHG standards were reduced by $8.0 billion at a 3% discount rate and $5.6 billion at a 7% discount rate. In addition, the agencies' estimated increase in new vehicle sales under the final GHG standards decreased from 2.2 million to 900,000. The agencies' estimated avoided fatalities under the final GHG standards also decreased by 277.

Sales Elasticity Estimates

Author(s)	**Year**	**Time Period**	**Short-Run**	**Long-Run**
McAlinden et al. (2016) - CAR Report				
Atkinson	1952	1925-1940	-1.33	-
Nerlove	1957	1922-1941; 1948-1953	-0.9	-1.2
Suits	1958	1929-1941; 1949-1956	-	-0.57
Chow	1960	1921-1953	-	-0.7
Suits	1961	1929-1941; 1949-1956	-	-0.675
Hymans, Ackley, and Juster	1970	1954-1968	-1.14	-0.46
Hess	1977	1952-1972	-1.63	-

[156] *Id*. at 24,617 n.1642.
[157] National Research Council, *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicle*s 330 (2015), cited in 83 Fed. Reg. at 43,025 n.123.
[158] Pinelopi K. Goldberg, *The Effects of the Corporate Average Fuel Efficiency Standards in the U.S.*, 46 J. Industrial Econ. 1 (1998), *cited in* 75 Fed. Reg. at 25,517 n.462.
[159] Admittedly, some studies that the agencies do not cite find short-run elasticities above -1.0. Our compilation of the literature, summarized in the table below, finds both mean and median short-run estimates of about -1.0.

Trandel	1991	1983-1985	-1.43	-
Levinsohn	1988	1983-1985	-0.82	-
McCarthy	1996	1989	-0.87	
Bordley	1993	Assumed	-1	
Fischer, Harrington, and Parry	2007	Not indicated	-1	-0.82
Irvine (1983) (basis for Kleit (1990))				
Dyckman	1975	1929-1962	-1.45	
Hamburger	1967	1954-1964	-1.17	
Evans	1969	1948-1964	-3.1	-1.5
Hymans	1970	1954-1968	-1.07	-0.36
Rippe and Feldman	1976	1958-1973	-1.14	-0.6
Carlson	1978	1965-1975	-1.1	
Additional estimates in the record				
Goldberg	1998	1984-1990	-0.9	
Juster and Wachtel	1972	1949-1967	-0.7	
Lave and Train	1979	1976	-0.8	
McAlinden et al.*	2016	1953-2013	-0.79	-0.61
Recent Estimates				
Berry et al.	2004	1993		-1
Gillingham and Stock	2018	1967-2016		-0.27
Leard	2020	2013		-0.4
Bento et al.	2020	Not indicated		-0.13
Dou and Linn	2020	1996 to 2016	-1.5	
Averages				
Mean			-1.2	-0.6
Median			-1.1	-0.6
Averages of Recent Estimates				
Mean published since 1980			-1.0	-0.5
Median published since 1980			-1.0	-0.5
Mean published since 2000			-1.1	-0.5
Median published since 2000			-1.0	-0.5
Mean published since 2010			-	-0.4

Median published since 2010			-	-0.3
*Averages Without Inconsistent Estimates***				
Mean			-1.1	-0.5
Median			-1.1	-0.6
Mean: Published since 2000			-1.1	-0.4
Median: Published since 2000			-1.0	-0.4

* McAlinden et al. (2016) conducted both a literature review, represented at the top of this table, and separately produced its own elasticity estimates, shown here.
** Inconsistent estimates: Nerlove (1957) as long-run elasticity is higher than short-run elasticity; Evans (1969) as elasticities are extreme outliers with long-run elasticity that is elastic contrary to intuition in the literature; and Berry et al. (2004) as estimate was suggested by GM staff despite "impl[ying] a large (in absolute value) own-price semi-elasticity of demand equal to −10.56" and conducted sensitivity analysis using -0.2 and -0.4 (the latter producing more realistic own-price semi-elasticity) (Leard, 2020).

M. The Agencies' Assumption in the Sales and Scrappage Models that Consumers Value Only the First 2.5-years of Fuel Savings is Unfounded and Inconsistent with their Current and Past Statements

As noted in previous comments, there is significant uncertainty regarding the level at which consumers value future fuel savings when purchasing a vehicle.[160] This is a critical factor in any attempt to estimate changes in new vehicle sales due to changes in standards that improve fuel economy. As a result, we do not believe it is currently possible to reliably estimate the sales effects of the GHG and fuel economy standards.[161] That said, there are several reasons why the agencies' selection of 2.5 years in the Final Rule was too low and arbitrarily so.

In the Proposed Rule, the sales and scrappage models did not include any estimate of consumers' valuation of fuel savings (also called consumers' willingness-to-pay ("WTP") for fuel economy improvements), meaning the models effectively assumed that consumers did not value fuel economy improvements at all. Numerous commenters objected to this.[162] In the Final Rule, the agencies agree that this was an error,[163] and deduct 2.5 years' worth of fuel savings from the change in vehicle prices under the final standards.[164] Because of the agencies' arbitrary

[160] This is consumers' "ex ante" valuation of fuel savings. It is distinct from the "ex post" benefits that will accrue to consumers and society in actual fuel savings, the full value of which must be accounted for in the cost-benefit analysis. *See*, *e.g.*, Comment from Ken Gillingham, Dec. 10, 2018 (attached to Comment from the California Air Resources Board, dated Dec. 19, 2018, Docket #EPA-HQ-OAR-2018-0283-7449), at 6-7.
[161] *See, e.g.*, NGO Joint Legal Comments at 164-75.
[162] *See*, *e.g.*, NGO Joint Legal Comments at 170; Comments of Consumers Union, et al., Docket #EPA-HQ-OAR-2018-0283-6182, Attachment A at 19-20.
[163] 85 Fed. Reg. at 24,603 ("The agencies agree that the degree to which new vehicle buyers value improvements in fuel economy is an important consideration when estimating the response of new vehicle sales to potential standards.").
[164] 85 Fed. Reb. at 24,633 ("the agencies have adjusted the new vehicle price series in both models [the sales model and the scrappage model] by the amount of fuel savings consumers are assumed to value at the time of purchase (30 months [or 2.5 years] of fuel savings"). The agencies use the 2.5-year willingness to pay assumption in the

selection of consumers' WTP for fuel economy improvements, the results of both the sales and scrappage models are fatally flawed.

The agencies begin their discussion of consumers' WTP for fuel economy improvements by acknowledging that "[p]ublished literature has offered little consensus about consumers' willingness-to-pay for greater fuel economy, and whether it implies over-, under-, or full-valuation of the expected discounted fuel savings from purchasing a model with higher fuel economy." 85 Fed. Reg. at 24,604. They further state that "[e]mpirical estimates using [discrete choice models] span a wide range, extending from substantial undervaluation of fuel savings to significant overvaluation, thus making it difficult to draw solid conclusions about the influence of fuel economy on vehicle buyers' choices." *Id*. (citation omitted).

But instead of discussing or evaluating any of this extensive literature, the agencies focus on just three studies—all of which, they say, "consistently suggest that buyers value a large proportion—and perhaps even all—of the future savings that models with higher fuel economy offer." *Id*. at 24,604.[165]

After discussing the findings of these three studies, the agencies then declare that for the Final Rule they have adopted a value of consumer WTP for fuel economy that is "more conservative" than that suggested by those three studies—specifically 2.5 years, *id*. at 24,606, which "equates to a willingness to pay for approximately a quarter of available fuel savings," FRIA at 7. The agencies purport to justify this value by stating that, "Manufacturers have consistently told the agencies that new vehicle buyers will pay for about 2 or 3 years' worth of fuel savings before the price increase associated with providing those improvements begins to impact affect [sic] sales. The agencies have assumed the same valuation, 2.5 years, in all components of the analysis that reflect consumer decisions regarding vehicle purchases and retirements." 85 Fed. Reg. at 24,606.

As a threshold matter, there is a total disconnect between the agencies' discussion of consumers' WTP for fuel economy—which focuses on three studies showing high valuation—and the agencies' ultimate adoption of a 2.5-year valuation. They call the use of 2.5 years a "conservative approach," *id*. at 24,607, but in the context of the sales and scrappage models, that is not true. A higher WTP would reduce the effective sales price difference under the final standards, which would lead to decreased sales and scrappage impacts under the Final Rule. The agencies attempt to build a case for high consumer valuation of fuel savings, but then arbitrarily adopt a valuation that is significantly lower.

In addition, the agencies disregard the vast body of literature that exists regarding consumers' valuation of fuel savings and WTP for fuel economy improvements. They state that the three studies upon which they focus undertook to "overcome shortcomings of past analyses," *id*. at

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scrappage model, too, because that model also uses new vehicle prices. *Id*. at 24,633, 24,656. Leaving aside any issues with the use of new vehicle prices as a proxy for used vehicle prices, which have been discussed in comments, the 2.5-year willingness-to-pay assumption is wrong in the scrappage model for the same reasons that it is wrong in the sales model.

[165] These three studies are Sallee, et al., 2016; Allcott & Wozny, 2014; Busse, et al., 2013. 85 Fed. Reg. at 24,604. *See also id*. at 24,610 ("recent research seems to show that such behavior [consumer undervaluation of fuel savings from investing in higher-efficiency vehicles] is not widespread, if it exists at all").

24,604, but they do not then discuss any of the shortcomings of the three studies themselves, nor put the relative merits of the wide array of studies into context.[166] This is despite the fact that the peer review of the sales and scrappage models explicitly called into question the agencies' "inappropriate emphasis to the recent econometric studies showing high consumer valuation of fuel economy," in light of the extensive literature that exists on the subject of consumer WTP for fuel economy improvements. NHTSA, CAFE Model Peer Review (July 2019, revised), B-34 to B-35 (also noting that two of the studies that the agencies focus on "address consumer response to fuel price changes rather than technology changes," thus questioning the degree of their relevance).

In addition to these flaws in the agencies' analysis, the ultimate premise upon which the agencies base their estimate of consumer WTP for fuel economy improvements is unsubstantiated. The agencies state that they chose 2.5 years of valuation because "[m]anufacturers have consistently told the agencies that new vehicle buyers will pay for about 2 or 3 years' worth of fuel savings." *Id*. at 24,606. The agencies provide no documentation or citation for this assertion. Moreover, in the 2012 rule that set the previous standards, NHTSA cited evidence that manufacturers believed that consumers valued 2-4 years of fuel savings, 77 Fed. Reg. at 63,103,[167] meaning a mid-point of that range would be 3 years of valuation. There is no explanation provided by the agencies in the Final Rule for when or why manufacturers' perception of consumer valuation of fuel savings might have changed. In addition, in the 2012 rule, NHTSA identified several problems and risks with relying on manufacturers' estimates. See *id*. at 63,103 ("Although some manufacturers have indicated in public remarks or confidential statements to NHTSA that their plans to apply fuel-saving technology depend on fuel prices and consumers' willingness to pay for fuel economy improvements, the agency does not have specific and robust information regarding how manufacturers interpret consumers' valuation of fuel savings."); *id*. ("it is possible that manufacturers are providing more or less fuel economy than consumers wish to purchase, because they do not correctly understand consumers' valuation of fuel economy"); *id*. at 63,104 (noting "the considerable uncertainty associated with consumer valuation of fuel savings and manufacturers' understanding of that valuation").[168]

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[166] At one point the agencies refer to "several recent studies" that estimate consumers' valuation of fuel savings, 85 Fed. Reg. at 24,607, but they never identify which studies they are talking about or explain if they are different from the three studies highlighted by the agencies, nor do they discuss any other studies in any detail. The agencies further state that "the most careful recent studies suggest that on average buyers appear to undervalue the savings from higher fuel economy at most modestly, and perhaps not at all, after accounting for the influence of vehicles' other attributes on prices and purchasing decisions." *Id*. But the citation given for this statement is to "Table VI–120—Percent of Future Fuels Costs Internalized in Used Vehicle Purchase Price using Current Gasoline Prices to Reflect Expectations (for Base Case Assumptions)," see *id*., n.1596. Based on the title, we believe the agency is referring to Table VI-151, *id*. at 24,605, which has the same title; this table shows results for just the three studies upon which the agencies focus.

[167] "A recent paper by David Greene examined studies from the past 20 years of consumers' willingness to pay for fuel economy and found that 'the available literature does not provide a reasonable consensus,' although the author states that 'manufacturers have repeatedly stated that consumers will pay, in increased vehicle price, for only 2–4 years in fuel savings' based on manufacturers' own market research." *Id*. (citation omitted).

[168] In the 2012 rule, NHTSA also discussed how the standards themselves might lead to greater valuation of fuel savings by consumers, a consideration the agencies ignore in the Final Rule. *See* 77 Fed. Reg. at 63,104-05; *id*. at 63,105 ("while it is difficult to determine how consumers will react to fuel economy improvements attributable to the final rule, we believe that it is likely that consumers will learn more about and increasingly value fuel economy improvements in the future").

In addition, the agencies' assumption of a 2.5-year WTP value for consumers is inconsistent with the NHTSA's previous position on the relative values of consumers' WTP for fuel economy and manufacturers' perception of consumers' WTP for fuel economy. As NHTSA described in the 2012 rule, these are two different perspectives and there are reasons why they are not the same.[169] Given the uncertainty regarding the values for the two perspectives, NHTSA's sales analysis in the 2012 rule looked at different pairings of consumer valuation of fuel savings (specifically, 1 year, 3 years, and 5 years[170]) with manufacturers' perception of consumers' valuation of fuel savings (specifically, 0 years, 1 year, 3 years, and 5 years). In this analysis, NHTSA explained that consumer valuation will generally be higher, stating: "NHTSA believes it is unlikely that manufacturers and consumers would value improvements in fuel economy identically, and believes that on average, manufacturers will behave more conservatively in their assumptions of how consumers value fuel economy than how on average consumers will actually behave. NHTSA expects that in practice the number of years fuel is valued by manufacturers will be shorter than the number of years fuel is valued by consumers." 77 Fed. Reg. 63,107.

In the Final Rule, the agencies have assumed that automakers believe that consumers value 2.5 years' worth of fuel economy improvements, and thus that automakers will apply fuel economy technology that pays for itself within those 2.5 years voluntarily. As a result, based on their prior reasoning, the level of consumer valuation of fuel savings would be greater than that value. The agencies cannot now use the same level for both without providing a reasonable explanation for the change of position from their prior analysis.

In sum, the agencies' estimation of consumers' willingness-to-pay for fuel economy improvements is unjustified, inconsistent, and arbitrary. They try to build a case for high consumer valuation of fuel savings ("a large proportion—and perhaps even all"), while ignoring the vast literature on this topic, only to adopt a value that equals about 25 percent of fuel savings with no substantiation other than an undocumented assertion that this is what automakers have told them. Moreover, the 2.5-year valuation is lower than what NHTSA previously cited for automakers' perception of consumers' valuation. It is also inconsistent with NHTSA's previous position that consumer valuation will be higher than manufacturers' valuation.

Even just a small increase in consumer valuation of fuel savings in the sales and scrappage models has meaningful impacts on the agencies' analysis. Petitioners ran the sales and

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[169] *See* 77 Fed. Reg. 63,102-03 (with the section heading, "How do consumers value fuel economy?") and 63,103-04 (with the section heading, "How do manufacturers believe consumers value fuel savings attributable to higher fuel economy?"). Commenters also discussed this in a letter to EPA's Science Advisory Board, explaining why "[g]iven historical evidence and market failures, a flat baseline fleet is the appropriate assumption [for manufacturer's application of fuel economy technology], while some level of consumer willingness to pay for fuel savings should be used in modeling sales"; this letter was subsequently submitted to both agencies. Comment from Center for Biological Diversity, et al. (Jan. 22, 2020), Docket #NHTSA-2018-0067-12452, #EPA-HQ-OAR-2018-0283-7636, Exhibit 2 at 15-16. The 2.5 year payback period assumption for technology application is unjustified and clearly too high, as discussed in comments on the Proposal.

[170] In including this value, NHTSA noted that it is "the average length of a loan." 77 Fed. Reg. at 63,105; *see also id*. at 63,103 (discussing "Turrentine and Kurani's in-depth interviews of 57 households," which found "almost no evidence that consumers think about fuel economy in terms of payback periods," and that when asked questions in those terms, "some consumers became confused while others offered time periods that were meaningful to them for other reasons, such as the length of their car loan or lease") (citing Turrentine, T.S. and K.S. Kurani, 2007, "Car Buyers and Fuel Economy," Energy Policy, vol. 35, pp. 1213–1223)).

scrappage models using a 3-year valuation instead of the agencies' 2.5-year valuation. As discussed above, the agencies erred in assuming a set amount of VMT (35,000 miles) for the first 2.5 years of a vehicle's life instead of using the agencies' own estimates in the CAFE Model. For the evaluation here, we use the agencies' actual VMT estimates for the first 3 years of a vehicle's life, and, for the reasons discussed above, we did separate model runs using car VMT and truck VMT, respectively, as upper and lower bounds of the effects.[171] Using the agencies' estimates of car VMT with a 3-year WTP, the net benefits of the GHG standards in the Final Rule decrease by $6.6 billion (from -$22 billion to -$28.6 billion) at the 3% discount rate and by $3.9 billion (from $6.4 billion to $2.5 billion) at the 7% discount rate. It also reduced the avoided accident-related fatalities that the agencies project under the final GHG standards by 186. Using the agencies' estimates of truck VMT with a 3-year WTP, the net benefits of the GHG standards in the Final Rule decrease by $11.2 billion (from -$22 billion to -$33.2 billion) at the 3% discount rate and by $6.6 billion (from $6.4 billion to -$0.2 billion) at the 7% discount rate. It also reduced the avoided accident-related fatalities that the agencies project under the final GHG standards by 319.

N. The Agencies' Compliance Modeling for the Final Rule is Flawed, Rendering the Model's Projections of the Costs and Benefits of the Final Rule Arbitrary and Unlawful

i. The agencies use an arbitrarily and unrealistically high estimate of off-cycle credit costs in their compliance modeling, and fail to account for the benefits from off-cycle credits in their cost-benefit analysis.

As the Proposal described, "'[o]ff-cycle' technologies are those that reduce vehicle fuel consumption and CO_2 emissions but for which the fuel consumption reduction benefits are not recognized under the 2-cycle test procedure used to determine compliance with the fleet average standards."[172] These technologies thus get their name because they provide real world benefits "off" of the two-cycle test, but do not provide benefits (or provide more limited benefits) "on" the two-cycle test. Thus, they are "off-cycle" technologies.[173]

To enable automakers to utilize off-cycle technologies as part of their compliance strategies, the agencies add "off-cycle credits" to manufacturers' two-cycle test performance values.[174] In other words, "off-cycle credits" are adjustments added to the two-cycle test results that "credit" the manufacturer for improving real-world fuel economy through use of off-cycle technologies.

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[171] These values represent expected values for each class based on the mileage schedule and survival table found in the CAFE Model parameters file. The car VMT used was 45,842, and the pickup truck VMT used was 53,600.
[172] 83 Fed. Reg. at 43,454. The benefits of these technologies are not reflected on the test cycle because that test cycle was "developed in the early 1970s" and simulates driving in that era. *Id*. Thus, the "city test simulates city driving in the Los Angeles area at that time" and "[t]he highway test simulates driving on secondary roads (not expressways)." *Id*. Because these test conditions do not mimic modern driving, they "are unable to measure or underrepresent some fuel economy improving technologies." *Id*.
[173] *See, e.g., id*. at 43,454-55.
[174] *See id*. Although these adjustments are often called "credits," NHTSA has observed that that term is something of a misnomer, as the agencies do not issue bankable or tradable "credits for implementing off-cycle technologies." *Id*. at 43,455. Rather, the "off-cycle credits" are more precisely described as "fuel economy improvement values" or FCIVs, because the agencies "adjust . . . compliance values . . . for those vehicles that implement . . . off-cycle technologies." *Id*.

The agencies' modeling of off-cycle credits in the Final Rule is arbitrary and capricious for a number of reasons, including those described in detail below. The agencies' estimates of the cost of off-cycle credits is unreasonably high, which drives the model to project irrationally and arbitrarily high costs of compliance. In addition, the agencies fail to account for the real-world fuel economy and GHG emissions resulting from the projected deployment of off-cycle technologies in the modeling—despite the fact that those real-world benefits are the entire purpose of the off-cycle crediting provisions in the agencies' standards. This error is likewise arbitrary, and likewise distorts the cost-benefit analysis in favor of the Final Rule. These errors render the agencies' compliance cost modeling wholly arbitrary and unlawful, and EPA must withdraw and reconsider the Final Rule after performing a new analysis in which it has fixed these egregious errors.

a) The agencies' estimates of off-cycle credit costs are unreasonably and arbitrarily high, artificially inflate the agencies' estimates of consumer costs, and fatally undermine the agencies' justifications for the Final Rule.

In the Proposal, the agencies failed to consider or model whether automakers could adopt off-cycle technologies as a means of complying with the previous standards. Specifically, in the Proposal the only off-cycle technologies that the agencies projected would be deployed on the fleet were: (1) those already on the fleet in MY 2016 (the analysis fleet); and (2) those that also have two-cycle benefits (*e.g.*, Stop-Start systems and active aerodynamics) and thus were projected to be adopted into the fleet by the CAFE modeling of two-cycle technologies.[175] In other words, the Proposed Rule did not project that manufacturers would adopt any additional off-cycle technologies that don't also have two-cycle benefits.

Because the Proposal did not model whether additional off-cycle technologies would be deployed beyond those already adopted in the analysis fleet and those associated with technologies with two-cycle benefits, the Proposal did not separately quantify the costs of any off-cycle technologies (or the cost of achieving their associated credits toward compliance).[176]

Comments on the Proposal observed that the agencies' failure to model or project penetrations of off-cycle technologies as means of cost-effective compliance pathways was arbitrary and irrational. For example, the International Council on Clean Transportation (ICCT) stated that "[i]f the agencies had appropriately analyzed the implications of the off-cycle

[175] *See* 85 Fed. Reg at 24,577 ("The NPRM [Proposed Rule] analysis used the off-cycle [Fuel Consumption Improvement Values] FCIVs and credits earned by each manufacturer in MY 2016 and carried these forward at the same levels for future years for the CO2 analysis and beginning in MY 2017 for the CAFE analysis. . . Additional off-cycle FCIVs were added in future years if a manufacturer applied a technology that was explicitly simulated in the analysis and also was an off-cycle technology listed on the predefined menu.")

[176] *See id*. at 24,584 ("the only A/C efficiency and off-cycle technologies applied dynamically in the NPRM analysis were explicitly simulated technologies like stop-start systems and active aerodynamic technologies. The NPRM analysis fully accounted for both the effectiveness and cost of these technologies and therefore separate cost accounting was not needed. For example, when stop-start or active aerodynamics technology was added by the model to a vehicle, the corresponding off-cycle FCIVs were applied and the technology costs were captured the same as every other technology on the decision trees.")

provisions, they would conclude that far greater use of the off-cycle provisions will occur by 2025, and this would greatly reduce the penetration of on-cycle technologies (e.g., engine, transmission, and hybrid), with major reductions in reducing overall GHG and CAFE compliance costs . . ."[177] And the Institute for Policy Integrity observed that using "the off-cycle credits submitted by each manufacturer for MY 2017 compliance and carr[ying] these forward to future years . . . [means that f]or some manufacturers . . . the agencies assume zero or low use of off-cycle adjustments in perpetuity, just because of their compliance choices for MY 2017. That is an illogical and arbitrary assumption. Rather, the agencies should assume that manufacturers will efficiently deploy all cost-saving offset opportunities, especially in the face of increasingly stringent standards."[178]

ICCT also observed that "trends that are clearly showing increasing adoption of off-cycle technologies that are evidently cost-effective for most automakers in the baseline 2016 fleet." [179] And ICCT commented that the agencies must "analyze and project the specific [OC] technologies automakers will use[.]"[180] ICCT further stated that "the agencies have failed to correctly assess the technology, costs, and effectiveness of both available and projected off-cycle technologies."[181] And ICCT objected that the Proposal did "not estimate technology cost, effectiveness estimates, future deployment by company, or cost effectiveness within technology pathways." [182]

In the Final Rule, the agencies changed their approach to considering off-cycle compliance pathways as part of the available mechanisms for automakers to comply with the standards. Specifically, the agencies state that they "agree that A/C and off-cycle technologies are likely to be more broadly applied by manufacturers within the rulemaking timeframe."[183] However, to account for their expectation that off-cycle technologies will be "more broadly" utilized by manufacturers, the agencies adopted a wholly irrational and arbitrary modeling methodology that causes the model to produce unrealistic, unreliable, and unlawful results.

In the Final Rule, the agencies again use the penetration of off-cycle technologies in the analysis fleet (now MY 2017) as their "starting point" (and thus carry these technologies forward throughout the remaining MYs in their analysis).[184] And the model still applies any off-cycle credits that the model projects will be applied to the fleet due to their two-cycle benefits.[185] However—unlike the Proposed Rule—they have also hard wired the model such that every

[177] Comment of the International Council for Clean Transportation (ICCT), Docket #NHTSA-2018-0067-11741 (Comment of the ICCT), at I-41.
[178] Comments from Institute for Policy Integrity, Attachment 1, Docket #NHTSA–2018–0067–12213, at 20–21.
[179] Comment of the ICCT at I-43 (citing U.S. Environmental Protection Agency, 2017. Greenhouse Gas Emission Standards for Light-Duty Vehicles Manufacturer Performance Report for the 2016 Model Year. Accessed from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100TGIA.pdf).
[180] *Id*. at I-43.
[181] *Id*. at I-40.
[182] *Id*.
[183] 85 Fed. Reg. at 24,579.
[184] *Id*.
[185] *Id*.

manufacturer will achieve 10 g/mi of off-cycle credits by 2023.[186] They do this by simply extending each manufacturers' pre-2017 historical rate of off-cycle technology adoption through 2023—or, where that method won't show a given manufacturer hitting the 10 g/mi cap by 2023, the agencies simply model a "linear increase" in off-cycle credits over time so that that manufacturer will hit the 10 g/mi cap by 2023.[187]

Thus, the agencies did not analyze the costs or cost-effectiveness of off-cycle technologies in the fleet relative to other available technologies, nor did they analyze whether adoption of off-cycle technologies in the model would increase or decrease projected compliance costs. In effect, the agencies wholly ignored (and did not acknowledge or respond to) comments that they must "analyze and project the specific [off-cycle] technologies automakers will use."[188] In other words, rather than modeling the specific off-cycle *technologies* that manufacturers will adopt, the agencies modeled the specific number of off-cycle *credits* they assume manufacturers will receive.

The costs assigned to the automatically-applied off-cycle credits are unjustified and vastly inflated. The agencies estimate that in MY 2026 off-cycle credits will cost $76.31 per g/mi.[189] But, as shown in the chart below, in MY 2026 *every* automaker's average cost for the two-cycle technologies used toward compliance in the GHG program is less than $32 per g/mi.[190] And the fleetwide average cost for two-cycle technologies is less than $23 per g/mi.[191] Thus, in the agencies' modeling the cost to comply using off-cycle credits is *3.3 times* as much as the cost to comply using two-cycle technologies. Contrary to the agencies' modeling, no rational automaker would use off-cycle credits as a compliance mechanism if they cost more than the alternate technologies available to achieve compliance. And the fact that automakers *are* using them and have announced plans to continue using them (as the agencies acknowledge in the Final Rule)[192] demonstrates that in the real world they *must cost less* than the alternate technologies available. The agencies' assumption that much more costly off-cycle credits will be applied before and instead of lower-cost test-cycle technologies—with no justification offered for this economically counterproductive outcome—is sufficient to demonstrate that the agencies' approach is arbitrary and unlawful.

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[186] *Id*. This petition refers to off-cycle credits in increments of g/mi in the context of both the GHG program and the CAFE program because NHTSA assigns off-cycle credits by using EPA's values in g/mi, and then converting them to "fuel consumption improvement values" in "gallons per mile." *Id*. at 25,228. Thus, NHTSA uses g/mi as its starting point in calculating off-cycle credit values. For this reason, even NHTSA's own sensitivity runs refer to changing the number of g/mi of off-cycle credits in the modeling analysis. *See* FRIA at 1771.

[187] *Id*. at 24,579. *See also id*. at 24,580-83 (showing rates of off-cycle adoption for each manufacturer). To put this 10 g/mi into context, the agencies project that the combined fleet will be required to improve by a total of 24 g/mi from MY2020 to MY2026 under the Final Rule standards. *Id.* at 24,119 (Table II-17). In MY 2017, the combined fleet averaged 4.8g/mi of OC credits, meaning the agencies project the fleet will add an additional 5.2 g/mi of OC credits by 2025. This modeled fleet-wide increase comprises more than 21% of the estimated improvement required in the fleet by the Final Rule standards (5.2/24 = 21.7%).

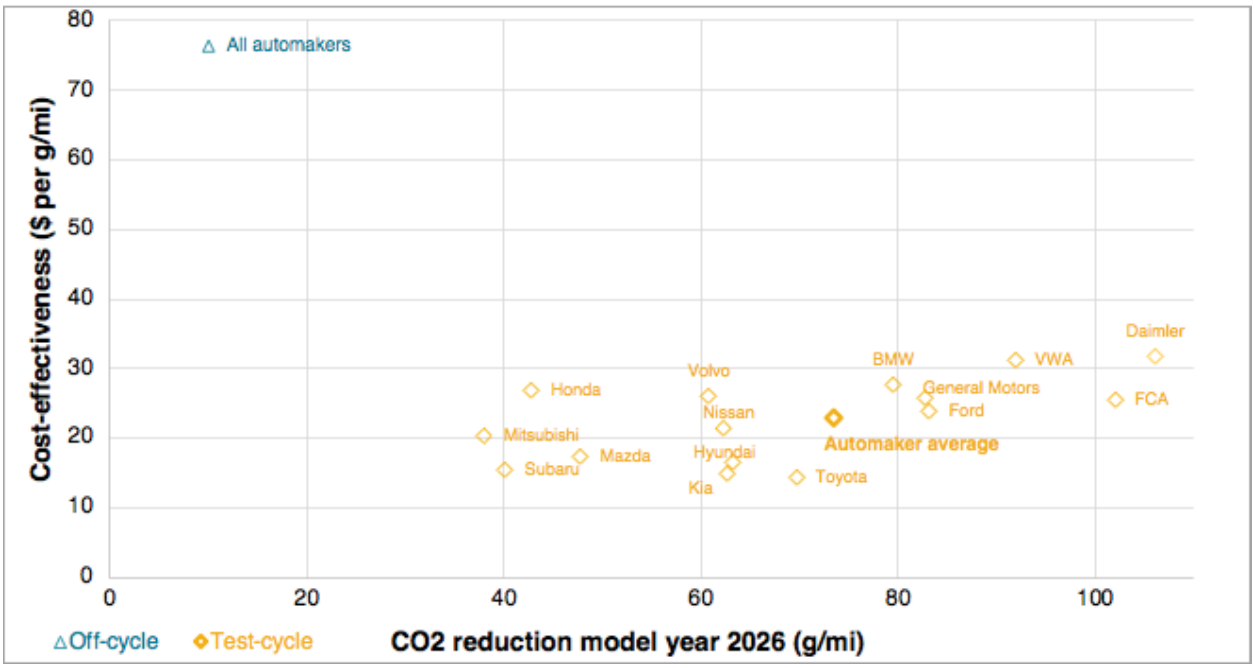
[188] *See* Comment of the ICCT at I-43.

[189] FRIA at 282 (Table VI-18).

[190] Data from the Final Rule CAFE Model Compliance Report (GHG standard-setting central analysis), with the average costs separately shown for test-cycle and off cycle technologies applied in model year 2026. Available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system

[191] *Id*.

[192] *See* 85 Fed. Reg. at 24,579.



Digging into the source of the agencies' cost estimate further confirms that their cost estimate is unmoored from any rational analysis or research into the true costs of off-cycle technology, and cannot plausibly be used even as a rough *estimate* of those costs. Specifically, the agencies state that they used the same cost values for off-cycle credits as EPA used for off-cycle credit costs in its 2016 Midterm Evaluation Technical Support Document ("TSD").[193] As described below, the agencies' use of that methodology is irrational and arbitrary in three separate ways. First, the methodology itself is arbitrary. Second, the fact that the agencies have used that methodology in *this* Final Rule is arbitrary. And third, the *way* they utilized that methodology in this Final Rule is arbitrary.

First, the methodology EPA used to estimate the costs of off-cycle credits in the TSD—that is, the method upon which the Final Rule estimate of off-cycle costs is based—is irrational and arbitrary. That methodology has no basis in the real world and cannot reasonably be used as a proxy for the real-world cost of off-cycle credits in the agencies' modeling.

In the TSD, EPA did not assess "particular off-cycle technologies or their costs and credits," but used an OMEGA sensitivity run for two-cycle technologies as a proxy.[194] Specifically, EPA used the OMEGA model to estimate the average cost to comply with the previous standards (with a then-projected CO_2 target of 199 grams CO_2 per mile in 2025) under the "Perfect Trading" run (which treats the entire U.S. Fleet as one manufacturer).[195] In that case, EPA found

[193] 85 Fed. Reg. at 24,584.
[194] TSD at 2-424.
[195] *Id.*

that the cost per g/mi reduction was $34.[196] EPA then "applied a 30 percent premium" to that figure, resulting in a $45 cost (in 2013 dollars) per g/mi reduction.[197] EPA did not explain where this 30 percent number came from.[198] EPA used this $45 figure as the base cost for the first increment of off-cycle credits that the model could deploy as a compliance strategy.[199] This first increment was labeled the "off-cycle technology level 1" credit package, and comprised 1.5 gCO_2/mi in credits.[200]

EPA also then made a second increment of off-cycle credits available in the model.[201] To calculate the cost for these credits, EPA increased the price premium from 30 percent to 60 percent, resulting in a base cost of $55 per g/mi (in 2013 dollars).[202]

EPA's methodology is arbitrary at every step of its process. First, EPA did not (and the agencies do not) offer any justification for using projections of the cost to comply in MY 2025 in the "Perfect Trading" sensitivity run as a starting point to estimate the costs of off-cycle credits. EPA offered no rationale whatsoever for why that run could plausibly serve as a proxy for estimating off-cycle credit costs,[203] and the agencies offer none here.[204] Second, EPA applied a cost premium on top of the cost per g/mi returned by that sensitivity run. But EPA itself acknowledged that automakers' actions demonstrated that off-cycle credits were cost-effective compliance pathways even before EPA published the TSD—in 2016—and thus that they would use them toward MY 2025 compliance.[205] The use of off-cycle credits for compliance demonstrates that off-cycle credits were (and are) *more* cost-effective than test cycle technologies, not *less*. Thus, if anything, EPA should have applied a cost *discount*, not a cost *premium*. Third, even if it had been appropriate to apply a cost premium, which it was not, EPA offered no justification or rationale for selecting 30% as the appropriate premium to apply for the first increment of off-cycle credits, nor for selecting 60% as the appropriate premium to apply for the next increment of off-cycle credits. Simply, every step in the TSD methodology of estimating off-cycle costs was unjustified, unsupported, unsupportable, and arbitrary. And nowhere did EPA even attempt to suggest that the estimate derived from that methodology bore any actual resemblance to the real-world cost of off-cycle technologies. Nor could it.

Second, the OMEGA cost projections that EPA used in the TSD to estimate off-cycle costs were costs for test-cycle technology to achieve an emissions level of 199 gCO_2/mile in MY 2025 without consideration of A/C or off-cycle credits.[206] But under the Final Rule, automakers will be complying with much weaker standards. Yet the agencies suggest that automakers have been

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[196] *Id*.
[197] *Id*.
[198] *Id*.
[199] EPA also adjusted the $45 to 2015 dollars and applied an unexplained 'low complexity markup' of about 25% (presumably to account for indirect costs) to arrive at a final total cost for the "off-cycle technology level 1" credit package of $57.33 per g/mi. *Id*.
[200] *Id*.
[201] *Id*. This was labeled the "off-cycle level 2" credit package and consisted of 3 g/mi of off-cycle credits. *Id*.
[202] *Id*. Again, EPA adjusted the $55 to 2015 dollars and applied the unexplained 'low complexity markup' of about 25% to arrive at a final total cost for the "off-cycle level 2" credit package of $70.33 per g/mi. *Id*.
[203] *See Id*.
[204] *See* 85 Fed. Reg. at 24,584.
[205] *See* TSD at 4-424
[206] *Id*.

and will continue to use off-cycle credits as a cost-effective compliance mechanism to achieve reductions in emissions and increases in fuel economy even under standards as lenient as the Final Rule standards. As a result, automakers' real-world behavior demonstrates that off-cycle technologies are more cost-effective than the test-cycle technologies needed to meet the weaker standards. Again, this demonstrates that any proxy for the costs of off-cycle technologies would need to rely on the costs of the test-cycle technologies applied to achieve the weakened MY 2025 standards—not those of the previous/augural CAFE standards or the previously promulgated GHG emission standards.

Finally, even if the methodology in the TSD were not itself arbitrary and unlawful, and even if it were not also arbitrary for the agencies to use that methodology in the Final Rule, the *way* the agencies have used that methodology in the Final Rule is also arbitrary. Specifically, the agencies have only incorporated the *highest* cost estimate from the TSD—that is, the TSD's cost estimate for the second increment of off-cycle technology, which includes a 60% price premium—and did not use the TSD's cost estimate for the first increment—which includes a 30% price premium—at all.[207] Even if the agencies could plausibly use the TSD cost estimates as the basis of off-cycle costs in the Final Rule, the agencies cannot reasonably use (without acknowledgment or explanation) only the highest cost (and thus least cost-effective) estimate from the TSD.[208]

To test the impact of the agencies' irrationally high off cycle costs, we ran a sensitivity case in which we set the cost of off-cycle credits to $0 per g/mi. In that run, the total cost to comply with the previous standards in MY 2029 (relative to the MY 2017 analysis fleet) decreased by $729—from $2,558 to $1,829. And costs to comply with the Final Rule standards decreased—from $1,553 to $824. That means off-cycle credits account for 29%[209] of agencies' total costs of compliance for the previous standards and 47%[210] of the agencies' projected costs to achieve the Final Rule standards.

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[207] The agencies do not acknowledge, discuss, or explain in the Final Rule that they used only the highest cost estimate from the TSD. *See* 85 Fed. Reg. at 24,584. But the only way we could replicate the figure used in the Final Rule was by using the highest cost estimate. Specifically, the base cost for the second increment of off-cycle credits in the TSD was $55 in 2013 dollars, as described above. Updating that value to 2018 dollars by adding 5.45% and then applying a 50% retail price equivalent (RPE) markup yields a total cost of $89.63—within $0.04 of the MY 2017 cost of $89.59 g/mi used in the Final Rule. *See id*. (For the 5.45% inflation value, *see* 85 Fed. Reg. at 24,712 n.1853 (describing that for inflation figures the Final Rule used the Bureau of Economic Analysis, NIPA Table 1.1.9 Implicit Price Deflators for Gross Domestic Product, available at https://apps.bea.gov/iTable/index_nipa.cfm.)).

[208] Yet another arbitrary aspect of the agencies' treatment of off-cycle costs is that they treat costs of off-cycle and A/C efficiency technologies that are already in the MY 2017 fleet as costs of compliance. This erroneously and unjustifiably adds cost on top of their existing baseline vehicle prices. Specifically, the agencies project that automakers will incur $432 per vehicle in compliance costs due to the 4.8 g/mi of off-cycle technology that they applied to their vehicles in MY 2017, and then the agencies arbitrarily include the cost of those same technologies as compliance costs in all following years. By definition, these technologies are already included in the baseline and cannot be included in the agencies' accounting of compliance costs. The agencies' approach is directly contrary to the agencies' methodology for all other technologies, which assumes that MY 2017 is the starting point for projecting compliance pathways and thus costs of compliance can only be incurred for new technologies installed in and after MY 2018.

[209] (729/2,558) = 28.5%

[210] (729/1,553) = 46.9%

Of course, real-world off-cycle costs are not zero. Nevertheless, they are more cost-effective than two-cycle technologies—otherwise, automakers would not be applying them (and stating their intention to *continue* applying them) so extensively. The agencies have offered *no* analysis of specific off-cycle technology costs to inform a decision on what off-cycle cost would be reasonable to adopt in the model. Therefore, the "zero cost" off-cycle sensitivity run described here provides a sense of the maximum impact the agencies' irrational modeling has. On the other end of the spectrum, as described above, automakers' real-world actions demonstrate that off-cycle technologies are more cost-effective than two-cycle technologies, and the GHG program modeling runs project that two-cycle technologies cost 71% less than the cost the agencies have assigned to off-cycle credits. Thus, off-cycle technologies must be modeled to cost less than this amount. And when we ran the model with off-cycle cost inputs 75% lower than the agencies modeled, the projections of total compliance costs declined by $547, or 21%,[211] in the previous standards scenario. Therefore, the agencies' unfounded and unreasonable estimates for off-cycle costs inflate compliance cost projections in the previous standards scenario by at least 20%, and almost certainly more.

These numbers are significant. EPA states that a central justification for rolling back the previous standards to the Final Rule standards is that the additional $977 in compliance costs that will be incurred for the fleet to meet the previous GHG standards is too much.[212] But the off-cycle credits account for $729 of the agencies' total projected compliance costs. EPA cannot plausibly justify the Final Rule by arguing that the additional $977 they project consumers will incur in vehicle costs from the previous standards drive total vehicle prices too high when the agencies' own analysis shows that their unreasonable and arbitrary off-cycle costs account for fully $729 of their projected total vehicle prices. In other words, the agencies cannot categorically argue that an *increase* in price is too much without a corresponding (and accurate) assessment of *total* price. And in the Final Rule, their projections of total price are fundamentally flawed and arbitrary, in part because of the agencies' arbitrary estimate for off-cycle costs. The agencies' unreasonable off-cycle cost estimates thus demonstrate that the agencies' justification for the Final Rule is arbitrary and unlawful.

b) The agencies arbitrarily fail to consider fuel-savings or GHG benefits from off-cycle technologies in the cost-benefit analysis, fatally undermining that analysis.

Further, in the Final Rule the agencies unjustifiably and arbitrarily fail to include the GHG or fuel savings benefits from off-cycle technologies in their cost-benefit analysis. In other words, the agencies have both assigned off-cycle credits unreasonably high costs in their modeling (as described above) and have assumed that those technologies carry *zero* actual benefits. This is, of course, contrary to the entire purpose of the off-cycle credit program, which is designed to allow automakers to improve real-world fuel economy and emissions performance in ways that are not captured on the compliance test. Yet the agencies have failed to offer any justification or explanation for their failure to attribute real-world benefits to off-cycle technologies. Nor could they, as this failure is irrational and arbitrary on its face.

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[211] (547/2,558) = 21.4%.
[212] *See*, *e.g.*, 85 Fed. Reg. at 24,176.

That the agencies have failed to count the benefits of off-cycle technologies in their analysis is evident from the CAFE Model Documentation, which has been revised to admit as much in the Final Rule version. It now states that "the values contained in the Societal Effects Report are computed as total VMT divided by total gallons (with the effect of the on-road gap backed out), and do not incorporate some of the compliance-related credits or adjustments (specifically, AC leakage adjustments or off-cycle credits)."[213] Though this sentence is somewhat convoluted, it is ultimately an admission that "the values contained in the societal effects report . . . do not incorporate some of the . . . off-cycle credits."[214] And, because the values in the societal effects report inform the agencies' cost-benefit analysis, the cost benefit analysis fails to incorporate the real-world impacts on fuel savings and GHG emissions from off-cycle technologies.[215]

The agencies' sensitivity runs provide insight into the impacts of the failure to consider benefits from off-cycle technologies. Specifically, the "fewer OC [off-cycle] credits" run shows that, using a 3% discount rate under the CAFE program, decreasing off-cycle credit use from 10 g/mi to 7 g/mi causes per-vehicle fuel savings to increase from $1,423 to $1,437, and increasing off-cycle credit projections from 10 g/mi to 15 g/mi causes per-vehicle fuel savings to decrease from $1,423 to $1,355.[216] For the GHG program, the per-vehicle fuel savings also increase in the "fewer" off-cycle credit run. Specifically, using a 3% discount rate the per-vehicle fuel savings in the central case (with 10 g/mi of off-cycle credits) are $1,461[217] and the "fewer" (7 g/mi) off-cycle credits run increases this to $1,502.[218] As for the "more" off-cycle credit run, the

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[213] Final Rule CAFE Model Documentation at 194.

[214] In particular, the sentence describes that the societal effects report uses Total Gallons to compute MPG, but there is no way to compute Total Gallons independent of MPG (that is, MPG is an input into the equation necessary to compute Total Gallons). This begs the question of how the agencies computed Total Gallons in the first place. Moreover, fuel savings and GHG benefits would be calculated off of Total Gallons, not off of MPG (except insofar as MPG is used to calculate Total Gallons). Thus, what the sentence *should* have explained is how the agencies arrived at the MPG they used to compute the Total Gallons, before then using Total Gallons to compute the fuel savings and GHG benefits in the societal effects report. But it doesn't. Regardless, in the societal effects report the reported Total VMT divided by reported Total Gallons does equal the reported onroad fuel economy; that onroad fuel economy multiplied by the on-road gap (0.8) equals the rated fuel economy; and that rated fuel economy value (in the societal effects report) differs from the rated fuel economy value in the compliance report output file by an amount equal to excluded off-cycle benefits. Thus, notwithstanding the agencies' lack of precision in this sentence, it does demonstrate that the difference between the values (including fuel savings and GHG emissions values) in the compliance report and the societal effects report are due to the fact that Total Gallons in the societal effects report does not account for off-cycle credits. In other words, the agencies do not attribute fuel-saving or emission reduction benefits to off-cycle credits in their analysis.

[215] The Proposed Rule CAFE Model Documentation did not directly identify that "the values contained in the societal effects report . . . do not incorporate some of the . . . off-cycle credits" as the Final Rule CAFE model documentation does. Final Rule CAFE Model Documentation at 194. Instead, the Proposed Rule CAFE Model Documentation stated only that the values in the societal effects report do "not incorporate some of the compliance-related credits or adjustments," leaving the reader to investigate which "credits or adjustments" were referred to. Proposed Rule CAFE Model Documentation at 160. Given this, commenters could not have known that the agencies were not counting benefits from off-cycle credits in the Proposal. Moreover, as discussed above, in the Proposal the agencies did not project that any additional off-cycle credits would be added to the fleet and so it was not highly relevant whether the model was built to count benefits from off-cycle technologies, and commenters had no reason to research whether the model could accurately perform such a basic task as counting benefits from off-cycle technologies.

[216] FRIA at 1779, 1780 (Table VII-474).

[217] *Id*. at 1783 (Table VII-476).

[218] *Id*. at 1785 (Table VII-476).

model output files and the Final Rule both show that that run also increases fuel savings (to $1,512)[219]—but that improbable result stems from an error in how the agencies performed the run. Specifically, for that run the agencies appear to have used the scenarios file for the CAFE standards, not the GHG standards.[220] When we performed the same run using the scenarios file for the GHG standards, fuel savings decreased to $1,358. Thus, the corrected run shows that fuel savings decrease in the "less" off-cycle credits scenario for the CAFE model runs for the GHG program—a result that is consistent with the results for the CAFE program.

In other words, the sensitivity cases for both the CAFE and GHG standards show that adding more off-cycle credits causes the model to project less fuel savings—meaning that the fuel savings the model projects to accrue from the previous standards decrease as the level of off-cycle credits increases. This is an absurd result. If the agencies had appropriately counted fuel savings benefits from off-cycle technologies, the sensitivity results would show no change in fuel savings because any loss in fuel savings from reducing off-cycle technologies in the fleet would be exactly offset by identical fuel savings from the test cycle technologies that are adopted to replace them. The agencies must treat fuel savings and GHG reductions achieved through off-cycle technologies as identical to fuel savings and GHG reductions achieved through test cycle technologies. Indeed, that is the entire reason for the off-cycle program's existence. By failing to account for the real-world benefits of the 10 g/mi of off-cycle technologies in the fleet, the agencies artificially deflate the benefits of the previous standards relative to the rollback.

Moreover, the failure to include these benefits filters through myriad aspects of the agencies' modeling—including the agencies' projections of sales, fleet size, and VMT—because the agencies use fuel savings values to create all of those projections.[221] Failure to count these savings fatally undermines the agencies' entire modeling analysis, demonstrating that the agencies' cost-benefit analysis is irrational and unreliable as a measure of the true costs and benefits of the Final Rule.

In sum, the agencies have assigned unjustifiably high costs to off-cycle credits in their modeling while simultaneously failing to attribute any fuel savings or GHG emissions benefits to those technologies. These flaws are wholly irrational, unreasonable, arbitrary, and unlawful. They undermine the agencies' central justifications for the Final Rule, and they permeate throughout the agencies' modeling rendering it unreliable as an analytical tool. EPA must reconsider the Final Rule, undertake an analysis to determine the actual costs of the specific off-cycle technologies automakers will use to comply with the standards, and include the benefits of those technologies in their cost-benefit analysis.

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[219] *Id*.

[220] *Compare* Final Rule CAFE Model log file "Summary.txt" for the CAFE "More Off-Cycle Credits" sensitivity run *with* Final Rule CAFE Model log file "Summary.txt" for the GHG "More Off-Cycle Credits" run (showing that the same "scenarios_more_OC_credits.xlsx" file was used for both the CAFE and the GHG sensitivity runs), available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system

[221] That the failure to consider benefits of off-cycle technologies impacts other aspects of the agencies' modeling is demonstrated by the agencies' sensitivity tables, which show that the "fewer" and "more" OC sensitivity cases return different forecasts of sales, fleet-size, and vehicle-miles-traveled (VMT) than the central case. *See* FRIA at 1789, 1792 (Table VII-478).

ii. The agencies have—without acknowledgement or explanation—arbitrarily reduced their assessment of efficiency and emissions benefits from mild hybrid belt mounted starter generator (BISG) technology.

The agencies have decreased the incremental efficiency and GHG emissions benefits of mild hybrid belt mounted integrated starter generator (BISG) technology in the modeling. Specifically, the midpoint BISG efficiency benefit over conventional non-electric powertrain technology (CONV) decreased from 6.5% in the Proposed Rule to 5.8% in the Final Rule, and the midpoint BISG benefit over 12 volt Stop-Start technology (SS12V) decreased from 4% in the Proposed Rule to 3.1% in the Final Rule.[222] Thus, the Final Rule decreases the modeled benefit from BISG technology over CONV by nearly 11%[223] and over SS12V by nearly 23%.[224] Those changes, in turn, effectively decrease the modeled cost effectiveness of BISG technology. However, the agencies fail to acknowledge, discuss, or explain the decrease in BISG efficiency values anywhere in the Final Rule, FRIA or model documentation.

Moreover, in this respect the Final Rule diverges from its approach to presenting efficiency values for other modeled technologies (such as engines, transmissions, road-load reductions and "other" technologies). For those technologies, the agencies provide figures and tables showing the changes in technology efficiency and emissions improvement values from the Proposal to the Final Rule.[225] But the agencies do not provide any such tables or figures for electrification technologies, including BISG.

Thus, to evaluate the change in modeled efficiency benefits of BISG from the Proposal to the Final Rule, we were required to replicate the technique the agencies used to derive their values for technology effectiveness for engines, transmissions, load reduction, and "other" technologies in the Final Rule. Specifically, we performed "sweeps" of the modeling results using CAFE model reference case technology input files for both the Proposal and Final Rule.[226] The database contains values (or "technology vectors") showing the efficiency benefit of every technology relative to every combination of baseline technologies in the model for each vehicle class in the model. In other words, we pulled these values from the database to find the incremental efficiency improvement attributable to BISG technology when added to any combination of baseline technologies. In so doing, we catalogued the projected effectiveness values for BISG in combination with projected variations of other technologies in the modeling.

The results are shown in the figure below (in the figure, the vertical lines, or "whiskers," show the range of effectiveness to the 95th percentile ranges, the boxes show the range of values

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[222] We note that even the Proposed Rule efficiency values were unreasonably low. *See, e.g.,* Comment of the ICCT at I-23 to I-25.
[223] 1 – (5.8/6.5) = 10.8%
[224] 1 – (3.1/4) = 22.5%
[225] *See*, *e.g.*, FRIA at 524 (Figure VI-67) (showing effectiveness values for engine technologies in the Proposal); *id*. at 526 (Figure VI-68) (showing effectiveness values for engine technologies in the Final Rule).
[226] Final Rule CAFE model file: "FE1_adjustments.csv," located in "SimulationDatabase.pack," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system; Proposed Rule CAFE model file: "FC1_improvements.csv" from within "SimulationDatabase.pack," located in "SimulationDatabase.pack," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.

for the middle 50%, and the horizontal lines represent the midpoint or median values). As shown, BISG efficiency over conventional, non-electric powertrain technology (CONV) decreased between the Proposal (where it had a midpoint efficiency benefit of 6.5%) to the Final Rule (where it has a midpoint efficiency benefit of 5.8%). Further, (also shown in the figure) relative to SS12V, the BISG efficiency benefit decreased even more—from a midpoint of 4.0% in the Proposal to a midpoint of 3.1% in the Final Rule, though this decrease relative to SS12V is due in part to the fact that the modeled SS12V efficiency benefit improved slightly from a midpoint of 2.5% in the Proposal to a midpoint of 2.7% in the Final Rule.

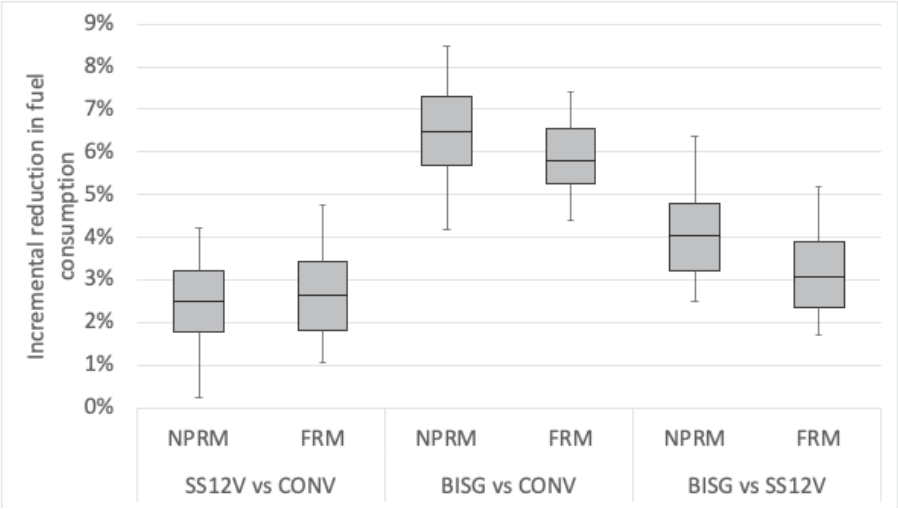

Figure: BISG technology effectiveness benefits across all technology packages

But these changes are completely unacknowledged and unexplained in the Final Rule. In fact, the only discussion in the Final Rule regarding BISG relates to changes in BISG cost and battery sizes that were made in the Final Rule analysis.[227] Specifically, the agencies describe that they reduced BISG voltage from 110v to 48v and reduced battery size from 0.86 kWh to 0.43 kWh, and that these changes brought associated cost reductions.[228] However, there is no discussion whatsoever regarding how these changes could have affected the agencies' efficiency values.

Moreover, there is no engineering or technological justification for concluding that either of these changes would alter BISG's efficiency benefits at all. First, the agencies affirmatively state that, despite these changes, the BISG motor efficiency maps used for the Final Rule analysis are "the same" as those used in the Proposed Rule analysis.[229] But if the efficiency *map* is the same, then the modeled *motor efficiency* should also be the same—because the values of a technology's efficiency are directly derived from the efficiency map.

[227] *See* FRIA at 631 ("The agencies . . . conclude that the NPRM analysis overestimated the costs of [mild hybrid] technologies.").
[228] *Id*.
[229] *Id*. at 620 ("For the final rule, the agencies used the same [electric motor] efficiency maps as the NPRM, except for BEVs.").

Second, the agencies state that the BISG motor size (10 kW) is the same in the Final Rule analysis as it was in the Proposed Rule analysis.[230] And if the motor size does not change, then a change in the battery pack *size* should not change the battery *operation* if both batteries can produce enough electricity to operate the same 10 kW motor at its full power, and if it can recapture the full power output from the motor through regenerative braking. And a 0.43 kWh BISG battery size can easily do both.[231] Moreover, because mild hybrid vehicles alternate between cycles of power output and regeneration frequently, the total battery state of charge rarely varies by more than a few percent. In other words, a BISG vehicle would not deplete the charge in a 0.43 kWh battery enough to affect performance or limit the efficiency benefit of the BISG system. Thus, the agencies' change in battery pack size should not degrade the efficiency of the modeled 10kW BISG system. The agencies' downward revision of this efficiency benefit is thus incorrect, arbitrary, and unlawful.

Moreover, the agencies in fact state that they changed aspects of their modeling of BISG that should have *increased* BISG's efficiency benefit. Specifically, the FRIA stated that in the agencies' updated modeling for the Final Rule, "the usable battery capacity" and "the duration of electric motor use by the vehicle before starting the engine" were increased.[232] In other words, the agencies expanded the amount of the battery's total capacity that is available to operate the motor, and expanded the amount of time during which the motor can operate to assist the engine—thus expanding the amount of time during which the motor provides fuel efficiency and GHG benefits to the vehicle. Both of these changes would *increase* the benefits of installing BISG technology, not *decrease* them as the agencies have modeled.

The agencies do not describe any further changes to BISG that would justify reducing its efficiency benefit in the modeling. Here we note that the agencies did state that the "specifications and assumptions for the 48V BISG system are further discussed in the FRM Argonne Model Documentation and FRM Argonne Assumptions Summary."[233] But neither the Argonne Model Documentation nor the Argonne Assumptions Summary contains any further description of how BISG efficiency estimates were adjusted for the Final Rule.[234]

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[230] *Id*. at 631 ("The 48V mild hybrid BISG system used the same 10 kW electric motor as the one used in the NPRM analysis[.]"); *see also* FRIA at 620-21 (Tables VI-103 and VI-104) (showing source of BISG efficiency map for Final Rule is the same as source of BISG efficiency map for the NPRM).

[231] *See, e.g.*, A123 48v battery with 0.36 kWh capacity and 15 KW of power output, available at: http://www.a123systems.com/automotive/products/systems/48v-battery/.

[232] FRIA at 631.

[233] *Id*.

[234] *See id.* n.1253 (citing FRM ANL Model Documentation, at 4.6, 4.13, and 5.7); ANL Model Documentation, Docket #EPA-HQ-OAR-2018-0283-7673, at 4.6 (providing no discussion of the BISG battery used or how the change in size might affect efficiency); *id*. at 4.13 (describing only how BISG systems are integrated with engine operation, specifically when the engine is turned on and off and adjustments for limited assist during propelling); *id*. at 5.7 (discussing fuel cell vehicles); *id*. at 5.6 (merely referencing the same BISG motor efficiency map as is referenced in the FRIA at 621 (Table VI-104), which is, in turn, the same map as was used in the Proposal, *see* FRIA at 620); *see also* FRIA at 631 n.1254 (citing ANL Assumptions Summary); *id*. at 236 (Table VI-6) (describing documents comprising the ANL Assumptions Summary); "ANL_Summary_of_Main_Component_Performance _Assumptions_FRM_06172019_FINAL," Docket #NHTSA-2018-0067-12467 (containing electric motor maps but no data or information on why BISG efficiency values were changed); "ANL - All_Assumptions_Summary _FRM_06172019_FINAL.xls," Docket #NHTSA-2018-0067-12464 (containing no data or information relevant to BISG efficiency); "ANL – Data_Dictionary_FRM_06172019.xls," Docket #NHTSA-2018-0067-12466 (merely

The agencies' change in BISG efficiency is thus arbitrary and unlawful, as is the agencies' failures to acknowledge, discuss, or explain that change or its impact.

iii. In the Final Rule, the agencies' estimate of the fuel economy and GHG emissions benefits from adding cylinder deactivation to turbocharged vehicles is unreasonably low and the agencies have failed to provide the public with adequate information to enable analysis of the methodology used to arrive at that estimate.

In a change from the Proposal, in the Final Rule the agencies allow cylinder deactivation (DEAC) and advanced cylinder deactivation (ADEAC) to be added to turbocharged vehicles (TURBO1) in their modeling. They refer to the resulting technology combinations as TURBOD and TURBOAD, respectively.[235]

The agencies' analysis shows that they used unreasonably low estimates for TURBOD effectiveness. For example, the technology input file for the Final Rule indicates that a 4-cylinder Medium Car with AT6 transmission and baseline loads and a basic engine (with variable valve timing and stoichiometric gasoline direct injection) will improve efficiency by 3.9% from adding DEAC.[236] But the technology input file also shows that adding DEAC to a turbocharged vehicle (moving from TURBO1 to TURBOD) on that same car improves efficiency by only 0.9%.[237]

That the agencies have modeled that the benefit of adding DEAC to TURBO1 is less than 25% of the benefit from adding DEAC to a basic engine appears unreasonable. That decrease is significantly more than would be expected. As the agencies have acknowledged, "DEAC's fundamental benefits are driven by reducing pumping losses and by enabling the engine to operate in a more thermal efficient region of the engine fuel map."[238] Although adding DEAC to other technologies that also reduce pumping losses—including TURBO—has "lower [benefits] than for naturally aspirated engines,"[239] DEAC does still reduce pumping losses relative to TURBO1. And—again, as the agencies acknowledge—DEAC has the additional benefit of "enabling the engine to operate in a more thermal efficient region of the engine fuel map."[240] Thus, even if there were zero additional benefit from pumping losses from adding DEAC to TURBO (which is not true), DEAC would still increase an engine's thermal efficiency relative to TURBO1. That the benefits for both the reduced pumping losses and increased thermal efficiency would total less than 1% improvement in engine performance is implausible.

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containing descriptions of the parameters used in Autonomie but no data or information on technology performance).

[235] *See* 85 Fed. Reg. at 24,402.

[236] Final Rule CAFE Model File "FE1_adjustments.csv" found in "SimulationDatabase.pack," which in turn is found inside the Final Rule CAFE Model source code, available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.

[237] *Id*.

[238] FRIA at 495.

[239] *Id*.

[240] *Id*.

And the impact of the agencies' estimate on their compliance modeling analysis could be large. The compliance model already projects that, in the previous standards scenario, 26% of MY 2026 vehicles will use TURBOD technologies.[241] Not only would this improvement directly impact the compliance modeling projections for those vehicles that the model already projects will adopt TURBOD technology, but it could alter the compliance pathways chosen for the remaining vehicles in the fleet (and in particular, the 21% of MY 2026 vehicles that the model projects will use TURBO without DEAC)[242], because with a higher effectiveness estimate TURBOD may become more cost-effective than the alternative technologies the model currently projects those vehicles will apply.

However, we are unable to provide a comprehensive critique of either the agencies' effectiveness estimates for TURBOD or of the impact of correcting those estimates because the agencies do not identify what data those estimates are derived from. TURBOD was not allowed in the Proposal and thus the Proposal did not discuss the concept or benefits of adding DEAC to TURBO1, nor did it include any engine map or specifications regarding that combination of technologies. In the Final Rule, the agencies again fail to discuss, reference, or explain what data—including engine maps or specifications—were used to model TURBOD, beyond a statement that the agencies made the same assumptions regarding DEAC "control logic" on turbocharged engines—that is, assumptions regarding when during vehicle use the agencies assume cylinders would be deactivated—as the agencies made regarding DEAC "control logic" on naturally aspirated engines in the Proposal.[243]

The only possible indication regarding what may have been used to model TURBOD's effectiveness are three tables in the Final Rule ANL Model Documentation describing that an "Eng12DEAC" engine map was used to represent the operation of an engine with both turbocharging and DEAC.[244] But even if the referenced map is—without any indication that it is the case—the basis for the agencies' new TURBOD technology, the record omits information critical to understanding and evaluating the agencies' assumptions. Unlike for other maps in the modeling, the documentation (1) does not contain the actual Eng12DEAC map, (2) does not identify or explain where the map came from or how it was developed, and (3) does not explain which specific technology in the Final Rule analysis the map was intended to represent.

By chance, we stumbled upon an engine map for Eng12DEAC in one of the worksheets embedded in the spreadsheet in the docket titled "ANL - Summary of Main Component

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[241] Final Rule CAFE Model CO_2 central case output file "technology_utilization_report.csv," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.
[242] *Id*.
[243] FRIA at 448 (citing PRIA at 186-187 (Section 6.2.1.2) (The agencies' citation is not to the most updated version of the PRIA. In the updated version the cited discussion is at 191-93.)). The PRIA does not use the term "control logic" in discussing DEAC, but the section cited in by the FRIA does discuss a description of "vehicle and engine conditions" when the agencies assume "cylinder deactivation is not used." PRIA at 191-93.
[244] ANL Model Documentation at 157 (Table 25) (describing Eng12DEAC as "DOHC Turbo 1.6l 18bar + DEAC); *id*. at 183 (Table 27) (describing that Eng12DEAC represents "Cylinder deactivation ability added to Eng12," which is in turn described as a "Gasoline, 1.6 l, 4 cyl, turbocharged, DI, DOHC, VVT, VVL" engine.); *see also* ANL Model Documentation at 27 (showing that Eng12DEAC was "considered for the Argonne Autonomie Final Rulemaking (FRM) Analysis).

Performance Assumptions FRM 06172019 FINAL."[245] However, this worksheet does not identify or explain the data from which the map was developed. That information is critical to the ability to understand, analyze, and critique the map itself. Simply, there is no discussion anywhere in the Final Rule documentation of the origins of this map, what it is based upon, or even the specifications for the modeled engine. Because the agencies have failed to explain how the map was used in the modeling, the public is also unable to adequately quantify and assess the impact of the Eng12DEAC map in the agencies' analysis—including whether or how it informed the modeling of TURBOD.

Because the agencies have failed to provide even the most basic information supporting their effectiveness estimates for TURBOD, the public is unable to assess the validity of those estimates, including whether they are based on appropriate or acceptable data.

The agencies must reconsider the Final Rule, provide detailed information explaining how they modeled the effectiveness of TURBOD—including an explanation of how the Eng12DEAC map, or whatever map was used to model the effectiveness of TURBOD, was derived and how it was used in the modeling—and allow the public an additional opportunity to comment on the agencies' analysis.

iv. The agencies' modeling assumptions remain fatally flawed and outdated as demonstrated by the fact that real-world improvements in the MY 2018 Toyota Camry hybrid and the MY 2019 Toyota RAV4 Hybrid achieved fuel economy and GHG improvements from powertrain improvements beyond the maximum theoretically possible in the agencies' modeling.

Comments on the Proposal objected that the agencies failed to use updated data regarding the effectiveness and costs of the technologies included in their analysis.[246] This failure is centrally relevant to the agencies' analysis, as the agencies' outdated data causes the model's projections of manufacturers' technology adoption to also be outdated, unrealistic, and arbitrary. Yet in the Final Rule the agencies again failed to use updated data. As a result of their use of outdated data for their modeling inputs, the model is incapable of projecting realistic efficiency and cost outcomes. This is demonstrated by the fact that automakers have already used certain technologies to achieve emissions improvements in the real-world that exceed the maximum emissions improvements possible from those technologies in the agencies' modeling.

More specifically, the agencies use a MY 2017 "analysis fleet" as their starting point in projecting pathways automakers could use to comply with the standards. That MY 2017

[245] "ANL_Summary_of_Main_Component_Performance_Assumptions_FRM_06172019_FINAL," Docket #NHTSA-2018-0067-12467.

[246] *See, e.g.*, Comment of the ICCT at I-45 (discussing agencies' failure to use updated engine maps); I-93 ("Assuming that the end of innovation has been reached and basing projections on what was in production in 2016, which the agencies have essentially done, ignores technology developments that have been achieved since then and developments in process, and this invalidly overstates the cost of future compliance."); *id*. ("We emphasize that the single most important factor in the accuracy of costs and benefits for projections is the use of the latest, most up-to-date technology data and developments. Using older data guarantees that the cost of meeting the standards will be overstated, as it does not include more recent technology developments and thus defaults to more expensive technology.").

Analysis Fleet is intended to be populated with real-world data.[247] From there, the CAFE model projects compliance pathways for automakers to achieve the MY 2025 standards. Thus, for every year after MY 2017, the agencies' analysis relies on projections of what automakers *could* do, rather than on assessments of what automakers *did* do. However, because the Final Rule was published in 2020, MY 2018, 2019 and 2020 vehicles already exist in the real world, meaning the agencies' analysis makes projections of theoretical compliance pathways automakers could adopt for model years that have already passed. For this reason, the agencies could compare the *real-world* emissions for specific vehicles to the agencies' *projected* emissions for those vehicles to ground-truth the agencies' modeling projections. We do that here and, as described below, this exercise demonstrates that the agencies' modeling of hybrid vehicles fails to capture large improvements to hybrid powertrains that are already in production. The agencies' technology assumptions and modeling projections are flawed and unreliable, and cannot inform a rational policy analysis.

The agencies' model contains baseline CO_2 emissions values for Toyota's MY 2017 Camry Strong Hybrid Electric Vehicle (SHEV) and RAV4 SHEV that closely match those two vehicles' real-world values for achieved CO_2. Thus, the CO_2 values for these vehicles in the MY 2017 analysis fleet do, in fact, reflect the correct starting point. However, Toyota redesigned the Camry SHEV for MY 2018 and the RAV4 SHEV for MY 2019, and in doing so incorporated major technology improvements on both vehicles leading to significant fuel economy and GHG emissions benefits. The official unadjusted combined CO_2 values (calculated from fueleconomy.gov[248]) show that after the redesigns the Camry Hybrid LE and the RAV4 Hybrid each reduced their CO_2 emissions by 19% relative to MY 2017. And the Camry Hybrid XLE/SE reduced its CO_2 emissions by 11% from 2017. These changes are shown in the table below.

In contrast, the CAFE model projects only a 7 to 8% reduction in the Camry Hybrid CO_2 emissions from its 2018 redesign and only a 12% reduction for the RAV4 Hybrid from its 2019 redesign. These values are far short of the actual real-world achieved improvements, demonstrating that the model is not accurately reflecting the change in real-world CO_2 emissions.

Investigating further, this problem reveals a fundamental failing in the agencies' modeling of hybrid vehicles. Specifically, in the real world, Toyota made improvements to the Camry and RAV4 hybrid powertrains, which allowed the vehicles to achieve significant fuel economy and GHG improvements. However, the agencies' modeling does not allow *any* hybrid powertrain improvements (on any hybrid vehicles in the fleet) beyond those that were already incorporated into the MY 2017 Camry and RAV4 Hybrids. More precisely, in the agencies' modeling the maximum hybrid powertrain efficiency is achieved by adopting power-split strong hybrid electric vehicle (SHEVPS) technology and improved accessories (IACC). Both of those were already on the MY 2017 Camry and RAV4, and thus the model is incapable of projecting any further improvements to those vehicles' powertrains.

[247] This petition does not concede that the Agencies' analysis fleet accurately reflects the real world MY 2017 fleet.
[248] Exact unadjusted combined MPG, adjusted combined CO_2, and adjusted combined MPG data are available for each model year from the downloadable fuel economy datafiles available at: https://fueleconomy.gov/feg/download.shtml. Unadjusted combined CO_2 values were calculated by multiplying the adjusted combined CO_2 value by the ratio of the adjusted combined MPG to the unadjusted combined MPG.

And the reason the model is incapable of projecting further improvements is simple: the agencies have not undertaken the basic task of updating their hybrid technology data. To project the fuel economy improvements and GHG emissions reductions from SHEVPS, the agencies use data from their "Eng26" engine.[249] That data, in turn, is based upon the efficiency data from a 2010 Prius powertrain—that is, from a vehicle from *ten years ago.*[250] The agencies thus use decade-old data to model the maximum potential emissions reductions achievable by improving the SHEVPS powertrain throughout the entire modeling period despite the fact that additional improvements already exist on real-world vehicles today. In other words, the agencies' modeling assumes that improvements in strong hybrid powertrains peaked in 2010.

Again, the Camry and RAV4 examples reveal this methodology as wholly arbitrary and contrary to demonstrated, real-world progress in hybrid powertrain technologies. Because the model is incapable of projecting further powertrain improvements beyond the MY 2017 Camry and RAV4, the only remaining improvements available in the CAFE model for those vehicles are road-load reductions. And indeed, the model projected that the Camry and the RAV4 hybrids would add significant load reduction technologies in MY 2018 and 2019, respectively.[251] These road-load reductions account for *all* of the modeled improvements on the Camry and RAV4 hybrids. That is, road load reductions alone account for 100% of the model's projections of 7%-8% reduction in CO_2 emissions for the Camry and 12% reductions in CO_2 emissions for the RAV4.

But, again, the actual, real-world 2020 Camry Hybrid LE and the RAV4 Hybrid each reduced CO_2 emissions by 19%—meaning the real-world improvement was significantly more than the improvement that the agencies modeled. Viewed from another perspective, the 2020 Camry Hybrid LE was modeled as achieving a CO_2 value of 143.9 g/mi, but the real-world achieved CO_2 of the MY 2018 Camry Hybrid LE was 122.6 g/mi—meaning the real-world Toyota Camry Hybrid LE achieved CO_2 emissions that are 15% lower than the model projects. And the 2020 RAV4 Hybrid was modeled as achieving 174.5 g/mi, but its real-world achieved CO_2 is 160.7 g/mi—meaning its real-world achieved CO_2 emissions are 8% lower than the model projects.

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[249] FRIA page 473-74.

[250] We note that the FRIA purports that "Argonne updated the HEV Atkinson cycle engine using the new Prius data to reflect the 41 percent thermal efficiency of the new 2017 system." FRIA at 474. However, Argonne's own 2020 Final Rule Model Documentation belies this description, stating simply that "[t]he data for the engine comes from 2010 Toyota Prius AMTL test data" without any indication whatsoever that they updated the 2010 map to reflect the 2017 system. ANL Model Documentation at 173. Also, the PRIA stated that "Engine 26 is [sic] carry over from the 2016 Draft TAR and no updates were made to this change for this NPRM analysis. The engine test data was from [sic] 2010 Toyota Prius with 1.8-L, 4-cylinder 73KW Atkinson engine." PRIA at 305. And the engine map in the PRIA is identical to the engine map used by Autonomie in the Final Rule modeling. *Compare* PRIA at 305 (Figure 6-110) *with* ANL._-_Summary_of_Main_Component_Performance_Assumptions_FRM_06172019_FINAL (tab "Eng26"), Docket #NHTSA-2018-0067-12467. Thus, the engine map actually used is from 2010. Moreover, the agencies' erroneous suggestion that the map was updated to reflect 2017 performance demonstrates that even the agencies concede that the map *should have* been updated.

[251] Specifically, the model projected Toyota would: (1) improve tire rolling resistance by 20% (by moving from the "Roll10" technology in the modeling to "Roll20") on both the Camry and the RAV4; and (2) reduce aerodynamic drag by 15% (by moving from the "Aero0" technology to "Aero15") on the RAV4.

Comparison of achieved CO_2 from fueleconomy.gov to the agencies' modeled projections of achieved CO_2

		Camry Hybrid LE		Camry Hybrid XLE/SE		RAV4 Hybrid	
		Actual	FR	Actual	FR	Actual	FR
2017	Engine	2.5L NA				2.5L NA	
	Baseline tech	SHEVPS, IACC, LDB, AERO5				SHEVPS, IACC, LDB	
	CO2	154.1	154.7	161.7	162.3	198.2	198.7
Redesign Years		2018, 2024, 2030				2019, 2024, 2029	
2020	Tech added		ROLL20		ROLL20		ROLL20, AERO15
	CO2	122.6	143.9	143.3	149.9	160.7	174.5
	'17 to '20 decrease	-20.4%	-7.0%	-11.4%	-7.6%	-18.9%	-12.2%
	Actual vs. FR	-14.8%		-4.4%		-7.9%	

Again, these discrepancies derive directly from the agencies' failure to capture proven, real-world hybrid powertrain improvements in their modeling. Thus, in the real world, Toyota demonstrated once again what it has demonstrated for every hybrid redesign since 1990[252]: that *significant* fuel economy increases and GHG reductions are achievable by improving hybrid powertrains. And Toyota specifically demonstrated that improvements are achievable beyond the maximum level of powertrain efficiency allowed in the modeling, which is the powertrain efficiency level that Toyota achieved ten years ago. And while we emphasize the Camry and RAV4 examples here, this deficiency undermines the entirety of the agencies' modeling—not least because *every* vehicle on the hybrid path is limited by the agencies' arbitrary cap of modeled hybrid effectiveness. In the CO_2 runs for the previous standards scenario, the CAFE model used in the Final Rule analysis projects SHEVPS will comprise 3.8% of the U.S. fleet in 2026 and plug-in hybrids (PHEVs) (for which the agencies also use the out-dated Eng26 data as the basis of their modeled fuel economy and GHG improvements) are projected to comprise another 0.4%.[253] Further, P2 hybrids, which are another 6.1% of the 2026 fleet,[254] are fully capable of using full Atkinson cycle engines (as SHEVPS does) and incorporating the same efficiency improvements. Therefore, powertrain improvements that increase fuel economy and decrease GHG emissions for SHEVPS vehicles can likewise do so for P2 vehicles.

Thus, more than 10% of the previous standards scenario MY 2026 fleet as-modeled in the Final Rule could improve real-world GHG emissions by significantly more than the model

[252] *See, e.g.,* ICCT, Technology Brief No. 1: Hybrid Vehicles, July 2015, Docket #NHTSA-2018-0067-11741 ("Attachment7_ICCT Hybrid July2015"), at 7-8.
[253] *See* Final Rule CAFE Model File for CO_2 standard-setting run, "technology_utilization_report.xlsx," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.
[254] *Id*. "P2" Hybrid vehicles are "a type of hybrid vehicle that uses a transmission-integrated electric motor placed between the engine and a gearbox or CVT, with a clutch that allows decoupling of the motor transmission from the engine." 85 Fed. Reg. at 24,471. Here, "P2 Hybrids" includes SHEVP2, P2HCR0, P2HCR1, and P2HCR2 in the agencies' modeling. *See id*. (explaining these technologies).

allows by applying technology that is already commercialized in the real world on the MY 2018 Camry Hybrid and the MY 2019 RAV4 Hybrid and continues to be used today. Moreover, if the agencies had accurately reflected the true panoply of real-world hybrid powertrain improvements, it is possible that additional vehicles currently *not* projected to adopt hybrid technology might in fact do so in the modeling if there were greater fuel economy and GHG gains provided by those technologies. Thus, this error demonstrates a fundamental flaw in the agencies' analysis, rendering its projected compliance paths and associated costs of compliance unreliable and arbitrary. Moreover, the agencies' use of outdated data is not limited to hybrid technologies—the agencies failed to update their efficiency and cost data for myriad technologies in their analysis rendering their modeling of all of those technologies unrealistic and arbitrary.[255]

The agencies must reconsider their Final Rule and update their modeling of emissions-improving technologies to reflect the feasible, real-world improvements in production today and the achievable future improvements rather than premising their analysis upon technologies pulled from ten years ago.

v. The agencies attempt to justify their refusal to allow HCR1 technology on pickup trucks, 6-cylinder, and 8-cylinder engines by purporting to identify a new category of Atkinson cycle engine that does not, in fact, exist.

Comments on the Proposal objected to the agencies' failure to allow more vehicles in the fleet to adopt HCR technology.[256] In particular, commenters observed that the agencies' suggestion in the Proposal that "HCR is not suitable for 6- or 8-cylinder engines" was belied by real-world production vehicles using HCR technology.[257] They also observed that "HCR technology is already used on V-6 versions of Lexus GS 350, GS 350 F Sport, Lexus RX 350, Lexus 450h, Toyota Tacoma."[258] And the commenters observed that these vehicles span the spectrum, including "non-hybrid models, pickup trucks, performance sedans, all-wheel-drive versions, four-wheel-drive versions, and mid-sized SUVs."[259] Thus, commenters demonstrated that HCR technology is already in place in the real-world on 6-cylinder vehicles, including pickup trucks, and that the agencies' refusal to allow that technology on those categories of vehicles in the modeling is arbitrary. Nevertheless, in the Final Rule the agencies have gone in the reverse direction, from allowing HCR technology on a limited number of 6-cylinder engines and pickup trucks in the Proposal to refusing to allow HCR on all 6- and 8-cylinder engines, as well as on any pickup trucks whatsoever.[260] As described below, the agencies purport to justify this decision by suggesting these vehicles may sometimes pull heavy loads or accelerate quickly, and HCR technology may not be enabled during those times and thus may not improve

[255] *See, e.g.*, ANL Model Documentation, Docket #EPA-HQ-OAR-2018-0283-7673, at 159 (describing that the base engine (Engine 1) is modeled off of a MY 2013 vehicle); FRIA at 425-25 (Table VI-41) (showing that all naturally aspirated, non-high-compression-ratio engine technologies are modeled off of Engine 1 – specifically, engines 02, 03, 04, 5a, 5b, 6a, 7a, 8a, 19, and 20); ANL Model Documentation at 166 (describing that Engines 18 and 21 are developed from Engine 1).
[256] *See, e.g.*, UCS Comment at 5; Comment of the ICCT at I-3.
[257] Comment of the ICCT at I-3.
[258] *Id*.
[259] *Id*.
[260] *See* 85 Fed. Reg. at 24,426-27.

efficiency during those times. But that assertion provides no evidence that the technology is categorically infeasible for vehicles that sometimes or even most of the time operate with heavy loads—in fact, it shows the opposite: those same vehicle engines will use HCR technology to operate more efficiently the rest of the time, which will provide fuel economy and emissions benefits. Those benefits must be included in the modeling. The agencies' refusal to allow HCR on pickups and 6- and 8-cylinder vehicles in the modeling is arbitrary and unlawful.

In the Final Rule, the agencies purport to divide HCR technology into three separate sub-categories, and claim that only two of these categories provide fuel economy and GHG benefits. Specifically, the agencies now describe that HCR (also known as "Atkinson-Cycle"[261]) technologies "can be categorized into three groups: (1) Atkinson engines, (2) Atkinson-mode engines, and (3) Atkinson-enabled engines, which are variable valve timing engines with late intake closing that enables the Atkinson cycle mode."[262] And the agencies assert that "[m]anufacturers typically apply one of these technologies and tune that technology for specific applications."[263] The agencies describe the first of these categories—the "Atkinson engine"—as generally used on hybrid vehicles, and the second and third as used on non-hybrid vehicles.[264] This categorization is a significant departure from the approach in the Proposed Rule, which simply utilized one engine map, Eng26, for Atkinson cycle engines on Hybrid-Electric Vehicles (HEV), and another engine map, Eng24, for Atkinson cycle engines on non-HEV vehicles, without any suggestion that there were distinct categories of non-HEV Atkinson cycle engines. Moreover, the agencies' discussion in the Final Rule itself demonstrates that their new categorization is absurd, arbitrary, and unlawful.

This becomes clear when examining the agencies' descriptions of the second and third categories of Atkinson engines. For the second category, the agencies assert that "Atkinson-mode engines are engines that use both the Otto cycle and Atkinson cycle during operation, switching between the modes of operation based on engine loads."[265] And for the third category, the "Atkinson-enabled engine, can be characterized by primarily running the Otto cycle, but can achieve Atkinson mode using variable valve timing (VVT) technology."[266] The agencies claim that these "Atkinson-enabled" engines are used on "vehicles that tend to have higher load demands," such as pickup trucks.[267]

These distinctions are both imaginary and irrelevant. They are imaginary because the agencies' own descriptions reveal that both categories in fact describe *the same technology*, and

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[261] A traditional engine operates in the "Otto" cycle, in which the "compression stroke" (which "compresses" the gasoline and air in the engine before it is ignited) is the same length as the "expansion stroke" (which captures the energy from igniting the gasoline and delivers it to the vehicle's wheels). In contrast, in the "Atkinson cycle" the expansion stroke is longer than the compression stroke, allowing the engine to capture more energy from the ignited gasoline, thereby making the engine more efficient. But, while the Atkinson cycle captures more overall energy, it has lower maximum power than the Otto cycle due to the compression stroke being shorter relative to the expansion stroke. Thus, as the agencies acknowledge, automakers incorporate technology allowing the engine to alternate between the Atkinson cycle and the Otto cycle depending on how much power the vehicle needs at any given time.
[262] *Id*. at 24,426.
[263] *Id*.
[264] *Id.* at 24,407-08.
[265] *Id*. at 24,408.
[266] *Id*.
[267] *Id*.

thus that there is no technical distinction between the purportedly different engine types. As noted above, the agencies expressly describe that an "Atkinson-mode" engine is one that can use both the Otto cycle and the Atkinson cycle, and uses the Atkinson cycle frequently. And they explain that an "Atkinson-enabled" engine is one that can use both the Otto cycle and the Atkinson cycle, and uses the Atkinson cycle less frequently. Thus, the distinction between the two categories is not the *technology,* but *the way agencies contend the vehicle with the technology on it will be used.* In fact, the agencies concede as much, stating that "any vehicle could . . . adopt an Atkinson-mode engine or an engine that enables operating in Atkinson cycle mode" but "the difference in vehicle application (high performance versus standard performance vehicles, towing requirements, trucks) leads to different effectiveness levels."[268] In other words, both categories of engines use Atkinson cycle at low loads, and both categories of engines do not use the Atkinson cycle at high loads. This concession demonstrates that the purportedly different categories of engines are, in fact, interchangeable. This is directly contrary to the agencies' own contention that these categories represent *distinct* technologies[269] thus justifying blocking HCR technology in the modeling from 6- and 8-cylinder engines and pickup trucks.

Further, the agencies' new categories are irrelevant because (even if the agencies' distinction between Atkinson-mode and Atkinson-enabled were valid) the agencies acknowledge that the only difference between the categories is that the "higher load demands" on Atkinson-enabled engines "tend to push these engines more frequently to the less efficient region of the engine map and limit the amount of Atkinson operation."[270] Even taking this as true, the agencies have not shown that the technology cannot be used on these vehicles—they have simply shown that in those instances when the vehicles using that technology are used in "high load" scenarios (*e.g.*, when they are towing heavy loads) they will use more fuel than in "low load" scenarios (where they operate most of the time). In fact, the agencies' discussion admits that even Atkinson-enabled engines will operate in the more efficient Atkinson-cycle in low-load scenarios—meaning that a truck with an Atkinson-enabled engine will be more efficient than a truck without an Atkinson-enabled engine at least some of the time, in turn demonstrating that its average fuel economy and GHG emissions performance will *also* be better than a vehicle without an Atkinson-enabled engine.

The agencies' treatment of HCR0 and HCR1 on pickup trucks, 6-cylinder and eight-cylinder engines is also inconsistent with their treatment of other technologies on those same vehicles. Most analogous is cylinder deactivation technology, which the agencies make available in the modeling for all pickup trucks, 6-cylinder, and 8-cylinder engines.[271] As the agencies themselves describe, cylinder deactivation "improve[s] engine efficiency by disabling or deactivating [engine] cylinders *when the load is significantly less than the engine's total torque capability*."[272] In other words, cylinder deactivation reduces vehicle emissions and increases fuel economy at low loads, but not at high loads—just like Atkinson cycle technology does. Indeed, *that's the point*. That is, the entire purpose of both technologies is to reduce fuel consumption and vehicle emissions at low loads (when the vehicle's full power is not needed) while still

[268] *Id*. at 24,407.
[269] *See id*. at 24,426.
[270] *Id.* at 24,408.
[271] *See* FRIA at 448.
[272] PRIA at 231 (Section 6.3.2.2.1) (emphasis added).

enabling the engine to engage its full power capabilities at high loads (when full power *is* needed). But while their function and purpose is the same, the agencies' treatment of the two technologies is diametrically opposite. For cylinder deactivation the agencies take the appropriate and rational approach, which is to allow the technology on all classes of vehicles (including pickup trucks and vehicles with six-cylinder, and eight-cylinder engines) in the modeling because it improves emissions at low loads (and only at low loads),[273] while for Atkinson cycle technology the agencies block the technology on pickup trucks and vehicles with six-cylinder and eight-cylinder engines in the modeling because it only improves emissions at low loads. The agencies' inconsistent treatment of these two technologies is irrational and itself demonstrates that the agencies' justification for blocking HCR0 and HCR1 technology from pickup trucks, 6-cylinder, and 8-cylinder engines is wholly arbitrary.[274]

More broadly, for *all* technologies the agencies' expectation that those vehicles will be used in high-load applications would mean achieved real-world fuel economy may be lower than the test-cycle results. To be clear, the agencies are not asserting that vehicles using HCR engines would not be able to tow heavy loads effectively—they would, as they would switch out of the Atkinson cycle when towing. Instead, the agencies are asserting that because those vehicles would switch out of Atkinson cycle and thus achieve lower fuel economy when towing loads, HCR should be omitted from the modeling of those vehicles. But this logic would apply to any technology. If a consumer tows heavy loads with a non-Atkinson pickup truck, that truck will have worse fuel economy than when that consumer drives without towing heavy loads, too. If the agencies were truly concerned with heavy loads in real-world operation, then the rational response would be to measure how often the truck will in fact tow heavy loads, and the specific effect on fuel economy when it does, and to do so for *every* combination of technologies on pickup trucks in the fleet. Instead, the agencies' selectively use this rationale to exclude *only* HCR from pickup trucks, simply asserting that the fact that *sometimes* trucks will haul heavy loads and *sometimes* vehicles with 6- and 8-cylinder engines will accelerate quickly justifies refusing to model HCR0 and HCR1 as feasible compliance pathways for pickup trucks, 6-cylinder, and 8-cylinder engines, while simultaneously ignoring that fact entirely as to every other technology in the modeling.[275] This inconsistency is arbitrary and unlawful. For HCR and any other technology, whether heavy loads would affect a technology's performance is a factor to consider in assessing the effect of that technology on achieved fuel economy and total emissions. It provides no evidence that the technology is categorically infeasible for vehicles

[273] In fact, the agencies have observed that cylinder deactivation is *especially* suited for use on pickup trucks. *See* PRIA at 303.

[274] In fact, in the rulemaking the agencies also acknowledged that certain factors "reduce the operating range in which cylinder deactivation is enabled." PRIA at 231-32. But, rather than entirely omitting the technology from whole categories of vehicles in the analysis, the agencies simply adjusted their modeling inputs to reflect their projection of when cylinder deactivation will be enabled. *See* PRIA at 191-93. To the extent Atkinson cycle technology may have a limited operating range, the agencies must take the same approach: include it in the modeling and adjust their inputs to account for the real-world operating range.

[275] As yet another analogy, the agencies' logic would mean that stop-start technology is an ineffective mechanism of reducing emissions because stop-start technology is only effective at reducing emissions when vehicles would otherwise be idle (because that is when stop-start kicks in to turn off the engine and conserve fuel). But, of course, most of the time vehicles *are not* idle. The agencies' logic here would thus implausibly suggest stop-start is not effective at improving fuel economy or GHG emissions. That suggestion is absurd. The correct approach – as the agencies have taken – is to measure the effectiveness of stop-start given the amount of time vehicles are idle, rather than to exclude the technology from the analysis entirely.

that sometimes or even most of the time operate with heavy loads. To the contrary, the agencies' (correct) observation that a vehicle engine that can operate in either Atkinson or non-Atkinson mode will operate in non-Atkinson mode when pulling heavy loads demonstrates the reverse: those same vehicle engines will operate in Atkinson mode the rest of the time, which will provide fuel economy and emissions benefits.

Tellingly, the agencies state that "[a]n example of the Atkinson-enabled engine is the Toyota MY 2017 Tacoma 3.5L 6-cylinder engine."[276] Comments on the Proposal observed that the Toyota Tacoma had an Atkinson cycle engine, demonstrating that the technology is both technologically feasible and effective when installed on both pickup trucks and 6-cylinder engines.[277] Thus, commenters observed, the agencies must allow HCR on pickup trucks and 6-cylinder engines in their modeling. In response, as described above, the agencies invented the new, imaginary category of "Atkinson-enabled" technologies; deemed without any analysis or support that the Atkinson-enabled engine seldom uses the Atkinson cycle; asserted without basis or support that the Toyota Tacoma 3.5L V6 engine with Atkinson technology is one of those "Atkinson-enabled" engines; and thus—without acknowledging that this is what they were doing—assigned zero efficiency benefit to the Tacoma's Atkinson system relative to a basic engine (and, in fact, coded the Tacoma as *having* a basic engine, thereby completely ignoring any benefits from its ability to operate in the Atkinson cycle). Having effectively dismissed this real-world example of an HCR engine on a pickup truck—and without analyzing the actual benefits of the technology on that truck—the agencies then categorically prohibited HCR from being applied to any pickup, 6-cylinder, or 8-cylinder engine in the fleet. Thus, it seems, the agencies may have invented a new category of Atkinson engines specifically to avoid having to confront the fact that the Toyota Tacoma demonstrates that the Atkinson engine is a feasible compliance pathway for pickup trucks, 6-cylinder, and 8-cylinder engines.[278] The agencies' bald assertion that use of the Atkinson engine on the Tacoma demonstrates infeasibility because the Tacoma might sometimes haul heavy loads is absurd, arbitrary, and contrary to both the record and the real world. To the contrary, the agencies' concession that pickup trucks can use the Atkinson cycle when they are not hauling heavy loads demonstrates that HCR technology must be included in the modeling for pickup trucks, 6-cylinder, and 8-cylinder engines.

In fact, in this sense the agencies moved backwards from their approach in the Proposal. There, the agencies coded the baseline MY 2016 Tacoma 3.5L as HCR1 (that is, as having an Atkinson technology already installed—which, in the real world, it did). Accordingly, they also allowed HCR technology to be used on the Tacoma for every future model year in the analysis. But in the Final Rule, the agencies no longer code the Tacoma as either having or being able to adopt HCR1, instead coding it as having only basic engine technology—contrary to the fact that the real-world Tacoma has an Atkinson cycle engine in production. Instead, the agencies merely model "Atkinson-enabled" engines (including the one on the Tacoma) as identical to basic

[276] 85 Fed. Reg. at 24,408.
[277] *See, e.g.*, Comment of the ICCT at I-3.
[278] As described above, the technology described for "Atkinson-mode" engines and "Atkinson-enabled" engines is exactly the same, and the agencies concede that the Tacoma has an "Atkinson-enabled" engine. 85 Fed. Reg. at 24,408. Therefore, the agencies effectively concede that the engine map they use for "Atkinson-mode" engines is equally applicable in modeling the Tacoma, and there is no technological reason they cannot use that map to do so – just as they did in the Proposal. *See* 85 Fed Reg. at 24,412 (describing engine map for Atkinson-mode engines).

engines—meaning the agencies assume *zero* benefit from these vehicles' ability to operate on the Atkinson cycle.[279]

Here also, the agencies ignore comments that demonstrate that HCR1 technology is a technologically feasible and cost-effective mechanism for improving fuel economy and GHG emissions in pickup truck applications.[280] The agencies' failure to consider and respond to those comments is itself unlawful and renders the agencies' treatment of HCR1 in pickup trucks, 6-cylinder, and 8-cylinder engines unlawful.

The impacts of the agencies' failure to allow HCR on pickup trucks, 6-cylinder, and 8-cylinder engines—and of justifying that failure by inventing a phantom category of "Atkinson-enabled" engines—are large. To test the impacts, we removed the model's limitations on HCR0 and HCR1 for all 4-cylinder, 6-cylinder, and 8-cylinder vehicles in the fleet, including pickup trucks. The results show that for the GHG program the net benefits of the Final Rule using a 3% discount rate decrease by $9.2 billion—meaning the analysis moves from showing the Final Rule imposes net costs of -$22.0 billion on society in the central case to -$31.3 billion in the case with HCR0 and HCR1 enabled. And using a 7% discount rate, net benefits decrease by $6.8 billion—meaning the analysis moves from showing net benefits of $6.4 billion to net costs of -$0.4 billion. Similarly, the results show the magnitude of technology costs decreased by $7.2 billion at a 3% discount rate—with total technology costs moving from -$107.9 billion in the central analysis to -$100.7 billion in the case with HCR0 and HCR1 enabled. And technology costs decreased by $5.7 billion at a 7% discount rate—with total technology costs moving from -$86.3 billion to -$80.6 billion.

Given the magnitude of these changes, the agencies must reconsider their Final Rule, eliminate their arbitrary and artificial distinction between "Atkinson-mode" and "Atkinson-enabled" engines, and allow HCR technology to be adopted by 4-cylinder, 6-cylinder, and 8-cylinder vehicles in the fleet, including pickup trucks, in their modeling analysis.

> *vi. The agencies rely on statements in the Final Rule that EPA has expressly admitted are factually incorrect to justify refusing to consider EPA data and modeling in their analysis, demonstrating both that the Final Rule analysis is arbitrary and unlawful and that EPA unlawfully delegated its technical decision-making obligations to NHTSA in the rulemaking process.*

In the Final Rule, EPA relies on factually inaccurate statements about EPA's engine maps, benchmarking studies, and modeling tools to justify rejecting use of EPA's data to inform the rulemaking analysis (and rejecting comments in the record stating that the agencies must consider that data).

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[279] *See* 85 Fed Reg. at 24,412 (describing that Atkinson-enabled engines are "characterized by the different VVT engine technologies identified earlier in basic engine discussions and shown on Table VI-41 and Table VI-42."); *see also* 85 Fed. Reg. at 24,403-04 (Tables VI-41 and 42) (showing only basic engine technologies, with no mention of "Atkinson-enabled engines").

[280] *See*, *e.g.*, Comment of the ICCT, Docket #NHTSA-2018-0067-12387, at 4; Comment of the California Air Resources Board (CARB), Docket #NHTSA-2018-0067-12390, at 4-5; Comment of H-D Systems, Docket #NHTSA-2018-0067-12389, at 3.

For example, in purporting to justify the EPA's decision not to use EPA data regarding various technologies' effectiveness in improving fuel economy or reducing GHGs, the Final Rule describes that EPA's Advanced Light-Duty Powertrain and Hybrid Analysis (ALPHA) model uses a "fixed-point model approach [that] . . . assigns a single value to a technology" and that the "single value is derived from benchmark testing, which often does not isolate the effect of a single technology from the effects of other technologies on the tested vehicle."[281] Thus, EPA asserts, "fixed-point effectiveness estimates tend to be too high, as they are unable to account for synergetic effects of multiple technologies."[282] Moreover, EPA states that to surmount this purported limitation of EPA's data, and "isolate a single technology's effect for use in fixed point modeling properly, the agencies would need to benchmark multiple versions of a single vehicle, carefully controlling changes to the vehicles' fuel efficiency technologies."[283] EPA then suggests that "[t]his process would need to be repeated for a large portion of the vehicle fleet and would require significant funding and thousands of lab hours to complete."[284]

And EPA goes on to make this purported description of EPA's data more specific by asserting that a particular EPA benchmarking study is an example of the limitations in EPA's data. EPA states that "when EPA benchmarks vehicles like the 2018 Toyota Camry, the resulting fuel map captures the benefits of many technologies associated with that engine."[285] Thus, EPA suggests, "it is inaccurate to conclude [from the study] that fuel consumption is directly related to individual engine technologies, such as lubrication and friction reduction, and geometric improvements in efficiency."[286]

These descriptions of purported limitations of EPA's benchmarking studies (and the allegedly massive investment that would be required to overcome them) are incontrovertibly false. In fact, EPA itself has admitted that these statements are "a mischaracterization of EPA's work" and that the statements incorrectly "implied that EPA used vehicle-level benchmarking to estimate Camry engine performance."[287] EPA also admitted that the Final Rule's apparent suggestion that the relevant EPA data is based on the two-cycle test (which does measure the fuel economy and GHG emissions performance of a vehicle without delineating what portion of the achieved fuel economy is attributable to individual technologies on that vehicle) is "factually incorrect, as can be seen by reading EPA's published paper" benchmarking the 2018 Camry.[288] As EPA explained, the paper itself "describes that the engine was tested on an engine dynamometer" (which isolates the fuel economy performance of the engine and thus eliminates the impact of other vehicle characteristics on achieved fuel economy or GHG emissions).[289] And

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[281] 85 Fed. Reg. at 24,345.
[282] *Id*.
[283] *Id*.
[284] *Id*.
[285] *Id*. at 24,345-46.
[286] *Id.* at 24,346.
[287] Comments from EPA on Draft Final Rule, dated February 5, 2020, Filename:"02-05-20epacommentstodot-optimized-.pdf" (Feb. 5 Comments from EPA), at 220 (These comments are attached to this petition, and are also available at: https://www.epw.senate.gov/public/_cache/files/b/8/b89ba080-25fd-4d39-b9c9-9ebd3a871c80/9D492D64E435FE651B96C666D2C15E30.02-05-20epacommentstodot-optimized-.pdf).
[288] *Id*. (citing SAE paper 2019-01-0249); *see also* SAE paper 2019-010-0249, Docket #NHTSA-2018-0067-12388.
[289] Feb. 5 Comments from EPA at 220.

EPA noted that through this process EPA *did* "directly measure" the impact of various technologies on the engine's performance.[290] Moreover, EPA admitted that its own benchmarking studies in fact capture information on engine performance that the data from IAV Automotive Engineering, Inc. used in the Final Rule does not capture.[291]

EPA admitted that these statements are factually incorrect and told NHTSA to delete them from the Final Rule.[292] When NHTSA failed to do so in the next iteration of the draft Final Rule, EPA *again* observed that these statements were incorrect and told NHTSA to delete them, referring back to EPA's original comments on this text.[293] But in the Final Rule both agencies continue to rely on these factually incorrect statements, unchanged.[294]

Similarly, EPA elsewhere in the Final Rule justifies using IAV's data instead of EPA's by stating that "that engine maps developed by IAV, while not exactly the same, are representative of EPA's engine benchmarking data."[295] But here, too, EPA admitted that this is "not factually correct. There are significant differences, both in baseline engine technologies and those with more advanced technologies between the IAV and EPA engine maps. Even when the incremental effectiveness between two technologies may be similar, the maps themselves are quite different."[296] Again, EPA has admitted that this statement is incorrect, and thus cannot lawfully rely on it in the Final Rule.

These are not isolated instances of EPA relying on factually inaccurate statements about EPA's own work that EPA has *acknowledged* are factually inaccurate. In another instance, the Final Rule describes that "[f]or the EPA Draft TAR [Technical Assessment Report] and Proposed Determination analyses, HCR engine and downsized and turbocharged engine technologies effectiveness was estimated using Tier 2 certification fuel, which has a higher octane rating compared to regular octane fuel."[297] The Final Rule then asserts that "[b]y not

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[290] *Id*. ("EPA individually instrumented the valvetrain to directly measure and completely map the valve events and we have full mapping of cylinder-pressure based heat release, combustion phasing, EGR rates, variation of the effective compression ratio, COV of IMEP, etc., etc.").
[291] *Id*. (Describing that EPA's Camry study included "full mapping" of the coefficient of variation (COV) in indicated mean effective pressure (IMEP), or "COV of IMEP (which can't be modeled within GT-Power, and without which there is no true way to tune EGR [exhaust gas recirculation] and spark timing within IAV's modeled maps)."
[292] *Id*.
[293] Comments from EPA on Draft Final Rule, dated Mar. 26, 2020, Filename:"5.03-26-20epacomments" (Mar. 26 Comments from EPA), at 282-83 (These comments are attached to this petition, and are also available at: https://www.epw.senate.gov/public/_cache/files/4/b/4b278947-fe36-4c57-99eb-9855bc9d8be9/52B386DFAE5E95350519F08DE89A1145.03-26-20epacomments.pdf).
[294] NHTSA did delete other text in this same section that EPA had acknowledged was incorrect, demonstrating that NHTSA indeed received and reviewed EPA's comments, and that NHTSA thus continued to rely on the descriptions of EPA's work described here despite knowing that those descriptions were factually inaccurate. *Compare* Feb. 5 Comments from EPA at 219 (identifying as "not factually correct" the statement that "the ALPHA model has only recently developed simulations and model controls to represent a basic 48V BISG mild hybrid vehicle using ANL test data in 2018") *with* Mar. 26 Comments from EPA at 282 (showing that sentence had been deleted).
[295] 85 Fed. Reg. at 24,341.
[296] Mar. 26 Comments from EPA at 272 (incorporating comment from Feb. 5 Comments from EPA at 210).
[297] 85 Fed. Reg. at 24,331; *see also id*. at 24,383 (describing that "in the EPA Draft TAR and Proposed Determination analyses, effectiveness of HCR engine technologies and downsized turbocharged engine technologies were estimated using Tier 2 certification fuel").

maintaining the fuel octane functionality and vehicle attributes, the EPA Draft TAR and Proposed Determination analyses applied higher effectiveness for these technologies than could be achieved had regular octane fuel been assumed for the HCR and downsized turbocharged engines."[298] Thus, the Final Rule states, "the agencies determined that engine maps developed for the Draft TAR and EPA Proposed Determination that were based on Tier 2 fuel should not be used for the NPRM and final rule analyses[.]"[299] EPA then cites this purported failure to use Tier 3 fuel in benchmarking studies as a central justification for refusing to include HCR2 in its analysis,[300] despite the fact that HCR2 is an extremely cost-effective technology that had dramatic impacts on the cost-benefit analysis, as observed in comments submitted to the rulemaking dockets.[301] Specifically, EPA describes that "[t]he concept was only modeled with high octane Tier 2 fuel. The HCR2's capability to operate on regular octane Tier 3 fuel was assessed using non-cycle specific operation, necessitating adjustments to the final results to account for Tier 3 fuel properties from Tier 2 operation, instead of simply operating the engine on Tier 3 to generate effectiveness estimates."[302]

But EPA expressly admitted that these assertions are factually incorrect. As EPA described, "EPA's engine maps were based on extensive vehicle chassis dynamometer testing on both Tier 2 and Tier 3 fuels, and as a result reflect both performance neutral operation on regular octane fuel as well as appropriate GHG performance on certification fuel."[303] And EPA specifically observed that the purported justification for refusing to allow HCR2 in the modeling was incorrect, because, again "EPA's benchmarking and modeling of engines is based on BOTH Tier 2 (for certification) and Tier 3 (for calibration in real-world use)."[304] Thus, EPA explicitly acknowledged that this central justification for refusing to use EPA's data on technological effectiveness is false and therefore arbitrary.

Further, EPA justifies its refusal to include HCR2 technology in the modeling by repeatedly asserting that EPA's HCR2 data has not been "validated," stating specifically that "the concept was not subjected to validation to assess its technical feasibility";[305] that "[a]ssumptions about compression ratio, EGR rates, and use of cylinder deactivation were not adequately validated";[306] and that the HCR2 "engine map has not been validated with hardware, bench data, or even on a prototype level (as no such engine exists to test to validate the engine map)."[307] But yet again EPA admitted that these statements are "factually incorrect" and that HCR2 "was indeed validated with bench data."[308]

EPA also justifies failing to allow HCR2 in the modeling because "[t]he HCR2 model combines multiple technologies to provide cumulative estimate of benefits without consideration

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[298] *Id*. at 24,331.
[299] *Id.* at 24,383.
[300] *Id*. at 24,383, 24,409.
[301] *See, e.g.,* UCS Comment, Docket #NHTSA-2018-0067-12039 at 16; Comment of the ICCT at I-60.
[302] 85 Fed. Reg. at 24,409.
[303] Feb. 5 Comments from EPA at 189; Mar. 26 Comments from EPA at 251-52.
[304] Feb. 5 Comments from EPA at 273, 274, 314; Mar. 26 Comments from EPA at 344-45, 389.
[305] 85 Fed. Reg. at 24,409.
[306] *Id*.
[307] *Id*. at 24,383.
[308] Feb. 5 Comments from EPA at 275; Mar. 26 Comments from EPA at 344-45.

the [sic] practical interaction of technologies."[309] Again, EPA admitted that this is false. In the CAFE model, HCR2 is comprised of Atkinson cycle, cooled exhaust gas recirculation (CEGR) and cylinder deactivation (DEAC) technologies.[310] And EPA observed that "CEGR was introduced in 2018 on a production Atkinson cycle engine with the Toyota Camry. Additioal [sic] benefits of cylinder deactivation were realtively [sic] easy to confirm using bench tests."[311] In other words, the data from EPA's study of the Toyota Camry *did* return data reflecting the "interaction of" the "multiple technologies"—Atkinson cycle, CEGR, and DEAC—that comprise HCR2.

In yet another instance, in the Final Rule EPA observes that "[f]or the EPA Draft TAR and Proposed Determination analyses, secondary mass reduction was applied exclusively based on cost, with no regard to whether sufficient primary mass reduction was applied concurrently."[312] Here again, EPA admitted that this statement is false, commenting that "[t]his is factually incorrect, and does not represent the mass reduction analysis used by EPA previously."[313]

In sum, EPA has admitted that statements and rationales that EPA relies on in the Final Rule are factually incorrect. These factually incorrect statements and rationales cannot lawfully serve as the basis of the rulemaking analysis, nor as the basis for the EPA's refusal to consider its own data and modeling in its analysis, nor as the basis for EPA's decision to exclude HCR2 and its associated benefits from its analysis. These demonstrably incorrect statements and rationales thus render the Final Rule arbitrary and capricious.

Moreover, the fact that EPA directed NHTSA to delete these factually incorrect statements and rationales described above from the Final Rule, but NHTSA did not do so, demonstrates that EPA unlawfully delegated its Clean Air Act obligations to exercise independent technical judgments to NHTSA in the rulemaking process.[314] That EPA failed to exercise its own expertise and judgment in the Final Rule renders the Final Rule unlawful.

EPA must reconsider the Final Rule; provide accurate analysis of EPA's data and modeling in determining the appropriate level of the standard; use EPA's data to project costs and benefits from HCR2 technology; and allow HCR2 to be adopted in the modeling.

vii. The agencies' estimates of battery costs are unrealistically and arbitrarily high.

Commenters on the Proposed Rule objected to the agencies' unreasonably high battery cost projections (and the high costs of battery electric vehicles (BEVs) that result from those projections).[315] Commenters also objected to the agencies' failure to provide the public with

[309] *Id*. at 24,384.
[310] *See* 85 Fed. Reg. at 24,408 (describing that engine map Eng25 corresponds to HCR2 in the CAFE modeling); ANL Model Documentation, Docket #EPA-HQ-OAR-2018-0283-7673, at 172 (describing that Eng25 is "a future Atkinson engine with cooled EGR and DEAC").
[311] Feb. 5 Comments from EPA at 275; Mar. 26 Comments from EPA at 344-45.
[312] 85 Fed. Reg. at 24,332.
[313] Feb. 5 Comments from EPA at 189-190; *see also* Mar. 26 Comments from EPA at 252.
[314] *See* NGO Legal Comments at 12-28.
[315] *See*, *e.g.*, Comments of the ICCT at I-80.

adequate information to be able to assess, analyze and critique the agencies' methodology in arriving at those inflated costs.[316] Specifically, commenters objected to a lack of adequate information regarding the BatPaC model, which the agencies relied on to project battery prices. In fact, the California Air Resources Board filed a lawsuit seeking information relating to the agencies' modeling of battery costs, in which EPA demonstrated that even EPA did not have that information in its possession.[317] Nevertheless, in response to those comments the agencies primarily and improbably assert that the commenters did have sufficient information to be able to comment on the battery cost modeling in the Proposal.[318] However, the Final Rule itself belies this point: for the first time in the Final Rule the agencies reveal information regarding how they modeled battery costs for the Proposal, including (as described in more detail below), assumptions regarding battery manufacturing production volumes and production efficiency values (or, "cell yield" values) as well as details regarding how they generated their cost learning curves. As a part of this new information, the agencies also provide data documenting that the agencies erroneously applied a retail price equivalent (RPE) markup to account for indirect costs even though costs derived from the BatPaC model already account for indirect costs—arbitrarily counting these costs more than twice. Moreover, the agencies make changes to certain aspects of their modeling of battery costs in the Final Rule, which changes are among the reasons that the Final Rule projects a higher per-kilowatt-hour battery cost than the Proposal did.[319]

In sum, the agencies unlawfully failed to provide sufficient information to allow adequate comment on their battery cost modeling prior to the Final Rule, and the Final Rule itself relies on numerous arbitrary and unreasonable changes and assumptions from the Proposal that render its battery cost projections fundamentally flawed, arbitrary, and unlawful, which in turn renders the agencies' compliance cost modeling and the overall cost-benefit analysis flawed, arbitrary, and unlawful. The agencies must withdraw and reconsider the Final Rule after correcting their arbitrary assumptions regarding, and modeling of, battery costs.

a) In using the BatPaC model to project battery costs the agencies use an arbitrarily low assumption regarding per-manufacturing-plant battery production volume.

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[316] *See*, *e.g.*, *id*. at I-81 ("The agencies have largely obscured their battery electric vehicle (BEV) cost sources or calculations, making it nearly impossible for even very interested researchers to understand how all the BatPac costs translate into BEV costs that can be compared with other full-BEV costs in the literature. To enable meaningful public comments, these sources and cost calculations must be made explicit and the agencies must provide an additional public comment opportunity."); Comment of the California Air Resources Board (CARB), Docket #EPA-HQ-OAR-2018-0283-5054, (CARB Comment) at 137-140; Supplemental Comment of the CARB, Docket #EPA-HQ-OAR-2018-0283-7449, at 3-11.

[317] *See, e.g.,* Joint Status Report, California Air Resources Board v. EPA et al., No. 1:19-cv-00965-CKK (Document 8) (D.D.C. Aug. 16, 2019), at 2; *see also* Comment of the ICCT at I-81 (observing that "it is clear that EPA's experts not only found battery costs to be too high compared to their own analysis of the BatPac model that was used, but NHTSA did not even provide enough information to allow EPA to understand why the newly-assumed battery costs were so inexplicably high").

[318] 85 Fed. Reg. at 24,502-03.

[319] *Compar*e "ANL - Summary of Main Component Performance Assumptions NPRM," Docket #NHTSA-2018-0067-0003, *with* "ANL BatPac Lookup tables 05132019 FINAL," Docket #NHTSA-2018-0067-12626.

To calculate battery costs for MY 2020 vehicles, the agencies developed "lookup tables" from Version 3.1 of Argonne National Laboratories' (ANL) BatPaC model.[320] Those lookup tables provide the BatPaC model's projected battery costs based in part on anticipated annual per-manufacturing-plant production volumes.[321] The values in the lookup tables depend on the specific inputs the agencies used when running the BatPaC model. Among these inputs is an assumption regarding battery manufacturers' average annual per-manufacturing-plant battery production volume. This assumption is highly consequential, because the BatPaC model projects lower per-unit battery prices as overall production volume increases. The BatPaC model utilizes a default average production volume of 100,000 units per year.[322] And for the first time in the Final Rule, the agencies reach back and describe that for the Proposal the agencies had also assumed an average annual battery production volume of 100,000 units in MY 2020.[323]

However, in the Final Rule the agencies dramatically depart from their prior estimate and instead assume an annual per-manufacturer battery production volume of 25,000 units in MY 2020.[324] The agencies acknowledge that this change in average production volume "has a significant impact on battery pack costs," and specifically that the agencies' projected battery costs would drop by 15% if the agencies used the annual production estimate from the Proposal (100,000 units) instead of the value they use in the Final Rule (25,000 units).[325]

The agencies' justification for decreasing their estimate of annual per-manufacturing-plant production from 100,000 units to 25,000 units is arbitrary and unlawful. In the real world, battery suppliers have already exceeded 100,000 units of annual production. In fact, fully two-thirds of global battery packs are currently manufactured by suppliers that already reached 200,000 units of annual output in MY 2019.[326]

Nevertheless, the agencies contend that the choice of 25,000 annual units is appropriate because most individual vehicle manufacturers have not yet sold 25,000 BEVs annually. To justify that logic the agencies argue that, although "one battery manufacturer might manufacture batteries for multiple vehicle manufacturers,"[327] "it is likely that each [automobile] manufacturers' BEV models had distinct characteristics such as unique battery packaging space, energy requirements, thermal control systems, and safety systems, which cause battery pack designs to vary between each manufacturer."[328] Thus, the agencies assert, the "BatPaC

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[320] *See* 85 Fed. Reg. at 24,495, 24,497, 24,499. The agencies then use the MY 2020 values to calculate costs for all other model years in their analysis. *Id*. at 24,499.
[321] *See* 85 Fed. Reg. at 24,495 (Figure VI-39), 24,501-02.
[322] *See, e.g.*, Paul A. Nelson, et. al., "Modeling the Performance and Cost of Lithium-Ion Batteries for Electric-Drive Vehicles: Third Edition," ANL/CSE-19/2 (March 2019) (BatPaC Model Documentation), at 81 (describing that the BatPaC model "assumes a "baseline plant produces 100,000 EV battery packs per year"). Although the Final Rule states that the BatPaC Model Documentation has been included in the rulemaking docket, 85 Fed. Reg. at 24,503 & n. 1217, the agencies did not in fact include it in the docket. The model documentation attached to this petition and available at: https://publications.anl.gov/anlpubs/2019/03/150624.pdf.
[323] 85 Fed. Reg. at 24,501-02.
[324] *Id*. at 24,502.
[325] *Id*.
[326] *See*, *e.g.*, Sharpe, Ben, et. al. Power Play: Canada's Role in the Electric Vehicle Transition, ICCT, April 2020, at 10 (Figure 8), available at: https://theicct.org/publications/canada-zev-transition.
[327] 85 Fed. Reg. at 24,501-02.
[328] *Id*. at 24,501.

assumption of 100,000 battery pack units manufactured per plant likely did not account for all of the cost differences in pack designs between manufacturers."[329] The agencies are asserting that even though a single battery manufacturer may produce batteries for multiple automobile manufacturers, and thus that that battery manufacturer may far exceed the 100,000 unit threshold triggering significantly lower cost projections in BatPaC,[330] that battery manufacturer's costs should nevertheless be modeled based on annual production of only 25,000 units precisely *because* it is selling to multiple automobile manufacturers who "*likely*" require substantively different batteries, and that the costs of those differences "*likely"* are not reflected in the BatPaC figures.[331] In essence, the agencies have failed to even investigate whether automobile manufacturers' battery requirements *actually* differ so significantly as to override any economies of scale associated with centralized manufacturing,[332] or whether the costs of differentiated product lines are already accounted for in the BatPaC model. Rather than undertaking these requisite investigations, the agencies irrationally and arbitrarily assume that outsourcing manufacturing to suppliers will have no economic benefit whatsoever. This bare, unsupported, and improbable speculation does not provide a rational or lawful rationale for departing from the assumptions in BatPaC, which were reviewed by "[e]xperts from all aspects of battery development."[333]

More importantly, however, the BatPaC model *does* account for the categories of costs the agencies identify as justification for their revision to the production volume estimate. Specifically, the agencies' suggest that automakers may have different needs for packaging, energy requirements (by which the agencies presumably mean battery output and size), temperature management systems, and safety systems.[334] But the BatPaC model includes these factors in its calculation of battery costs. [335] Thus, the agencies' assertion that it "likely" does not account for them is simply false.

Furthermore, even if it were valid to base production volumes on manufacturer BEV sales, the agencies' analysis is still fatally flawed. This is because the agencies' analysis is limited to

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[329] *Id*.

[330] In the real world, battery manufacturers do produce batteries for multiple automobile manufacturers. *See, e.g.,* Comment of the ICCT, EPA-HQ-OAR-2018-0283-5456, "Attachment 11 - Power Play: How Governments Are Spurring The Electric Vehicle Industry May 2018," at 5 (Figure 2) & 6 ("suppliers are serving multiple vehicle manufacturers and achieving higher production scale more quickly"), also available at: https://theicct.org/publications/global-electric-vehicle-industry.

[331] 85 Fed. Reg. at 24,501-02.

[332] *See id*. at 24,493 (describing that the BatPaC model "also considers annual pack production volumes and economies of scale for high-volume production.").

[333] BatPaC Model Documentation at 2.

[334] 85 Fed. Reg. at 24,500.

[335] *See, e.g.*, BatPaC Model Documentation at 81 ("the costs for the thermal management, battery management system, and disconnects have been estimated to provide the total cost to the OEM for the integrated battery pack"); 60-75 (discussing BatPaC modeling of battery thermal management); *id*. at 88 (discussing BatPaC modeling of safety systems); *id*. at 89 (discussing BatPaC modeling of the "thermal management of the battery" which is "crucial to meeting the life and safety requirements of transportation applications"); *id*. at 21 (describing that "[t]he user may change the input values for the pack, such as the number of cells per module and the arrangement of the modules into rows to change both the pack dimensions and the pack voltage while meeting the set criteria for pack energy and power").

U.S. BEV sales for each major manufacturer.[336] But if a manufacturer's BEV sales considered alone were relevant to the question of battery costs, the question would at least be how many *total* BEV sales that automaker has, not how many *U.S.* sales it has. Thus, the agencies' discussion of U.S. sales fails to provide even the most basic information—global sales data—that would be necessary to inform a decision regarding battery costs. For example, ten companies (including BMW, General Motors, Hyundai-Kia, Tesla, Toyota, Volkswagen) each had more than 50,000 annual electric sales in 2017, up from five such companies in 2016.[337] And in 2019 automakers have increased their annual electric vehicle production further: Tesla has 367,000 sales, BMW has 151,000, Volkswagen has 141,000, Hyundai-Kia has 126,000, General Motors has 96,000, Nissan has 87,000, and Toyota has 57,000.[338] As ICCT submitted to the docket, global automakers have publicly announced their commitment to produce electric vehicles at much higher numbers in the future, including over 2 million plug-in electric vehicles per year each by Toyota, Nissan-Renault, Volkswagen; over 1 million each by General Motors and Tesla; and over 400,000 each by Mercedes and BMW.[339] These sales figures and automaker announcements demonstrate that the agencies' assumption that average production volume in 2019 was less than 25,000 units is patently unreasonable and unrealistic.[340]

Finally, the agencies' analysis regarding production volume is arbitrary and unlawful due to their treatment of Tesla's BEV sales in their analysis. The agencies dismissed Tesla as irrelevant to "selecting a battery pack volume estimates [sic] for an industry-wide assessment" for two reasons. First, they describe Tesla's sales as "outlying" because Tesla is the only manufacturer whose U.S. BEV sales exceeded 100,000 (and nearly 200,000) units in 2018 and 2019, and because Tesla "sold more BEVs than all manufacturers combined in MYs 2016, 2018, and 2019."[341] Second, they assert that "beginning in MY 2018 Tesla is a vertically integrated battery and BEV manufacturer."[342] But neither of these assumptions justifies removing Tesla from the analysis.

First, Tesla is not, in fact, a fully vertically integrated battery and BEV manufacturer. Tesla jointly manufactures batteries with Panasonic.[343] Tesla also, according to multiple reports, has

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[336] *See* 85 Fed. Reg. at 24,501 (discussing that "individual manufacturer *U.S.* BEV sales are substantially below 100,000 units per year except for Tesla" (emphasis added)).
[337] *See* Comment of the ICCT, EPA-HQ-OAR-2018-0283-5456, "Attachment 11 - Power Play: How Governments Are Spurring The Electric Vehicle Industry May 2018," at 5 (Figure 2), also available at: https://theicct.org/publications/global-electric-vehicle-industry.
[338] Data derived from EV-Volumes.com, EV Data Center, available at: http://www.ev-volumes.com/datacenter/
[339] *See, e.g.*, Comment of the ICCT, Docket #EPA-HQ-OAR-2018-0283-5456, "Attachment 13 - Modernizing vehicle regulations for electrification," at 20 (Figure 10).
[340] Moreover, neither the agencies' analysis nor the numbers discussed here include production volumes for non-BEV electric vehicles, such as strong hybrid and plug-in hybrid vehicles. But the agencies offer no justification for omitting batteries manufactured for those vehicles from their analysis of the appropriate estimate of per-battery-manufacturer production volume.
[341] 85 Fed. Reg. at 24,502.
[342] *Id.* at 24,501.
[343] *See, e.g.*, Shirouzu, Norihiko and Lienert, Paul. "Exclusive: Tesla's secret batteries aim to rework the math for electric cars and the grid," Reuters, June 9, 2020, available at: https://www.reuters.com/article/us-autos-tesla-batteries-exclusive/exclusive-teslas-secret-batteries-aim-to-rework-the-math-for-electric-cars-and-the-grid-idUSKBN22Q1WC

agreements to source batteries from Contemporary Amperex Technology Ltd. (or, CATL)[344] and LG Chem.[345] And, as commenters notified the agencies, CATL and LG Chem are among the "world's largest lithium-ion battery production companies for light-duty vehicles."[346] In fact, Panasonic, CATL, and LG Chem each produce battery cells for more than 150,000 vehicles per year.[347] And each of these three suppliers already supplies batteries to other automakers, and can increasingly do so to support those automakers' announced electric vehicle growth through economies of scale.

Second, the fact that Tesla dominates the BEV market in 2019 does not justify excluding Tesla from the analysis as the agencies suggest, but in fact demonstrates the opposite: it is wholly irrational and arbitrary to exclude Tesla from the analysis.[348] Rather than dismissing Tesla's sales on account of Tesla being, at present, the highest-volume BEV manufacturer, the only rational approach to analyzing BEV costs is to recognize that Tesla already produces hundreds of thousands of BEVs annually, and sources batteries for those BEVs from third-party high-volume battery manufacturers that are equally capable of providing batteries to other manufacturers, too. Therefore, the Tesla case demonstrates that even if a single automaker does not sell more than 25,000 BEVs annually, it can still capitalize on economies of scale from high-volume battery production by sourcing from high-volume suppliers. The agencies' cost projections for higher-volume production must reflect this fact, but they do not.[349]

In sum, the agencies have failed to offer any rational explanation for reducing their estimated average annual battery production volume from 100,000 units, as they used in the Proposal, to 25,000 units, as they use in the Final Rule. To the contrary, given the fact that automakers have access to battery suppliers producing well over 100,000 units, the only reasonable and data-based

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[344] *See, e.g.*, Hamilton, Isobel. "Tesla's battery supplier says it's made a battery that can last 16 years and 1 million miles," Business Insider, January 9, 2020, available at: https://www.businessinsider.com/catl-claims-battery-1-million-miles-2020-6;

[345] *See, e.g.*, "Tesla Agrees to Buy LG Batteries for Vehicles Made in China," Bloomberg News, August 22, 2019, available at: https://www.bloomberg.com/news/articles/2019-08-23/tesla-said-to-agree-to-buy-batteries-from-lg-for-china-factory

[346] *See* CARB Comment at 141.

[347] *See,* Comment of the ICCT, EPA-HQ-OAR-2018-0283-5456, "Attachment 11 - Power Play: How Governments Are Spurring The Electric Vehicle Industry May 2018," at 6, also available at: https://theicct.org/publications/global-electric-vehicle-industry;

[348] The agencies' arbitrary approach to Tesla's sales is not limited to their battery cost analysis. In fact, the agency's modeling arbitrarily projects that Tesla's U.S. sales will remain below 50,000 units per year through 2026, *see* Final Rule CAFE Model File for CAFE standard-setting run, "compliance report," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system, while the agencies themselves acknowledge that Tesla's U.S. sales even in 2018 and 2019 were nearly four times that much, at 191,627 units and 189,355 units, respectively, 85 Fed. Reg. at 24,502 (Table VI-94), and Tesla's global sales increased from 100,000 units in 2017 to over 367,000 units in 2019, *see* Tesla Q4 2019 Vehicle Production & Deliveries, available at https://ir.tesla.com/news-releases/news-release-details/tesla-q4-2019-vehicle-production-deliveries; *see also* Tesla Sales Data & Trends for the U.S Automotive Market, available at https://carsalesbase.com/us-tesla/

[349] The agencies' assertions that Tesla's sales are irrelevant to its cost analysis is also arbitrary in that it is internally inconsistent. The agencies in fact use Tesla's MY 2016-2017 Model S 100D to define the maximum power and energy value used in BatPaC to develop the lookup tables the agencies used for their battery cost analysis. In other words, the agencies expressly rely on Tesla's vehicle designs and requirements in defining battery costs, but refuse to rely on Tesla's production volumes in defining battery costs. The agencies offer no explanation for this arbitrary inconsistency.

approach is to use a modeled annual production volume of at least 100,000 units. Failing to do so has arbitrarily and unlawfully increased the agencies' estimates of battery costs by at least 15%.

b) In using the BatPaC model to project battery costs the agencies use an unsupported and arbitrarily low estimate for manufacturing plant efficiency.

In addition to annual production volume estimates, the ANL Lookup tables' estimates of battery costs also depend on "[m]anufacturing plant efficiency."[350] "BatPaC version 3.1 defines manufacturing plant efficiency in terms of cell yield, or the number of cells that are usable out of the total number of cells that the plant produced."[351] In the Final Rule, the agencies reveal for the first time that in the Proposal the agencies used a plant efficiency (or "cell yield") value of 95%.[352] As the agencies and BatPaC[353] both describe, this value is the default value in the BatPaC model. And the BatPaC model documentation describes that the BatPaC model's default inputs have been rigorously selected. Specifically, the documentation describes that "[e]xperts from all aspects of battery development have reviewed the model both privately and as part of a formal peer-review process."[354]

In the Final Rule, however, the agencies state that they use the significantly lower value of 85%.[355] And, again, they do so without having provided the public with any opportunity to comment on the cell yield value, because they failed to provide public notice of what value they were using in the Proposal or of a potential change to that value (and the default BatPaC value). This change causes BatPaC to significantly inflate battery costs by effectively assuming that more waste will be created in the manufacturing process. When we ran the BatPaC version 3.1 model using a value of 95% rather than 85%, projected battery pack costs decreased by an average of 6.8%.[356] That means that for battery packs that cost, *e.g.*, $11,000,[357] changing the cell yield value back to 95% would reduce costs by an average of $748. That is a significant change.

Yet the agencies fail to provide any valid justification for this change. In fact, the agencies' entire discussion is limited to a single paragraph in the Final Rule in which they assert that: (1) "[s]ince battery pack technology and battery pack manufacturing processes are proprietary, the data on plant efficiencies are not widely reported"; (2) "BatPaC uses a default cell yield (plant efficiency) value of 95 percent;" and (3) "Argonne battery experts have used an 85 percent cell

[350] 85 Fed. Reg. at 24,495, 24,502.
[351] *Id*.
[352] *Id*. at 24,500.
[353] *See* BatPaC Model Documentation at 99 (describing that "[s]crap is generated in preparing the electrodes and in rejection of 5% of the cells that go through formation cycling and charge-retention tests").
[354] *Id*. at 2.
[355] 85 Fed. Reg. at 24,502.
[356] We measured this change by comparing costs for batteries 1 through 6 in the agencies' BatPaC BEV200 files using both 85% and 95% inputs for cell yield. "BatPac 05102019 BEV200 Version 3.1 - 28June2018 FINAL," Docket #EPA-HQ-OAR-2018-0283-7674, #NHTSA-2018-0067-12469. We found cost reductions range from 6.67% to 6.94%, with an average of 6.8%.
[357] For example, as discussed below, the agencies' modeling assumes that a battery pack for the Chevy Bolt would cost approximately $11,000 in MY 2020.

yield value to represent the current production yield for internal DOE studies."[358] The agencies then assert that "[b]y selecting an 85 percent cell yield value for the final rule analysis, the agencies aligned the cell yield value assumption with internal DOE studies."[359] Moreover, in a footnote the agencies purport to identify only *one* DOE study, stating that "Argonne used an 85% cell yield assumption in its Estimated Cost of EV Batteries 2018-19 analysis."[360]

Thus, the agencies appear to diverge from the default cell yield value in BatPaC solely in the name of aligning with a single internal DOE study. But the agencies provide no information whatsoever to allow the public to analyze or assess the content, purpose, methodology, or validity of that DOE study, much less do they provide the actual study itself (or identify any way for the public to access it). Nor do they provide any valid explanation for why a single DOE study is sufficient to override the judgment of the "[e]xperts from all aspects of battery development [that] have reviewed the [BatPaC] model," including its default inputs.

Simply, the agencies' justification for departing from the default BatPaC value of 95% cell yield is arbitrary and unlawful, as is their failure to provide the public with the "internal DOE study" that forms the entire basis of the agencies' decision to revise a consequential model assumption with significant impacts on projected battery costs.

c) The agencies' projected battery costs are arbitrarily high because the agencies use arbitrarily low fuel efficiency estimates for BEVs.

The BatPaC lookup tables provide projected costs for batteries with varying power (measured in kilowatts, or kW) and capacity (measured in kilowatt-hours, or kWh, where one kWh provides enough capacity to deliver one kW of power to the vehicle for one hour). Thus, to determine which battery to use for any specific vehicle, the agencies must project both (1) the energy requirements for that vehicle, and (2) that vehicle's intended range (or, the distance that vehicle will be capable of driving on a single charge of the battery). The efficiency (or required energy per mile) multiplied by the intended range in miles will equal the required battery pack size. Thus, for example, for a Chevrolet Bolt BEV with a max power of 150 kW and a capacity of 60 kWh[361] the ANL lookup tables project that a battery pack will cost approximately $11,000 in MY2020 (as shown below).[362] This projection reflects the agencies' assumed annual production volume of 25,000 batteries and a cell yield value of 85% (both of which are arbitrary and erroneous inputs, as described above).[363]

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[358] 85 Fed. Reg. at 24,502.
[359] *Id*.
[360] *Id*. at 24,502 n.1212.
[361] *See* Chevrolet, 2017 Chevrolet Bolt EV Specifications, available at: https://media.chevrolet.com/content/media/us/en/chevrolet/vehicles/bolt-ev/2017/_jcr_content/iconrow/textfile/file.res/2017-Chevrolet-Bolt-EV-Product-Facts-081717.pdf
[362] This is the agencies' modeled cost for a small SUV, 60 kWh battery pack with 200 horsepower (or, 150 kW) of maximum power output (actual cost calculation requires interpolating between values shown in the table). *See* "ANL_BatPac_Lookup_tables_05132019_FINAL.xlsx," Docket #NHTSA-2018-0067-12468.
[363] The Bolt battery cost example is illuminating. The ANL Model Documentation describes that an engineering teardown analysis of a MY 2017 Chevrolet Bolt was used to "evaluate the assumptions in BatPaC." ANL Model Documentation at 194. Using inputs from that teardown analysis, ANL states that BatPaC returned a battery pack cost of $8,583. *Id*. But as shown in the lookup table containing the costs actually used in the Final Rule analysis the

Final Rule BatPac Lookup Table for Small SUV[364]

Annual Production Volume = 25,000										
	BEV200		Energy, kWh							
			30.0		50.0		70.0		90.0	120.0
BatPac Cost	Power, kW	20.0	$ 8,001	$	9,947	$	11,779	$	13,512	$ 16,079
		40.0	$ 8,015	$	9,962	$	11,794	$	13,526	$ 16,093
		60.0	$ 8,030	$	9,976	$	11,808	$	13,541	$ 16,107
		80.0	$ 8,045	$	9,991	$	11,823	$	13,555	$ 16,122
		100.0	$ 8,060	$	10,006	$	11,837	$	13,570	$ 16,136
		120.0	$ 8,075	$	10,021	$	11,852	$	13,585	$ 16,151
		140.0	$ 8,091	$	10,036	$	11,867	$	13,600	$ 16,166
		160.0	$ 8,107	$	10,051	$	11,883	$	13,615	$ 16,181
		180.0	$ 8,123	$	10,067	$	11,898	$	13,630	$ 16,196
		200.0	$ 8,139	$	10,083	$	11,913	$	13,645	$ 16,211
		240.0	$ 8,173	$	10,115	$	11,945	$	13,676	$ 16,242
		280.0	$ 8,210	$	10,148	$	11,977	$	13,708	$ 16,273
		320.0	$ 8,247	$	10,182	$	12,010	$	13,740	$ 16,305
		400.0	$ 8,329	$	10,255	$	12,078	$	13,807	$ 16,370

Comments on the Proposal objected that the agencies' estimates of BEV efficiency and, thus, of battery capacity, size, and cost were unrealistic and arbitrary.[365] In response, the agencies state that they "updated the modeling of electric machines used in BEVs to reflect improvements in efficiency."[366] However, notwithstanding the agencies' updates, the agencies' new estimates for the BEV vehicle efficiencies remain unrealistically low in the Final Rule, which causes the agencies to select larger and more expensive batteries from the ANL lookup tables.[367] In particular, the agencies continue to model MY 2026 vehicles as less efficient than existing, real-world MY 2017 BEVs. The figure below plots the agencies' assumed efficiencies for MY 2026 vehicles against the actual efficiencies of existing, real-world MY 2017 vehicles.[368] As the table shows, the agencies assume that many electric vehicles will be far less efficient in MY 2026 than various electric vehicles were three years ago—an unrealistic and arbitrary assumption given automakers' recent trend of improving BEV efficiency.

Bolt battery pack has a base cost of approximately $11,000 in MY 2020. And the agencies' learning factor for MY 2017 is 1.141, meaning the agencies' cost for the Bolt battery in MY 2017 (before applying the agencies' 50% RPE markup) is approximately $12,551 (1.141 * 11,000 = $12,551). That's 46% ($12,551/$8,583 – 1 = 46.2%) higher than the value derived using data from the engineering teardown analysis in the ANL Model Documentation. And that's before the agencies erroneously (as described below) apply a full 50% markup to the Bolt battery cost, which produces a total cost of $18,826 ($12,551 * 150% = $18,826.50). That's 120% ($18,826/$8,583 – 1 = 119.3%) higher than the value derived using the teardown data.

[364] From "ANL_BatPac_Lookup_tables_05132019_FINAL.xlsx," Docket #NHTSA-2018-0067-12468.

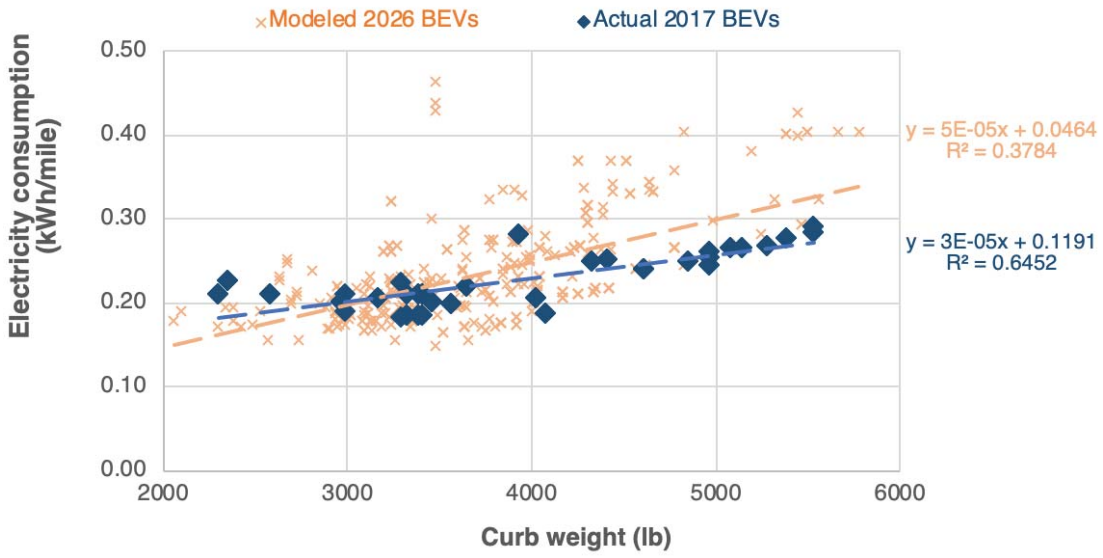
[365] *See, e.g.,* CARB Comment at 145-149; 85 Fed. Reg. at 24,491 (describing that CARB commented that "that some MY 2016–2018 BEVs exist that have a higher efficiency than simulated for BEV200s in Autonomie.").

[366] 85 Fed. Reg. at 24,491; *see also id*. at 24,479-82 (discussing updates to electric vehicle efficiency modeling).

[367] Comments on the Proposed Rule objected to the agencies' arbitrarily low estimates of BEV efficiency. *See, e.g.*, Comment of the ICCT at I-81.

[368] Data in the table for both modeled 2026 and actual 2017 BEV efficiencies are from Final Rule CAFE Model File for CAFE standard-setting run, "vehicles report," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system

Figure: Comparison of Modeled MY 2026 BEV Efficiency Values and Real-World MY 2017 Efficiency Values[369]



d) The agencies' projected battery costs are arbitrarily high because the agencies use arbitrarily shallow learning curves.

After pulling a base MY 2020 battery cost from BatPaC, the agencies then use learning curves "to reduce the cost of batteries over time."[370] As the agencies describe, "[t]he learning curves act as a proxy for potential future improvements in battery chemistry and other battery-related advancements that would reduce costs."[371] This statement demonstrates that these learning curves are particularly important to the agencies' modeling of long-term battery costs, because rather than returning to the BatPaC model to update their assumptions regarding, *e.g.*, production volumes, cell yields, and battery chemistries, the agencies simply assume that all of those improvements in battery costs are captured by the learning curves.[372]

Commenters objected that the learning curves used in the Proposed Rule failed to reflect publicly available data regarding projected battery costs, and that the agencies had used battery cost learning curves that were 29% shallower than the agencies previously used.[373] Yet the learning curves the agencies apply for the Final Rule continue to be unreasonably shallow. The agencies' learning curves cause the base cost derived from BatPaC to be reduced by 4.5% per year from MY 2020 to MY 2032, by 4% per year from MY 2033 to 2035, by 2% per year from

[369] The figure plots BEV efficiency versus vehicle curb weight to account for the relationship between road load and energy requirements. The fact that the MY 2026 vehicles in the agencies' modeling have such poor efficiency relative to real-world MY 2017 vehicles with similar curb weights demonstrates that the agencies' efficiency estimates are unrealistically low.
[370] *See* 85 Fed. Reg. at 24,499.
[371] *Id*.
[372] *See, e.g.*, *id*. (describing that the learning curves make it "unnecessary to make inherently uncertain projections of potential future improvements in battery chemistry over time").
[373] *See id*. at 24,513-14. *See also* CARB Comment at 142-44; Comment of the ICCT at I-83.

MY 2036 to MY 2039, and by 1.5% per year from 2040 to 2044.[374] These learning rates are arbitrarily low, based on an arbitrary methodology, and contradicted by empirical studies.

The agencies themselves acknowledge that studies of real-world battery costs found historical learning rates for battery manufacturing costs have been significantly steeper than this, and thus concluded that learning rates used in prospective analyses should also be significantly steeper.[375] For example, a Bloomberg New Energy Finance (BNEF) study found a historical learning rate of 18%.[376] And a report by the ICCT found that market competition, innovation in the battery supply chain, and greater economies of scale are currently driving an annual learning rate of 7% per year, and potentially as high as 9% per year.[377] The battery innovations cited in the battery literature include movement to battery chemistries with higher energy density, lower usage of high-cost materials, pack-level improvements, and manufacturing process improvements.[378] These are all factors that the agencies have refused to model directly, instead purporting to capture them in their modeling through the use of learning curves. Yet rather than actually engaging with and assessing the validity of the learning rate findings from those studies, the agencies simply assert without explanation that they "considered them" in the Final Rule.[379] Such a bare assertion does not meet the legal threshold for reasoned decision-making.

For the first time in the Final Rule, the agencies describe how they developed their learning curves for the Proposal. Specifically, they describe that "[b]ecause BatPaC does not simulate battery costs as a function of time, the agencies modified the battery volume inputs for MY 2015, MY 2020, MY 2025 to show costs in each of those MYs."[380] Then, the agencies state, "a learning curve was developed from the year over year cost change, and this rate was used to develop the learning curves used in the NPRM."[381] The agencies then state that—without allowing the public any opportunity to comment on their methodology—they use "the same cost learning projection method from the NPRM to project learning rates out through 2050."[382]

But this methodology is unreasonable and arbitrary. First, the agencies fail to provide the requisite information to even assess the validity of their assumptions—namely, they do not provide the specific battery production volumes they assumed for MYs 2015 and 2025 or how they arrived at those estimated volumes, nor do they provide the projected costs that BatPaC produced for those years using those volumes, nor do they provide details regarding how the agencies extrapolated values for the intervening years (*e.g.*, MYs 2021-2024) from the three data

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[374] *See* Final Rule CAFE Model File for CAFE standard-setting run, "technologies_cafe_ss_ref," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system; *See also* 85 Fed. Reg. at 24,515 (Figure VI-43).
[375] *See* 85 Fed. Reg. at 24,510.
[376] *Id*.
[377] Lutsey, Nic and Nicholas, Michael, Update on electric vehicle costs in the United States through 2030, ICCT (April 2, 2019), available at https://theicct.org/publications/update-US-2030-electric-vehicle-cost; *see also* 85 Fed. Reg. at 24,509 n.1235 (citing this ICCT study).
[378] *See* Lutsey, Nic and Nicholas, Michael, Update on electric vehicle costs in the United States through 2030, ICCT (April 2, 2019)
[379] 85 Fed. Reg. at 24,514.
[380] *Id*.
[381] *Id*.
[382] *Id*. at 24,515.

points they extracted from the BatPaC modeling. Without this information, the public is unable to adequately assess or critique the agencies' methodology or the resulting values.

Further, the methodology is arbitrary on its face for at least the following reasons. First, the agencies acknowledge that factors other than production volume have had and will have significant effects on battery costs. For example, evolutions in battery chemistry, battery density, and production processes (including cell yield, among other factors) have significant impacts on battery costs. Yet none of these factors are considered in the agencies' blunt approach to learning curves, which relies solely on undisclosed projections of future battery production volumes.[383] Second, as described above, the agencies' estimates of model year 2020 battery production volumes are unrealistically and arbitrarily low. If the agencies use that production volume, which is in conflict with observed production values, as their starting point for measuring the impact of learning on future battery costs, then the learning curves that result from that starting point are likewise unreasonable and arbitrary.[384]

In sum, the agencies' methodology for calculating future learning rates was not revealed until the Final Rule, and even then they have failed to disclose that methodology in enough detail to enable the public to analyze and critique it. But even the details they have provided demonstrate that it is arbitrary and unlawful. Moreover, the agencies have wholly failed to consider the relevant literature regarding historical and prospective learning rates, which literature demonstrates that the agencies' learning curves are unreasonably shallow. The agencies must withdraw and reconsider the Final Rule using realistic, empirically-based rates for future battery cost learning.

e) The agencies erroneously inflate costs by applying the retail price equivalent (RPE) markup, intended to represent indirect costs, to base costs that already include indirect costs.

The agencies apply their retail price equivalent (RPE) markup to the cost values that they generated using BatPaC. Here, the agencies apply the same RPE value they use for all of the other technologies in the agencies' modeling (including, *e.g.*, technologies used to improve emissions and fuel economy of internal combustion engines)—that is, 50%. However, applying a 50% RPE markup to cost values from the BatPaC lookup tables is arbitrary.

The agencies' methodology for estimating the costs of all technologies in their analysis is to first quantify direct manufacturing costs, which are the "[c]ost of labor, materials, and variable energy needed for production."[385] On top of this direct manufacturing cost, the agencies apply a 50% RPE markup to "account[] for indirect costs like engineering, sales, and administrative support, as well as other overhead costs, business expenses, warranty costs, and return on capital considerations."[386] According to the agencies, the RPE markup constitutes the agencies'

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[383] That the agencies' omission of these factors is arbitrary is further evidenced by the fact that the agencies *did* at least purport to consider battery chemistry in selecting learning curves after model year 2033. *See id*. at 24,514-15.
[384] It is not possible to assess what starting point the agencies actually used, because the agencies fail to disclose that information in the Final Rule. *See id*. at 24,514.
[385] 85 Fed. Reg. at 24,350.
[386] *Id*.

estimate of line items including the "cost of developing and engineering the product," the "cost of maintaining and operating manufacturing facilities and equipment," the "cost of providing product warranty," the "depreciation and amortization of manufacturing facilities," and the "manufacturer costs of advertising manufactured goods."[387]

However—unlike for the other technologies in the agencies' analysis—the vast majority of these costs are already included in the base costs that the agencies used from ANL lookup tables. In other words, those lookup tables do not provide "direct manufacturing costs," they provide total costs, including indirect costs. Specifically, the ANL BatPaC documentation states that "[t]hese costs include launch costs, working capital, variable overhead, general, sales, administration (GSA), research and development, depreciation, warranty, and profit."[388] All of these costs are among the costs the agencies purport to capture in their analysis by applying the RPE, as described above.

Thus, the agencies applied the RPE not to direct manufacturing costs but rather to total costs, including indirect costs, and in doing so arbitrarily inflated their estimates of total costs significantly. To be clear, this is not simply a matter of counting indirect costs twice (which would be egregious in and of itself)—but rather it is a matter of erroneously inflating *all* battery-related costs (direct manufacturing costs and indirect costs alike) by 50%, which is effectively the same as accounting for the indirect costs more than twice. To illustrate, if the direct manufacturing cost were $1 and indirect costs were (as the agencies suggest they should be) 50% of that direct manufacturing cost, then the total cost should be $1.50.[389] But the agencies' methodology would dictate that we take that total cost and add another 50% to (erroneously) account for indirect costs a second time. That methodology in turn would lead to a total cost of $2.25.[390] That means that using the correct methodology, the indirect costs would be $0.50 and the total costs would be $1.50, but using the agencies' methodology total costs are $2.25—50% more than the correct amount.[391]

For example, for the Chevrolet Bolt, on top of the direct cost of the battery pack of approximately $11,000, there would be an additional $5,500 RPE markup, making the total battery pack cost to the consumer approximately $16,500 in MY 2020 in the agencies' modeling.[392] But, as described above, that $5,500 already includes many of the same costs that are already reflected in the base $11,000 cost. Therefore, inflating the Bolt battery cost by $5,500 is plainly erroneous. The sheer size of the markup when erroneously applied to battery costs makes this error centrally relevant to the agencies' analysis, rendering that analysis arbitrary and unlawful.

That the agencies erred in applying the RPE markup to the base BatPaC costs is further demonstrated by the agencies' attempt to justify their battery costs by "compar[ing] the battery pack cost estimates generated using BatPaC to other current studies or studies cited by

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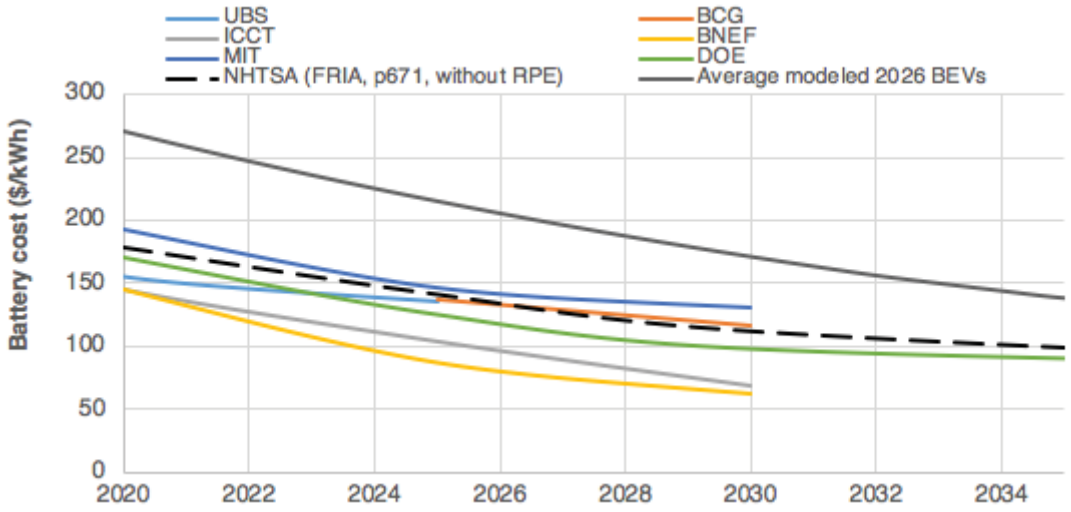
[387] *Id*.
[388] BatPaC Model Documentation at 82.
[389] (1*150%) = 1.50
[390] (1.50*150%) = 2.25
[391] (2.25/1.50) – 1 = 50%
[392] This is based on applying the 1.5 RPE factor to the agency cost for a small SUV, 60 kWh battery pack, 200 hp (149 kW) power. *See* "ANL_BatPac_Lookup_tables_05132019_FINAL.xlsx," Docket #NHTSA-2018-0067-12468.

commenters."[393] The agencies' presentation of the results from these studies suggest that only one of the studies they considered projected battery costs to be higher than the BatPaC cost estimates the agencies used in the Final Rule.[394] But this is misleading. The agencies compare only the pre-RPE battery cost from BatPaC to the values cited from other studies. As described above, the agencies apply the RPE markup to the cost derived from BatPaC in order to account for indirect costs, meaning that the actual cost they assume for batteries is 50% higher than the value they compare to the values in the various studies. The studies, in contrast, already include many indirect costs in their base cost estimates.[395] In other words, where the agencies suggest that their per-kWh total battery cost in MY 2020 is $178,[396] in fact it is $267—a number that dwarfs the costs found by every other study considered.[397] The figure below shows the actual comparisons between the cost figures modeled in the Final Rule and the costs found by the studies the agencies cite in the Final Rule. This figure confirms that it is wholly irrational and arbitrary to apply the RPE adjustment to costs derived from BatPaC.

Figure: Comparison of cost per kWh in the Final Rule and costs found by the studies cited in the Final Rule.



In sum, application of the RPE markup to battery costs derived from the BatPaC model is unsupportable. That methodology results in arbitrarily and unrealistically high battery costs, rendering EPA's entire modeling analysis arbitrary and unlawful. EPA must withdraw and

[393] 85 Fed. Reg. at 24,509.
[394] *Id*. at 24,510.
[395] *See, e.g.*, *id*. at 24,509 n.1235 (citing Nic Lutsey and Michael Nicholas, Update on electric vehicle costs in the United States through 2030, ICCT (April 2, 2019)); Nic Lutsey and Michael Nicholas, Update on electric vehicle costs in the United States through 2030, ICCT (April 2, 2019) at 2 & Table 1 (showing that studies considered by ICCT in developing its battery cost estimate included consideration of indirect costs including "process, overhead, depreciation, warranty, and profit").
[396] 85 Fed. Reg. at 24,510 (Table VI-118).
[397] *See id.*

reconsider the Final Rule, and must undertake a new analysis in which it does not apply the 50 percent RPE markup to battery costs from BatPaC.

f) The agencies' errors in projecting battery costs are centrally relevant to EPA's analysis in the Final Rule.

The effect of these errors has a significant effect on compliance costs, which makes it centrally relevant to EPA's analysis in the final rule. To illustrate, as described above, the agencies' modeling assumes that the base battery cost (from BatPaC) for the Bolt EV in MY 2020 is approximately $11,000, and the total cost of that battery after applying the RPE markup is $16,500.

But, as noted above, restoring the annual production volume assumption of 100,000 units from the Proposal would decrease the base cost by 15%, or $1,650 - meaning this one change would cause the base cost for the Bolt battery to be $9,350 rather than $11,000.[398] Further, restoring the manufacturing plant efficiency (or cell yield) value back to the 95% would decrease this cost (on average) by another 6.8%, or $636.[399] Thus, restoring the prior estimates of both production volume and cell efficiency would make the base cost of the MY 2020 Bolt EV battery as low as $8,714[400]—a 21% decrease from the base cost value the agencies use.[401] And if we omit the 50% RPE markup altogether, given that that multiplier is duplicative of indirect costs already included in the base costs derived from BatPaC, then this $8,714 value would be the *total* cost to be used in the modeling, which would be a full $7,786,[402] or 47%,[403] lower than the $16,500 cost the agencies used in the Final Rule.

Even if the agencies did continue to apply the full, erroneous 50% RPE markup (which they cannot reasonably do), adding the markup to the $8,714 base cost described above would produce a total cost of $13,071[404]—that's still $3,429,[405] or 21%,[406] lower than the total cost the agencies use in the analysis.

Furthermore, this example highlights only the impact on battery pack costs in MY 2020. As described above, the agencies also erroneously under-estimate the BEV efficiencies throughout the period covered by the modeling analysis, and erroneously apply arbitrarily shallow learning curves. Fixing each of those errors would cause battery pack costs to decrease even further after MY 2020 as the effects of the learning curves and efficiencies are reflected in the modeling.

These changes in costs are centrally relevant to the agencies' analysis, as evidenced by the agencies' own sensitivity runs. In particular, the agencies perform a sensitivity run for the GHG standards setting the base manufacturing costs at 10% lower than the values the agencies derived

[398] $11,000 - $1,650 = $9,350.
[399] $9,350 * 6.8% = $635.80.
[400] $9,350 – $636 = $8,714.
[401] $8,714/$11,000 – 1 = -20.8%
[402] $16,500 - $8,714 = $7,786.
[403] $7,786/$16,500 = 47.2%.
[404] $8,714 * 150% = $13,071.50.
[405] $16,500 - $13,071 = $3,429.
[406] $13,071/$16,500 - 1 = -20.8%.

from BatPaC.[407] As described above, restoring the annual production volume estimate to 100,000, restoring the cell yield value to 95%, and correcting the agencies' erroneous application of the 50% RPE markup decreases battery pack prices by between 21% and 57%. Thus, the 10% cost reduction in the agencies' sensitivity case is still far too small. But that sensitivity case still has a significant effect. In this run the net cost to society from the GHG standards in the Final Rule increases by $8.4 billion (from a net cost of $22.1 billion to a net cost of $30.5 billion) using a 3% discount rate.[408] And total net benefits decrease by $4.6 billion (from $6.1 billion to $1.5 billion) using a 7% discount rate.[409]

The agencies also performed a sensitivity run in which they increased "early" annual decreases in costs due to learning to 6% (up from the 4.5% used in the agencies' central analysis), in addition to reducing battery direct manufacturing costs by 10%.[410] Again, this change in learning is too small—as the literature cited above shows learning rates of at least 7% and up to more than 18%. Nevertheless, this sensitivity case shows that the net cost to society from the GHG standards in the Final Rule increases by $19.9 billion (from a net cost of $22.1 billion to a net cost of $42 billion) using a 3% discount rate,[411] and net benefits for the GHG program decreased by $5.5 billion (from $6.1 billion to $0.6 billion) using a 7% discount rate.[412]

These sensitivity cases illustrate the dramatic impact that changes to the agencies' assumptions regarding battery costs have on the agencies' analysis. And these sensitivity cases still woefully underestimate the total impact from fixing the errors in the agencies' modeling of battery costs. Restoring the agencies' production volume and cell yield estimates to those used in the Proposal along with eliminating or significantly reducing the 50% RPE markup would decrease battery costs by nearly 50%—a reduction 5 times larger than that the agencies modeled in their sensitivity cases. That even those sensitivity cases show dramatic impacts on total costs and benefits of the Final Rule demonstrates that the agencies' errors in battery cost modeling undermine the agencies' entire analysis, rendering it arbitrary.

EPA must withdraw the Final Rule, restore the previously existing GHG standards, and fix the errors in the battery cost modeling analysis described above before considering the appropriate level of future standards.

viii. Contrary to explicit statements in the preamble, the agencies failed to update the model to use automakers' existing MY 2016 credit bank toward their compliance obligations when they updated the analysis fleet to Model Year 2017.

As the Final Rule describes, "[u]nder EPA's regulations, manufacturers can use credit flexibilities to comply with CO2 standards."[413] Specifically, "[m]anufacturers gain credits when the performance of a fleet exceeds its required CO_2 fleet average standard," and those credits can

[407] *See* FRIA at 1770 (Table VII-471) (describing "Lower Battery Direct Costs and Reference Case Learning" sensitivity case)
[408] *Id*. at 1807, 1808.
[409] *Id*. at 1809, 1810.
[410] *See id*. at 1770 (Table VII-4171) (describing "Lower Battery Direct Costs and Faster Learning" sensitivity case).
[411] *Id*. at 1807, 1808.
[412] *Id*. at 1809, 1810.
[413] 85 Fed. Reg. at 25,205.

be applied toward compliance obligations in future model years.[414] Therefore, the number of credits the fleet already has in its existing "credit bank" impacts both (1) how much technology the fleet actually has to apply in future model years to comply with the standards in those years; and (2) when the fleet actually has to apply that technology. Both of these factors have direct impacts on the EPA's projections of manufacturers' costs to comply with future-year standards. Therefore, as commenters made clear during the comment period,[415] it is important that EPA accurately quantify the number of credits in manufacturers' existing credit banks, and make the full credit banks available for manufacturers to use in future model years. But, as described below, EPA failed to do so in the Final Rule.

The agencies use an "analysis fleet" as their starting point in projecting pathways automakers could use to comply with the standards. That analysis fleet is intended to be populated with real-world data.[416] From there, the CAFE model projects compliance pathways for automakers to achieve the MY 2025 standards. In addition to serving as the starting point for measuring automaker GHG emissions and fuel economy performance—and thus the starting point for modeling the required improvements, and their costs, to achieve GHG and fuel economy standards in subsequent model years—the analysis fleet also determines the starting point for automakers' overcompliance credit banks in the modeling. Specifically, because the last full year of accumulated credits in manufacturers' credit banks is from the model year before the year of the analysis fleet, that prior year is the end point for the agencies' tabulation of the overcompliance credits in manufacturers' banks at the start of the agencies' modeling analysis.

In the Proposal, the agencies used a MY 2016 analysis fleet.[417] Thus, as described above, the last year of real-world credit bank data used in the agencies' analysis was MY 2015.[418] In the Final Rule, the agencies now use a MY 2017 analysis fleet.[419] Thus, the agencies state that they have updated their analysis to include credits earned in MY 2016.[420] And EPA expressly includes the MY 2016 credit bank in its description of the "banks with which the simulations in this analysis were conducted."[421] Thus, it is clear that EPA intended the last year of real-world credit bank data used in EPA's analysis to be MY 2016. But the MY 2016 credit bank is not, in fact, reflected in the agencies' analysis.

The agencies' error is not that they failed to populate the MY 2016 credit bank in the modeling files. They did. Specifically, the agencies' input files show that the MY 2016 credit bank contains more than 60 million megagrams (Mg) of credits. These credits comprise 27% of

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[414] *Id*.
[415] *See, e.g.*, Comment of UCS, Docket #EPA-HQ-OAR-2018-0283-5840, at 39 (objecting that the agencies "did not accurately reflect . . . the full bank of credits accrued by manufacturers under EPA's greenhouse gas program").
[416] This petition does not concede that the agencies' analysis fleet accurately reflects the real world fleet.
[417] *See* 83 Fed. Reg. at 43,005.
[418] *See id.* at 24,308 (describing that "MY 2016 was simulated explicitly in the NPRM analysis to prohibit the inclusion of banked credits in MY 2016").
[419] *See id*. at 24,176.
[420] *Id*. at 24,308.
[421] *Id.* at 24,308-09.

the fleet's total credit bank going into MY 2017 (meaning 73% of the banked credits were earned and placed in the credit bank before MY 2016).[422]

However—contrary to their description in the Final Rule of what they should have done—the agencies failed to update the modeling to actually allow automakers to *use* the credits from MY 2016 as part of their compliance strategies. Specifically, the model is still hard-wired to end the usable credit bank in MY 2015.[423] In other words, the programmers updated the model's input files with data regarding the MY 2016 credit bank, but they failed to change the model itself to allow it to use those credits in the compliance modeling. Therefore, the modelers effectively blocked the fleet from utilizing 27% of the existing credit bank.

This is a clear error in the agencies' analysis. And it has a significant impact. When we updated the model to allow use of the existing credit bank through MY 2016—without making any other changes to the model—it caused the net costs to society from the Final Rule GHG standards to increase by $7 billion (from a net cost of $22.1 billion to a net cost of $29.1 billion) at a 3% discount rate, and caused total net benefits decrease by $4.6 billion (from $6.1 billion to $1.5 billion) at a 7% discount rate. Thus, without fixing any of the other flaws in the agencies' modeling, allowing the model to use the MY 2016 credit bank—which the agencies state the model *should* be allowed to do—has a dramatic impact on the agencies' cost-benefit analysis.

Moreover, even these impacts are likely understated. As described in more detail below, the Final Rule CAFE model responds irrationally to increased availability of credits. Therefore, while the changes in compliance costs from allowing the model to use the MY 2016 credit bank demonstrate that the agencies made a clear error in their modeling that will have material impacts on the analysis, they do not demonstrate the total impact that fixing the error would have. Instead, as described below, the impact is likely to be far greater.

ix. The model responds irrationally to increased availability of overcompliance credits and to availability of credit trading, demonstrating that the model is fundamentally flawed and produces unrealistic, arbitrary results.

As described above, the GHG standards allow automakers to earn credits for performing better than required in any given model year and then to either apply those overcompliance credits towards their compliance obligations in future years or to sell them to other

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[422] *See* Final Rule CAFE Model File market_ref.xlsx, "Manufacturers" tab, columns BB-BN. Additionally, this model file shows fewer banked credits than, and is otherwise inconsistent with, the credits EPA has elsewhere reported for manufacturers entering MY 2017. *See* EPA, Greenhouse Gas Emission Standards for Light-Duty Vehicles, Manufacturer Performance Report for the 2016 Model Year, Docket #EPA-HQ-OAR-2018-0283-0647, at 76 (Table 5-2). EPA's failure to accurately reflect the amount of banked credits appears to be another error in the agencies' analysis.

[423] The limitation blocking use of the MY 2016 credit bank is in the parser for the market data file. Final Rule CAFE Model file: Volpe.Cafe.IO.InputParsers.XIMarketDataParser.cs, specifically lines 157-166, 288, and 302, available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system. The agencies' failure to allow use of the MY 2016 credit bank in their modeling is also apparent by looking at debugging logs used to monitor credit usage by manufacturers. *See* Final Rule CAFE Model file: Central Analysis/output/CO2_ref/debug-logs/credit_trades_sn?.csv (showing modeled manufacturers utilizing overcompliance credits earned in MYs 2011-2015 (in the "eYear" column) and earned in future modeled years (MY 2017 and beyond), but not utilizing any credits earned in MY 2016).

manufacturers for use toward those manufacturers' compliance obligations.[424] This crediting flexibility enables automakers to maximize cost-effectiveness in their compliance strategies by averaging over-compliance and under-compliance. In other words, because the automakers are not required to meet their regulatory targets every year through emissions improvements alone, they are able to reduce overcompliance with the standards and reduce their costs of compliance.

However, the agencies' modeling shows that crediting provisions frequently have the opposite effect on their analysis. In the modeling, when credits are made more plentiful or more accessible to manufacturers, the costs of compliance often *increase*. This is an absurd result—making overcompliance credits more abundant or more accessible should uniformly cause compliance costs to decrease, as those credits enable automakers to forego or delay technological improvements to their fleets as a means of complying with the standards. Thus, the fact that making overcompliance credits more abundant or more accessible causes compliance costs to increase in *any* scenario demonstrates that the model is incapable of rationally modeling manufacturers' most cost-effective compliance pathways—which, of course, is the model's central purpose.

This irrationality is evident in the agencies' own sensitivity analyses. In particular, the agencies include a sensitivity run intended to measure what the costs and benefits of the Final Rule would be if the automotive industry could trade overcompliance credits between manufacturers with zero cost. The agencies do this by treating the entire U.S. fleet as a single entity, thus (in theory) enabling that fleet to deploy credits in the most cost-effective way possible, regardless of which manufacturer in fact earned those credits. The agencies refer to this as the "perfect trading" sensitivity run.[425] As the agencies have described in past analyses, this sensitivity run is intended to represent a "'best-case' or least cost" scenario.[426] The agencies reaffirm this description in the Final Rule, stating that in the perfect trading run "the most cost-effective choices are made for the fleet as a whole"[427] and that treating "all manufacturers as a single entity . . . should lead the model to show lower costs than when manufacturers are treated as separate entities that do not trade."[428]

But the "perfect trading" sensitivity run using the Final Rule CAFE model does not return the "best case" or "least cost" results. In fact, it shows *increased* compliance costs for the previous standards scenario. The agencies admit as much, stating that "starting in MY 2025, the 'perfect trading' case shows considerably higher costs, even though average achieved CO_2 levels are very similar in some model years."[429] And the agencies acknowledge that total compliance costs are higher in the perfect trading case, too.[430]

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[424] The standards also allow automakers to carryback their overcompliance credits to apply toward compliance obligations in past years in which they had a compliance deficit.
[425] *See* FRIA at 1854.
[426] *See* 2016 TSD at 2-242.
[427] 85 Fed. Reg. at 24,220 n.99.
[428] FRIA at 1854.
[429] *Id*. 1854.
[430] *Id*. at 1855.

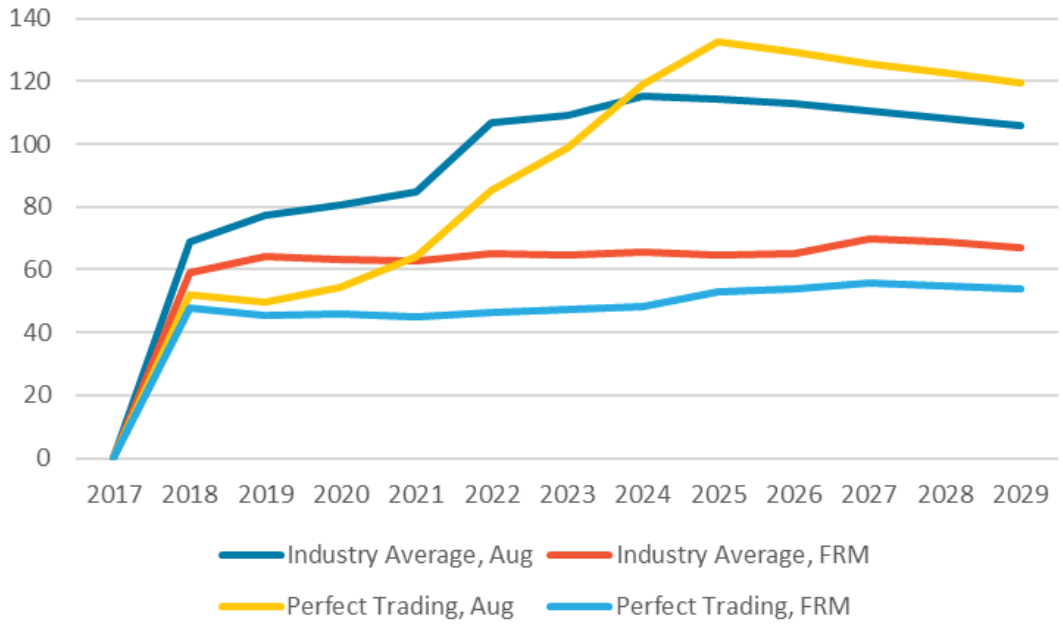

FIGURE: *The marginal technology costs for the previous standards in the perfect trading run rise rapidly post-2020, inexplicably surpassing the marginal costs of compliance for the previous standards in the Final Rule's central analysis. But that result is irrational – because "perfect trading" should enable the most cost-effective compliance strategy to be chosen for every manufacturer, under no scenario should it be possible for the costs of the perfect trading run to exceed the costs in the agencies' central run. In fact, the marginal costs for the Final Rule standards in the perfect trading run behave as one would expect, falling below the projected costs of the Final Rule standards in the central analysis. The cost projections for the previous standards scenario in the perfect trading run thus demonstrate that the model is producing irrational and absurd results.*

Rather than determining the reason for this irrational and absurd result, the agencies simply state that the "counterintuitive results appear at least partially attributable to the new 'cost per credit' metric" used to rank technologies in the modeling.[431] Here, the agencies are referring to a fundamental change made to the model's ranking algorithm in response to comments on the Proposal.[432] After acknowledging that the problem may lie, in part, in the very core of the model—the ranking algorithm—the only rational result would be to track the problem down and fix it. But that is not the approach the agencies took. Instead of analyzing why the algorithm inexplicably produces an irrational and absurd result by projecting that compliance costs will increase when overcompliance credits become more readily available, the agencies simply note that the algorithm they had used in the Proposal did not produce that result.[433] That the agencies

[431] *Id*.
[432] *See* 85 Fed. Reg. at 24,278-79. In the Proposal the model ranked technologies using the "effective cost" metric, which "represents the cost of a given option as the cost to apply a given technology to a given set of vehicles, and represents the benefit of the same option as the extent to which the manufacturer might expect buyers would be willing to pay for fuel economy (as represented by a portion of the projected fuel savings), combined with any reduction in CAFE civil penalties that the manufacturer might ultimately need to pass along to buyers." *Id*. at 24,279. In the Final Rule, the agencies changed the ranking algorithm to instead rank technologies based on the "dollars per ton" of CO_2 reduction, where the cost in dollars is adjusted to account for the agencies' projection of a portion of the fuel expenditures that will be avoided due to a given technology. *See id*. at 24,279. This is what the agencies refer to as the "cost per credit" metric.
[433] FRIA at 1856-57.

left this unexplained and obvious error unaddressed demonstrates that the model is fatally flawed.[434]

Moreover, additional modeling runs we performed using the Final Rule CAFE model also showed irrational and absurd results for the GHG program. For example, the agencies built into their modeling an assumption that automakers will automatically apply any technology that reduces fuel expenditures in 2.5 years by enough to fully offset that technology's up-front costs.[435] The agencies refer to these technologies as "cost effective" (or CE) technologies.[436] More specifically, the Final Rule model first applies any technology that pays for itself in 2.5 years or less, then applies any credits expiring in the year in which a vehicle is redesigned, and then—if necessary—looks for and applies additional technology to allow the vehicle to meet its regulatory target.[437] To test the impact of the agencies' automatic application of cost-effective technologies, we turned off that function in the modeling.[438] We refer to this as our "No CE Technology Run." This run had the effect of both (1) removing the automatic application of cost-effective technologies, as we intended; and (2) causing the model to apply any expiring overcompliance credits as the first step in its process, rather than as the second step—thus making overcompliance credits more available to manufacturers as a compliance pathway.[439] In

[434] Even if the perfect trading run did not produce inherently irrational and arbitrary results due to flaws embedded in the model itself, that run would still fail to show the full importance of considering credit trading in calculating the costs and benefits of the Final Rule. This is because the agencies' modeling of Tesla's battery electric vehicles sales (BEVs) (which generate significant overcompliance credits in the GHG program) is fundamentally flawed and arbitrary for two reasons. First, the agencies failed to update their analysis to reflect the impact of technical amendments EPA finalized the same day as the Final Rule. EPA, Light-Duty Vehicle Greenhouse Gas Program Technical Amendments, 85 Fed. Reg. 22,609 (April 23, 2020). Those amendments effectively double the number of credits that accrue from Tesla's BEV sales in the GHG program. In fact, the agencies included an option in the modeling to account for those amendments (Final Rule CAFE Model Documentation at 65), but irrationally and arbitrarily chose not to use it in their modeling analysis. Selecting that option in the modeling causes Tesla to generate 40% more credits than Tesla does in the agencies' analysis. That is, Tesla's credits increase from 17.8 million megagrams to 24.7 million megagrams. Second, although the agencies admit that Tesla sold approximately 190,000 BEVs in MYs 2018 and 2019, *see* 85 Fed. Reg. at 24,502 (Table VI-94), they nevertheless modeled Tesla's sales throughout the period of the analysis based on its MY 2017 sales of 46,979 vehicles, leading to sales volumes modeled for the previous and final standards which do not exceed 48,000 vehicles in the compliance timeframe (MY 2017-2029) (Final Rule CAFE Model file: Central Analysis/output/*/compliance_report.csv). That number is arbitrarily low. Using Tesla's actual MY 2018-2019 sales instead (and accounting for the finalized technical amendments) shows Tesla's overcompliance credits increasing to 127.3 million megagrams – more than *seven times* the number of credits the agencies' modeled. Of course, because Tesla sells only BEVs, its fleet is already in compliance with the previous standards through MY 2026, and thus Tesla's only use for overcompliance credits is to sell them. And in the real world, it does. *See* Weiss, Miles and Welch, David, "GM, FCA unmasked as source of Tesla's cash from emissions credits," Automotive News (June 3, 2019), available at https://www.autonews.com/regulation-safety/gm-fca-unmasked-source-teslas-cash-emissions-credits. The agencies' failure to model the full real-world impact of Tesla's existing and future credits in their analysis demonstrates that that analysis fails to rationally reflect the real-world impacts of the Final Rule.

[435] *See* 85 Fed. Reg. at 24,232. Numerous comments on the Proposal objected to this unsupported and unsupportable assumption, *see, e.g.*, Comment of UCS at 39, and it remains unsupportable and arbitrary in the Final Rule.

[436] *See* Final Rule CAFE Model Documentation at 70, 71.

[437] *Id*. at 70, 71.

[438] This was accomplished by preventing the execution of lines 540-548 in Final Rule CAFE Model file Volpe.Cafe.Model.Compliance.cs (which are the first step in the "compliance finding" process for a manufacturer).

[439] *See* Comment of UCS at 39 (objecting that the fact that the model's first step is to apply technology regardless of an automakers' compliance status is unrealistic and arbitrary).

other words, automakers in this run should be able to use overcompliance credits toward their compliance obligations before even determining whether to apply the technologies that would have been forced onto their fleet regardless of compliance status in the agencies' central scenario. Therefore, our modeling run should cause the model to allow automakers to maximize their use of overcompliance credits, causing a corresponding reduction in costs of compliance.

But that is not what happened. Instead, the cost of compliance in the previous standards scenario *increased* after we turned off the automatic application of cost-effective technologies. Specifically technology costs increased by $11.9 billion undiscounted, and by $10.5 billion using a 3% discount rate and $9.1 billion using a 7% discount rate.[440] As with the perfect trading run described above, this should never happen. Our run removed automatic application of technologies and enabled automakers to make more efficient use of overcompliance credits. Both of those factors—alone and considered together—should cause compliance costs to decrease. But in the Final Rule CAFE model, they don't. They increase. That result again demonstrates that the agencies' model is fatally flawed and incapable of projecting rational, cost-effective compliance pathways.[441]

That the model responds irrationally when overcompliance credits are made more abundant or more available demonstrates that the model cannot serve as the basis for a rational rulemaking analysis. Indeed, the model forms the "bulk of the agencies' analysis,"[442] and its central purpose is to "estimate manufacturers' potential responses to new CAFE and CO_2 standards and to estimate various impacts of those responses."[443] Moreover, the compliance cost projections from the CAFE model are the starting point for nearly every other aspect of the agencies' analysis—including impacts on sales, scrappage, vehicle miles traveled, emissions, fuel consumption, jobs, and, ultimately, the total net costs and benefits of the standards.

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[440] The cost of compliance refers to the total regulatory costs over MYs 2017-2029. We note that despite this absurd result, as compared to the agencies' central analysis the modeling run nevertheless showed that net costs to society from the Final Rule GHG standards increased by $9 billion (from a net cost of -$22 billion to a net cost of -$31 billion) at a 3% discount rate, and net benefits decreased by $3 billion (from $6 billion to $3 billion) at a 7% discount rate. Thus, even using the agencies' flawed modeling the agencies arbitrary assumption that automakers will apply any technology that pays for itself in 2.5 years or less still unreasonably and unlawfully tilts the agencies' analysis in favor of the Final Rule.

[441] We had speculated that part of the problem with the agencies' modeling may be the fact that the agencies continue to refuse to allow automakers to use overcompliance credits towards compliance except in the year those credits are expiring. *See* Final Rule CAFE Model Documentation at 71 (describing that the model only "applies available credits . . . which are due to expire during the analysis year" – that is, the "model year currently being evaluated by the modeling system"); *see also, e.g.*, Comment of UCS at 39 (objecting to the fact that the model irrationally allows credits to expire unused). Indeed, even in the No CE Technology run for the previous standards scenario, automakers allow 252 million megagrams of credits to expire unused – the equivalent of throwing billions of dollars out the window. *See, e.g.*, Comment of UCS at 39. However, in the agencies' central analysis automakers allow even more credits – 272 million megagrams worth – to expire unused. *See* Final Rule CAFE Model file compliance_report.csv. Thus, the No CE Technology run for the previous standards scenario does show some marginal increase in the use of credits – yet the total costs of compliance still increase. Therefore, although the agencies' irrational limitation on the years in which overcompliance credits can be used toward compliance obligations does arbitrarily inflate projected compliance costs in the agencies' central case and in the No CE Technology run, that limitation is not the sole cause of the model's projections that compliance costs will increase when credits are made more available.

[442] 85 Fed. Reg. at 24,219.

[443] *Id*. at 24,217.

But, as demonstrated by the model's treatment of overcompliance credits, the model does not produce rational or reliable results. In a rational model the optimal strategy chosen by a manufacturer would result in the lowest costs of compliance. Thus, as the agencies have acknowledged, affording a manufacturer more flexibility should only cause a decrease in compliance costs—both in the model and in the real world. But the agencies' model does the opposite—when provided with more flexibility and opportunities to reduce compliance costs, the modeled manufacturers inexplicably *increase* their costs to comply with the standards. That result is absurd, demonstrating that the model does not produce rational results. And even the agencies acknowledge as much.[444] This indicates a deeper flaw with the core of the compliance model—if the model is producing irrational results in response to fluctuations in credit availability or abundance, it may also be producing irrational results in response to other factors in the modeling. Despite that fact, the agencies have failed to definitively identify or resolve the source of the observed irrationality. And that failure undermines the entirety of the agencies' analysis, which relies principally on the model's projections of compliance costs to determine the costs and benefits of the Final Rule.

Moreover, even if the flaw in the modeling is limited to its projections of the impacts from overcompliance credits, that flaw still renders the agencies' analysis arbitrary, because those impacts alter the results of the compliance modeling, and thus alter all of the model's projected impacts. The agencies themselves emphasize the importance of considering overcompliance credits in their modeling of the GHG program, stating that by accounting for and modeling use of banked overcompliance credits the model "provides a more complete and realistic basis for estimating actual impacts of new CO2 standards."[445] But contrary to the agencies' description, the model's treatment of overcompliance credits does not provide a "more complete and realistic projection of the standards' impacts." It provides a wholly unrealistic and irrational projection of the standards' impacts.

Because the CAFE model produces irrational, absurd results, the agencies' reliance on it as the foundation of their rulemaking analysis is wholly arbitrary. The agencies must withdraw the Final Rule, fix the model such that it produces rational projections of cost-effective compliance pathways, and reconsider the Final Rule.

O. Contrary to their Prior Practice, the Agencies Have Failed to Include the Ethanol Content in Modern Retail Gasoline in Calculating the "Gap" between Compliance Test and Real World Fuel Economy

In the Final Rule, the agencies fail to account for the fact that test-cycle fuel contains more energy by volume than retail gasoline, because retail gasoline contains ethanol and test-cycle fuel does not. This failure is a departure from the agencies' prior practice that the agencies did not acknowledge in either the Proposed Rule or the Final Rule and that has significant impacts on the agencies' cost-benefit analysis, as described below.

[444] *See* FRIA at 1855-57.
[445] 85 Fed. Reg. at 24,218.

In the agencies' 2016 Draft Technical Assessment Report ("TAR"), which was part of the midterm evaluation process, the agencies explained that "[r]eal world tailpipe CO2 emissions are higher, and real world fuel economy levels are lower, than the corresponding values from EPA standards compliance tests."[446] As the agencies described, "[t]his is because laboratory testing cannot reflect all of the factors that can affect real world operation, and, in particular, the city and highway tests used for compliance do not encompass the broad range of driver behavior and climatic conditions experienced by typical U.S. drivers."[447] Thus, to convert the agencies' modeled compliance test value projections into real-world fuel economy values (for use in quantifying the projected real-world impacts of their regulations in the cost-benefit analysis), the agencies use a fleetwide average value for the "fuel economy gap"—or, the "gap" between the compliance test fuel economy results and expected real-world fuel economy.[448]

The analysis supporting the 2012 final rule promulgating the original GHG standards and previous/augural CAFE standards assumed that the fuel economy gap was 20%.[449] That means that the real world achieved fuel economy value was assumed to be 80% of the fuel economy value achieved on the two-cycle test (leaving a 20% "gap" between the compliance test values and the real-world values).[450] "For example, a vehicle with a fuel economy compliance test value of 30 mpg would be projected to have a real world fuel economy of 30 multiplied by 0.8 (equivalent to a 20 percent reduction) or 24 mpg."[451] The gap in GHG emissions is the inverse of the gap for fuel economy.[452] As the agencies described in the TAR, "[t]he inverse of 0.8 is 1.25," meaning the GHG gap is 25%, "and a vehicle with a CO_2 emissions compliance test value of 300 grams/mile would be projected to have a real world CO_2 emissions value of 300 multiplied by 1.25 or 375 grams/mile."[453]

The 20% value used in the 2012 analysis "was based on data from MY2004-2006."[454] However, in the TAR the agencies observed that "one factor [that impacts the magnitude of the gap] which has clearly changed [since 2004-2006] and can be quantified is ethanol content in gasoline."[455] Specifically, "[w]hen the 20 percent fuel economy gap was first projected in 2005-2006, ethanol accounted for a small fraction of the gasoline pool."[456] By 2016, the amount of ethanol content in retail gasoline had risen significantly, but the compliance test cycle continued to use gasoline without ethanol. Because "[e]thanol contains about 35 percent less energy than gasoline . . . EPA project[ed] that average in-use gasoline will contain about 3.5 percent less energy in 2025 than it did in the 2005-2006 timeframe" due to the increased ethanol content in gasoline.[457]

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[446] TAR at 10-1.
[447] *Id.*
[448] *See id.*
[449] *Id.*
[450] *Id.*
[451] *Id.*
[452] *Id.*
[453] *Id.*
[454] *Id.*
[455] *Id.*
[456] *Id.*
[457] *Id.* Although this section in the TAR referred to "EPA," it was contained in a section of the TAR that applied equally to both EPA and NHTSA, and was entitled "Economic and Other Key Inputs Used in *the Agencies'*

Therefore, the agencies updated their analysis to reflect this decrease in energy content of retail gasoline. Specifically, EPA continued to use the 20% value as the "base" fuel economy gap, but added "the projected impact of the ethanol increase in 2025" to that "base" value.[458] From this methodology, the agencies determined that the increase in ethanol content caused the total fuel economy gap to increase from the 20% used in the 2012 final rule to 23%, which was the value the agencies used in the TAR[459]—meaning the magnitude of the total fuel economy gap increased by 15% due to the increased ethanol content in gasoline.[460] In other words, the agencies determined that, accounting for the ethanol content in modern gasoline, real world achieved fuel economy is only 77% the fuel economy value achieved on the two-cycle test, rather than 80% as assumed in the 2012 final rule.[461] The inverse of 77% is 1.298, meaning (as described above) that the on-road GHG emissions gap is 29.8%.[462]

Thus, the TAR methodology used two distinct components to calculate the total fuel economy gap: 1) the "base" gap of 20% derived from 2005-2006 data; and 2) an adjustment to this base gap that accounted for the ethanol content in modern U.S. commercial gasoline. In the Proposed Rule, the agencies did not acknowledge or describe any decision or intention to depart from this prior methodology. In fact, in the Proposal, the agencies provided only a single sentence stating that "[t]he main analysis assumes operation on gasoline or diesel fuel achieves fuel economy 20% below rated [fuel economy] values."[463] The agencies did not elaborate on the rationale for using this value for the fuel economy gap, and they did not indicate that they were discontinuing their practice from the TAR of adjusting the base gap to account for the ethanol content in retail gasoline.

In fact, the only other discussion of the gap in the Proposal stated that "[w]hile the model currently allows the user to specify an on-road gap that varies by fuel type (gasoline, E85, diesel, electricity, hydrogen, and CNG), it does not vary over time, by vehicle age, or by technology combination."[464] And it described that "[i]t is possible that the "gap" between laboratory fuel economy and real-world fuel economy has changed over time, that fuel economy degrades over time as a vehicle ages, or that specific combinations of fuel-saving technologies have a larger discrepancy between laboratory and real-world fuel economy than others."[465] Finally, the Proposed Rule stated that "[f]urther research would be required to determine whether the model should include a functional representation of the on-road gap to address these various factors,

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Analyses." *Id*. (emphasis added). Thus, the discussion described the fuel economy gap methodology used by both NHTSA and EPA in the TAR analysis, notwithstanding that certain passages in that section refer to EPA.

[458] *Id*.

[459] *Id.*

[460] (23%/20%) – 1 = 15%.

[461] *Id*. at 10-1 to 10-2. EPA explained this same rationale and methodology for updating the fuel economy gap in the TSD at 3-1 to 3-2.

[462] (77/100) = 0.77, and (100/77) = 1.298.

[463] PRIA at 11. The agencies also stated that "[t]he main analysis . . . applies a 30% on-road gap for operation on electricity," though the agencies did not provide any explanation, discussion, or support for this value. *See id*. In the Final Rule, the agencies suggest for the first time that this 30% value was "introduced in 2011 (in the notice proposing standards for MYs 2017-2025)." FRIA at 1828.

[464] 83 Fed. Reg. at 43,187.

[465] *Id*.

and comment is sought on the data sources and implementation strategies available to do so."[466] None of these statements concern the issue of whether the difference in fuels used on the test cycle and in the real world impact the magnitude of the total fuel economy gap. Thus, again, the agencies did not acknowledge, mention, discuss, or analyze any change from the methodology in the TAR of adjusting the base gap to account for ethanol content in retail gasoline. As a result, the public was not on notice of any change in the agencies' methodology relative to the TAR, and thus it appears no one submitted comments regarding any such change.[467]

In the Final Rule, the agencies again simply reiterate that they are using 20% as the value for the fuel economy gap. Specifically, they state that they "have applied the same estimates of the 'on road gap' as applied for the analysis supporting the NPRM. For operation on gasoline, diesel, E85, and CNG, this gap is 20 percent[.]"[468] Further, the FRIA explains that "[p]rior to 2008, NHTSA applied EPA estimates that this 'gap' was 15 percent. Starting in 2008, NHTSA increased this value to 20 percent."[469] Thus, this discussion in the Final Rule describes the history of NHTSA's estimate of the *base* fuel economy gap. It does not acknowledge the agencies' methodology in the TAR, where they applied an adjustment to the base gap to account for ethanol content in retail gasoline, much less does it acknowledge that the agencies had abandoned that methodology in the Final Rule.

Because the agencies did not acknowledge, mention, or discuss any changes to their prior methodology of applying an adjustment factor to account for ethanol content in gasoline, commenters only discovered a change in this methodology by chance when digging through CAFE modeling files. Specifically, when we examined the "Parameters" input file to the Final Rule CAFE model,[470] we discovered for the first time that the agencies made *no* adjustment to the fuel economy gap to account for the increased level of ethanol in retail gasoline. Instead, the agencies have abandoned the methodology adopted in the TAR, and instead have applied *only* their estimate of the *base* fuel economy gap in projecting the costs and benefits of their standards.

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[466] *Id*. NHTSA also provided a brief discussion of the fuel economy gap in the Draft Environmental Impact Statement for the Proposed Rule. NHTSA, *Draft Environmental Impact Statement for the The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks* ("DEIS") at 2-10. But that discussion merely described what the fuel economy gap is (*i.e.*, the difference between compliance test values and real-world values) without providing any insight into the agencies' methodology used for the Proposed Rule. *See id*.

[467] Some CAFE model peer reviewers did comment that the agencies should assess whether the base fuel economy gap has increased as vehicles' fuel economy levels have increased. *See* FRIA at 1828; 85 Fed. Reg. at 24,378-79. Indeed, in the TAR the agencies acknowledged that the gap may be increasing over time, but that this issue is distinct from the issue of whether ethanol content impacts the gap. *See* TAR at 10-1.

[468] 85 Fed. Reg. at 24,281 n.343. *See also id*. at 42,378-79 ("For today's analysis, and considering data EPA collects from manufacturers regarding vehicles' fuel economy and CO2 as tested for both fuel economy and emissions compliance and for vehicle fuel economy and emissions labeling (labeling making use of procedures spanning a wider range of real-world vehicle operating conditions), the agencies have determined that the future gap is, at this time, best estimated using the same values applied for the analysis documented in the NPRM."); FRIA at 397-98 (same).

[469] FRIA at 1828.

[470] Final Rule CAFE Model Input File "Parameters_ref.xlsx," available at https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system

The agencies' failure to adjust the fuel economy gap to account for ethanol in gasoline is clearly erroneous, arbitrary, and unlawful—as is their failure to acknowledge their change in position regarding incorporating such an adjustment since the TAR. As the agencies acknowledged in the TAR the energy content of retail gasoline differs significantly from the energy content of the fuel used on the compliance test—as well as the energy content of retail gasoline in 2005-2006, the time period from which the base 20% estimate was derived.[471] As described above, in the TAR the agencies acknowledged that this decreased energy content would translate into a total fuel economy gap of 23%—that is, 15% larger than the total gap used in the Final Rule analysis. And that total projection of 23% remains as valid today as it was then, because the ethanol content of U.S. gasoline has not changed since the time of the TAR. The agencies have offered no rationale whatsoever for their decision not to account for ethanol in their calculations of the total gap in the Final Rule analysis, nor could they offer any rational reason not to account for ethanol, because no such reason exists.[472]

The agencies' about-face in methodology is centrally relevant and has material impacts on their analysis. We changed the value of the total fuel economy gap in the GHG program modeling run from 20% to 23%. As a result, the model's projections of net benefits decreased for the GHG standards relative to the central case by $7.5 billion (at a 3% discount rate) and $4.8 billion (at a 7% discount rate). This means that—without addressing any of the other flaws in the agencies' analysis—the net loss to society from the Final Rule grew by 34%—increasing from -$22.0 billion in the agencies' central analysis to -$29.5 billion at a 3% discount rate. And using a 7% discount rate, the net benefits to society decreased by 74%—from $6.4 billion in the central case to $1.7 billion. These are dramatic changes in the agencies' projected impacts from the Final Rule.[473]

Because the agencies failed to acknowledge or justify their change in methodology from the TAR, and because adding the adjustment factor to the fuel economy gap to account for ethanol in retail gasoline has significant, material impacts on the agencies' analysis and justification for the Final Rule, the agencies must reconsider the Final Rule and include a fuel

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[471] TAR at 10-1. Again, EPA also acknowledged this fact in the TSD in 2016. TSD at 3-1 to 3-2.

[472] As discussed above, in the Proposed Rule the agencies stated that further research would be needed to expand the estimate whether the gap has changed beyond the 20% used in the Final Rule analysis due to factors such as vehicle age or new technology combinations in use on the fleet. 83 Fed. Reg. at 43,187. Indeed, the agencies also acknowledged as much in the TAR. TAR at 10-1. However, the TAR distinguished those types of impacts from the impact due to ethanol content, which was "clear." *Id*. As demonstrated by the TAR, no further research is needed to add an adjustment factor to account for ethanol content in retail gasoline.

[473] We note that in the FRIA the agencies purport that their own sensitivity analysis using a 30% fuel economy gap shows that "[c]hanges in incremental total benefits and costs to consumers and society are . . . small," though the agencies state that "corresponding changes in net benefits to consumers and society appear larger on a relative basis." FRIA at 1828. This attempt to minimize the results of that sensitivity run is belied by the actual results of that sensitivity analysis, which show that using a gap of 30% decreased the net benefits of the GHG standards relative to the central case by *$13.9 billion* and *$9 billion* using 3% and 7% discount rates, respectively. FRIA at 1803, 1805. This means that – without addressing any of the other flaws in the agencies' analysis – the net loss to society from the Final Rule increased by more than 60% at a 3% discount rate – increasing from -$22 billion in the agencies' central analysis to -$35.9 billion in the sensitivity case. *Id*. at 1807. And at a 7% discount rate the sign of the total cost benefit analysis flipped, with the net benefit to society from the Final Rule turning into a net cost. *Id*. at 1809. Specifically, net benefits decreased from $6.4 billion in the central case to -$2.6 billion in the sensitivity case. *Id.* These are not "small" changes. To the contrary, they demonstrate that an error in calculating the fuel economy gap can have enormous impacts on the agencies' analysis.

economy adjustment factor to account for ethanol in their calculations when determining what final action to take after reconsideration.

P. The Agencies' Fleet Footprint Projections are Undermined by NHTSA's Statements in Setting the Minimum Domestic Passenger Car Standard

The agencies' analyses of the standards in the Final Rule are based on the "footprint" size of a vehicle[474]—essentially, "the larger the vehicle footprint, the less numerically stringent the corresponding vehicle CO2 and miles-per-gallon (mpg) targets." 85 Fed. Reg. at 24,175. As a result, analyzing the impacts of the standards requires the agencies to make projections about the footprint size of the vehicles in the fleet, as this affects average fleetwide fuel economy and GHG levels—and thus fuel consumption and emissions, as well as compliance costs.[475]

The analysis in the Final Rule is, therefore, premised on the agencies' assumptions about the footprints of passenger cars and light trucks in the fleet. But in a separate part of the Final Rule, related to NHTSA setting the Minimum Domestic Passenger Car Standard (MDPCS), NHTSA states that it believes the footprint projections in the central analysis are wrong. This undermines the agencies' entire analyses.

The MDPCS is based on projections of average fuel economy under the CAFE standards. *See* 49 U.S.C. § 32902(b)(4). In setting the MDPCS in the Final Rule, NHTSA discussed automakers' complaints that the MDPCS's set in the past have sometimes turned out to be more stringent than what the MDPCS would have been if it were set based on the actual average fuel economy required for a given model year. NHTSA "agree[d] that the actual total passenger car fleet standards have differed significantly [sic] the 2012 projection," and so "examined the projections from past rulemakings in greater detail."[476]

Based on this analysis, NHTSA claims that the MDPCS for MY2011-2018, calculated based on the Secretary's projection of passenger car fleet average fuel economy, has been more stringent by an average of 1.9% than it would have been if based on actual average passenger car fleet fuel economy.[477] NHTSA states that, "[t]his difference indicates that in rulemakings conducted in 2009 through 2012, the agencies' projections of passenger car vehicle footprints and production volumes consistently underestimated the consumer demand for larger passenger cars over the MYs 2011 to 2018 period."[478] As a result, NHTSA unlawfully "adjusts" the MDPCS's for MY2021-2026 down by 1.9%.

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[474] Footprint is "defined as a measure of a vehicle's size, roughly equal to the wheelbase times the average of the front and rear track widths." 85 Fed. Reg. at 24,742, n.1968.

[475] "Overall average requirements (*e.g.*, reflecting both passenger car and light truck fleets) applicable to each manufacturer will depend on the mix (i.e., footprint distribution) of vehicles produced in each model year, and relative production shares of passenger cars and light trucks." 85 Fed. Reg. at 24,909. *See also*, *id*. at 24,619 (noting that regulatory costs depend upon "depend upon the mix of footprints, their distance from the relevant curve, and the technology cost needed to bring each fleet into compliance").

[476] *Id*. at 25,125.

[477] As noted elsewhere, there are several problems with NHTSA's calculation of the 1.9% difference, including the agency's inclusion of projections based on proposed rules instead of just final rules, which inflated the number. But we leave those issues aside here, as NHTSA's action is plainly illegal, even if it had calculated the number correctly.

[478] 85 Fed. Reg. at 25,127.

Leaving aside for this discussion the illegality of NHTSA's adjustment to the MDPCS, NHTSA's discussion undermines the agencies' footprint projections in the central analysis. The agency effectively states that it believes those projections are wrong.

It is patently arbitrary to conduct the analysis for CAFE and GHG standards using a certain set of projections, and then, when setting other standards in the same rulemaking, state that the projections in the main analysis are wrong and yet continue to rely on them. The agencies either have confidence in the projections in the central analysis or they do not; and if they do not, they should change them.

NHTSA asserts that it conducted separate analysis reflecting the change that "demonstrates that doing so does not change estimated impacts of any of the regulatory alternatives under consideration."[479] However, NHTSA's analysis does not demonstrate that. The agency essentially inserted a minimum per-manufacturer passenger car fleet fuel economy standard into the central analysis modeling, based on the MDPCS, but it was so low that it did not affect any automakers' compliance results or have other impacts.

But that is not the relevant question. What NHTSA should have done was actually increase the passenger car footprint projections in the central analysis to correspond to a 1.9% reduction in the average fuel economy target—as NHTSA asserts, in setting the MDPCS, they should be. To appropriately test the effect of that change—and make the central analysis fleet footprint projections for the GHG program consistent with the MDPCS discussion—we increased the footprint of all passenger car models by 2.07% for each MY in the analysis.[480] Doing so reduces the net benefits of the Final Rule from -$22.0 billion down to -$23.9 billion at the 3% discount rate, and from $6.4 billion down to $4.3 billion at the 7% discount rate.

NHTSA's statement in setting the MDPCS that it believes that the central analysis' projections of vehicle size are wrong undermines the Final Rule analysis and its conclusions. If the agencies in fact believe that vehicles will be larger than they project in the central analysis, then they must re-do the central analysis as a result. Doing so would have significant impacts on the agencies' analysis, as shown here. As a result, NHTSA's statement renders the central analysis arbitrary and unlawful. EPA must withdraw and reconsider the Final Rule and re-do the analysis for the GHG standards using figures that the agencies believe are accurate.

II. EPA's expansion of the advanced technology multiplier credit for natural gas vehicles (NGVs) in the Final Rule is unlawful.

The Final Rule significantly expands the advanced technology multiplier credit for natural gas vehicles ("NGVs"), amending 40 C.F.R. § 86.1866-12 to apply a multiplier of 2.0 for NGVs sold between 2022 and 2026. This new multiplier is arbitrary and capricious because EPA does not explain why the multipliers will in any way reduce GHG emissions or incentivize emissions-

[479] *Id*. at 25,128.

[480] This value corresponds to the corresponding shift in average footprint required for passenger cars to move from a fleet average target of 47.7 mpg to 46.8 mpg in 2026 (a 1.9% adjustment), according to the CAFE curves utilized by the agencies in the CAFE compliance model, FRIA at 1916 (Table VIII-3).

reducing technologies. And assuming the multipliers *will* produce these effects, EPA has not analyzed the environmental consequences of increased natural gas consumption and production flowing from the Final Rule. EPA must grant reconsideration to remedy these oversights.

The purpose of the advanced technology—multiplier provisions—which grant additional GHG credits to qualifying vehicles—is to "provide a temporary incentive to promote technologies which have the potential to produce very large GHG reductions in the future." 75 Fed. Reg. 25,324, 25,341 (May 7, 2010). In 2012, EPA extended the program to NGVs, but at lower rates than other advanced vehicles. 77 Fed Reg. 62,624, 62,815-16 (Oct. 12, 2012). As EPA explained in 2012, the lower multipliers—which began at 1.6 in 2016 and fell to 1.3 by 2021—were appropriate because although NGV technology could theoretically lower emissions relative to gasoline powered vehicles, the technology faced fewer barriers to commercial production and necessitated higher upstream emissions from fossil fuel extraction and production relative to other advanced technology vehicles. *Id.*

In the Proposal, EPA addressed the substance of NGV credits in a single, vague sentence. Specifically, EPA explained that it had "received input from several industry stakeholders who supported expanding [NGV] incentives to further incentivize vehicles capable of operating on natural gas, including treating incentives for natural gas vehicles on par with those for electric vehicles and other advanced technologies, and adjusting or removing the minimum range requirements for dual-fueled CNG vehicles." 83 Fed Reg. 42986, 43,464 (Aug. 24, 2018). The Proposal did not suggest specific multipliers for NGVs.

Notwithstanding the Proposal's limited and vague reference to NGVs—and contrary to EPA's earlier conclusions regarding the commercial viability and full emissions profile of the vehicles—the Final Rule arbitrarily applies a 2.0 multiplier to NGVs. EPA's *entire* rationale for this change is as follows:

> While other alternative fuel vehicles that were provided multiplier incentives are increasingly available in the light-duty marketplace, no OEM is currently offering light-duty NGVs. Since Honda ended production of the CNG version of the Honda Civic at the end of MY 2015, there have been no OEM NGV offerings available to consumers. EPA continues to believe that NGVs could be an important part of the overall light-duty vehicle fleet mix, and such offerings would enhance the diversity of potentially cleaner alternative fueled vehicles available to consumers.

85 Fed. Reg. at 25, 211.

The Final Rule does not explain if or how the new multiplier will reduce GHG emissions, stating only that the multiplier might "enhance the diversity of *potentially* cleaner alternative fueled vehicles." *Id*. (emphasis added). This is especially problematic when EPA previously declined to give NGVs higher multipliers due in part to NGVs' higher upstream air pollution emissions relative to other advanced technology vehicles. Nor does the Final Rule offer any other explanation of how the new multiplier is consistent with EPA's obligation to safeguard human health and welfare. 42 U.S.C. 7241(a). In short, the EPA must reconsider its new multiplier and explain why the multiplier is appropriate under the statutory framework when, according to the agencies' prior analysis, NGVs neither require nor deserve an incentive reserved

for technologies with "the potential to produce very large GHG reductions in the future." 75 Fed. Reg. at 25,341.

III. EPA failed to adequately respond to key comments submitted after the close of the formal comment period that are of central relevance to the rulemaking and that, if properly considered, would materially alter the agency's analysis in the Final Rule.

We again note that in the Proposed Rule, EPA committed to consider all comments submitted after the close of the formal comment period "[t]o the extent practicable." 83 Fed. Reg. at 43,471. All of the letters described below were submitted in time for EPA's review of them to have been "practicable," and therefore they should have been considered by EPA in finalizing the GHG standards in the Final Rule.[481] In addition, they are of "central relevance" to the rulemaking. To the extent EPA responded to these comments in the Final Rule, those responses were inadequate for the reasons described below.

To the extent EPA might conclude that these comments were not submitted with sufficient time for the agency's review to have been "practicable," that is because the facts arose after that time or only became known publicly after that time, and/or because the comment period for the Proposed Rule was wholly inadequate. *See, e.g.*, NGO Joint Legal Comments (Docket #NHTSA-2018-0067-12000, as corrected Docket #NHTSA-2018-0067-12368), Appendix A at 200-213. Specifically, the comment period did not allow the public sufficient time to provide comment on the extensive actions proposed—including two highly complex, technical rules on fuel economy and GHG standards for light-duty vehicles, NHTSA's preemption regulations, and EPA's proposal to revoke existing state authority to regulate greenhouse gas emissions from motor vehicles. *See id*. at 206-213. The breadth of these proposals, combined with the agencies' pervasive lack of clarity and failure to provide centrally relevant information, *see, e.g.*, Letter from Center for Biological Diversity, et al., dated December 20, 2018, Docket #NHTSA-2018-0067-12371, severely restricted the public's ability to comment on the Proposed Rule. We also note that the formal comment period lasted only 63 days,[482] and the agencies denied requests—including requests from automakers—for an additional 57 days, citing a purported need for

[481] In particular, we note that at a June 20, 2019 hearing of the House of Representatives Committee on Energy and Commerce ("Driving in Reverse: The Administration's Rollback of Fuel Economy and Clean Car Standards"), then-Assistant Administrator of EPA for Air and Radiation William Wehrum and then-acting Administrator of NHTSA Heidi King asserted that no final decisions on the Proposed Rule had been made, and Ms. King stated that the agencies "are reading the public comments" and "are considering all public comments we receive before [we] make decisions in the final rulemaking." Hearing Transcript at 144, lines 3332-34, available at: https://docs.house.gov/meetings/IF/IF17/20190620/109670/HHRG-116-IF17-Transcript-20190620.pdf; *see also* Letter from Environmental Defense Fund, et al., dated July 18, 2019, Docket #NHTSA-2018-0067-12432, at 4. Accordingly, supplemental comments that were submitted on the Proposed Rule up to at least June 20, 2019, were "practicable" for EPA to have considered and must be properly considered as part of the agencies' administrative record. In addition, in the Final Rule, the agencies expressly addressed a comment submitted on August 27, 2019, showing that all comments submitted up to that date were "practicable" for EPA to have considered and properly part of the agencies' administrative record. *See* 85 Fed. Reg. at 25,157 nn.2846,2847 (citing Comments of Environment America et al., NHTSA–2018–0067–12441, dated Aug. 27, 2019). The Final Rule also discusses the EPA Science Advisory Board's review of the Proposed Rule, which was submitted to EPA Administrator Wheeler on Feb. 27, 2020.

[482] See EPA and NHTSA, *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks; Extension of Comment Period*, 83 Fed. Reg. 48,578 (Sept. 26, 2018) (extending the initial 60-day comment period set out in the Proposed Rule by 3 days).

automakers to have "maximum lead time to respond to the final rule."[483] Yet it took EPA and NHTSA a year and a half to finalize the actions in the Final Rule. The agencies' protracted process demonstrates just how complex the Proposed Rule was, and how unreasonable the arbitrarily short comment period was.

We hereby incorporate all of these comments, including their attachments, into this petition.

A. Comments related to reports and studies evidencing the increasingly imminent and catastrophic effects of climate change

"Since the agencies provide no basis to reject the overwhelming scientific consensus, the policy changes the agencies propose are completely arbitrary, as well as in direct conflict with their statutory obligations to protect the public." NGO Joint Legal Comments at 7-8. Additional studies, published and submitted to the agencies after the close of the formal comment period, support the overwhelming scientific consensus regarding the imminent and catastrophic consequences of unabated carbon emissions.

These studies, and the comments described below, further demonstrate that EPA's GHG standards in the Final Rule—which EPA's own analysis estimates will increase CO2 emissions by 867 million metric tons in the midst of an environmental crisis that gravely and imminently imperils human health, the economy, and the natural resources on which human survival depends—are not only contrary to the Clean Air Act, but are also otherwise wholly unreasonable. Under the Clean Air Act, EPA must set emissions standards to protect the public health and welfare. These studies, and the comments described below, demonstrate the massive toll the anthropogenic climate change is already taking and will continue to take on human health and well-being, as well as the environment. EPA's transgression is all the more egregious when viewed in the context of the Proposed Rule, in which EPA joined with NHTSA in proposing not only to abdicate their own legal obligations to address the climate crisis, but to simultaneously eliminate state authority to address that crisis, as well. EPA's analysis, as reflected in the Final Rule, assumes massive, runaway climate change—including temperature increases within the next few decades at levels that leading scientific assessments show would do severe harm to human society and ecosystems—but then proceeds to avoid taking actions that are among the most effective policies available to reduce those risks. EPA's disregard of comments pointing to critical information on climate change is unjustifiable and fails to rationally address the massive consequences of the agency's decision for climate risk.

EPA must reconsider the Final Rule in light of these additional climate studies and comments, as well as the comments submitted during the formal comment period, as they further evidence the arbitrary and capricious nature of EPA's decision-making in setting the Final Rule standards. EPA must address these studies and the complete record regarding the catastrophic effects of global climate change.

[483] *Id.* at 48,581.

i. Letter from NGOs on the National Climate Assessment, dated December 14, 2018 (Docket #EPA-HQ-OAR-2018-0283-7438,[484] #NHTSA-2017-0069-0695 to -0701) ("NGO NCA Comment")

This comment presented EPA with the United States Global Change Research Program's (USGCRP) Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States ("NCA4-II"), which was released on November 23, 2018, after the close of the formal comment period for the Proposed Rule. The comment observed that the NCA4-II compiles "compelling new evidence of the gravity and immense costs of the current impact of climate change and the hazards it poses, and details the multiple ways in which climate change now damages and continues to threaten public health, the economy, and natural resources throughout the United States." NGO NCA Comment at 2. And, the comment alerts EPA to the fact that the NCA4-II "emphasizes that the degree of harm society experiences now and in the future from climate change depends upon whether effective efforts are taken now—including efforts by the federal government itself—to mitigate emissions of climate-destabilizing greenhouse gases." *Id.* EPA's failure to reconcile its actions with the NCA4-II's conclusions "is not just unconscionable; it is unlawful." *Id.*

The Final Rule does not respond to the NGO NCA Comment; indeed, it does not address the NCA4-II at all.

ii. Letters from States and Cities on the NCA4-II, dated December 11, 2018 (Docket #EPA-HQ-OAR-2018-0283-7440) ("States and Cities First Comment") and December 21, 2018 (Docket #EPA-HQ-OAR-2018-0283-7447) ("States and Cities Second Comment")

These comments explain that "it remains EPA's and NHTSA's responsibility to take into account the full [NCA4-II] Assessment." States and Cities Second Comment at 4. The comments emphasize the NCA4-II's conclusion that, "[u]nder scenarios with high emissions and limited or no adaptation, annual losses in some sectors are estimated to grow to hundreds of billions of dollars by the end of the century. It is very likely that some physical and ecological impacts will be irreversible for thousands of years, while others will be permanent." *Id*. at 8.

Citing the NCA4-II, the letters identify numerous grave harms to public health and welfare across the United States that will result from failure to aggressively reduce carbon emissions, including increased flooding, heat waves, wildfires, insect-borne disease, ocean acidification and sea level rise, as well as decreased agricultural productivity. *Id.* at 4-7. The letters also explain that the NCA4-II confirms that GHGs and the climate change they cause "exacerbate local or regional pollution problems" and that "there is high confidence that climate change will increase

[484] Certain public submissions on the Proposed Rule appear to have been docketed on regulations.gov by one agency but not the other, even though they were submitted to both dockets. Thus, where EPA did not docket comments referenced herein, we refer to the NHTSA docket identification number. We further note that in the Proposed Rule the agencies directed that "comments submitted to the NHTSA docket will be considered comments to the EPA docket and vice versa … Therefore, commenters only need to submit comments to either one of the two agency dockets, although they may submit comments to both if they so choose." 83 Fed. Reg. at 43470. Thus, EPA is obligated to consider submissions to the NHTSA docket.

ozone levels over most of the United States, particularly over already polluted areas, thereby worsening the detrimental health and environmental effects due to ozone." *Id*. at 13.

As these letters explain, the NCA4-II makes clear that there is no time to spare in reducing GHG emissions, and that "choices made today largely determine which impacts will occur in the future." *Id.* at 7. The States and Cities thus conclude "there is no way to achieve the necessary economy wide-reductions without abandoning EPA's and NHTSA's proposed rollbacks." *Id.* at 8.

The Final Rule does not respond to the States and Cities First Comment or the States and Cities Second Comment; indeed, it does not address the NCA4-II at all.

iii. Pennsylvania Department of Environmental Protection (DEP) Supplemental Comment on the NCA4-II, dated January 29, 2019 (Docket #NHTSA-2018-0067-12370) ("Pennsylvania DEP Comment")

This comment letter describes the NCA4-II findings "regarding realized and projected effects of climate change on states and regions of the United States, and the existence of clear scientific evidence that the nation and states cannot afford to forego cost effective, technologically feasible emission reduction strategies for significant sources of GHGs." Pennsylvania DEP Comment at 9. The comment explains how, according to the NCA4-II, unchecked climate change will extensively damage public health and welfare in Pennsylvania, including by degrading air and water quality, increasing extreme heat and flooding, and imperiling critical infrastructure. *Id.* at 5-8. The comment emphasizes the NCA4-II's warning that time is of the essence in trying to reduce carbon emissions, that the NCA4-II "points specifically to highway vehicles as an example of a GHG source reduction strategy that would contribute to the lessening of the magnitude of climate change." *Id.* at 5. The comment concludes that the NCA4-II further demonstrates that "the agencies failed to analyze and consider the deleterious effects of climate change when considering the Proposed Rule."

The Final Rule does not respond to the Pennsylvania DEP Comment; indeed, it does not address the NCA4-II at all.

iv. Letter from NGOs regarding additional climate studies, dated April 5, 2019 (Docket #EPA-HQ-OAR-2018-0283-7452; #NHTSA-2017-0069-0703; #NHTSA-2018-0067-12377) ("NGO Climate Studies Comment")

This letter notifies EPA of several additional climate studies and reports released after the close of the formal comment period on the Proposed Rule. In particular, the comment notes that "[e]ven while action to steeply reduce greenhouse gas emissions within the next decade is more urgently needed than ever, [a] report [by the Rhodium Group] notes that U.S. emissions of carbon dioxide (CO_2) 'rose sharply' [in 2018], reversing a previous three-year decline. Rhodium estimates that emissions increased by 3.4% in 2018, marking 'the second largest annual gain in more than two decades—surpassed only by 2010 when the economy bounced back from the Great Recession.'" NGO Climate Studies Comment at 2. Rhodium concluded that current

efforts to reduce GHG emissions from the fleet are "not nearly . . . big enough . . . to meet medium- and long-term US emissions targets." *Id*. at 3.

The NGOs also highlighted a study by Charles G. Gertler and Paul A. O'Gorman of the Massachusetts Institute of Technology, which found that climate change is altering the atmosphere's heat structure such that "dangerous pollution can remain in the ambient air over cities longer and storms can deliver 'more rainfall from short, intense bursts.'" *Id*. at 3-4.

Finally, the NGO letter highlighted a study by Patrick L. Barnard, et al., published in *Scientific Reports*, which found that the "the consequences of sea-level rise (SLR), storms, and flooding" due to climate change "have been underestimated in prior studies," and that fixing flaws in those prior studies "dramatically increases the number of people and the amount of property exposed to flooding impacts" from climate change. *Id*. at 4. Because of this, "the economic impacts of projected future coastal flooding in California are of the same order of magnitude as Hurricane Katrina ($127 billion), and an order of magnitude higher than the most costly natural disasters in California history, the 1989 Loma Prieta Earthquake ($10 billion) and the 2017 Wildfire Season ($18 billion), and conclude that the 'comparison suggests to policy makers that future coastal flooding due to storms and sea level rise must be considered an economic threat on par with the state's and the world's most costly historical natural disasters.'" *Id*. at 5.

The Final Rule does not respond to the NGO Climate Studies Comment or address in any way the Rhodium Group, Gertler/O'Gorman, or Barnard studies discussed above.

v. NGO Comment on the IPBES Global Assessment Report on Biodiversity and Ecosystem Services, dated May 31, 2019 (Docket #EPA-HQ-OAR-2018-0283-7566; #NHTSA-2017-0069-0714, #NHTSA-2018-0067-12408) ("NGO IPBES Comment")

This comment discusses the United Nations' landmark assessment report—released on May 6, 2019, after the close of the formal comment period on the Proposed Rule—that found unprecedented, climate-change-exacerbated degradation of the environment on a global scale. The comment explains that the IPBES Report "culminates a three-year assessment which draws on thousands of peer-reviewed sources and includes the work of experts from 50 countries" and "provides the ominous context of accelerating global environmental collapse in which NHTSA's and EPA's unprecedented proposal willfully to increase greenhouse gas pollution from the nation's light duty vehicle fleet over current levels must be evaluated." NGO IPBES Comment at 2. It highlights the IPBES Report's finding that "*one million species* are at risk of extinction in coming decades due to man-made dangers, including climate change." *Id*. The letter also notes that the IPBES Chair summed up the report as follows: "The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide." *Id*. at 3. The comment concludes "that the agencies' failure even to consider these crucial scientific facts would be plainly unlawful." *Id*.

Not only does this comment demonstrate the grave and catastrophic impacts facing myriad species from human-made dangers, including climate change, it also demonstrates that EPA's determinations that the Final Rule will have "no effects on listed species or designated critical habitat and therefore do not require consultation under Section 7(a)(2) of the ESA," 85 Fed. Reg. at 25,252, are arbitrary and unlawful.

The Final Rule does not respond to the NGO IPBES Comment; indeed, it does not address the IPBES Report at all.

vi. CARB Comment on two new studies on climate and carbon pollution, dated May 31, 2019 (Docket #NHTSA-2017-0069-0715; #NHTSA-2018-0067-12411) ("CARB Carbon Comment")

This comment notifies the agencies of two important studies that were released after the close of the formal comment period on the Proposed Rule. First, the comment discusses a study by Northcott D., et al. (2019), which documented, "for the first time, that CO_2 concentrations over ocean waters ebb and flow throughout the day, often peaking in the early morning—showing that a previously common scientific assumption that CO_2 concentrations over ocean waters do not vary much over time and space does not always hold true." CARB Carbon Comment at 2. The study examined Monterey Bay, off the coast of California, and found that CO_2 from the Santa Clara and Salinas Valleys was being concentrated over the Bay in the early morning; it further found that this "previously undocumented process could increase the amount of CO_2 that coastal waters are absorbing by about 20 percent." *Id*. The more CO_2 that is dissolved into the ocean, the more acidic it becomes—leading to "harmful impacts" that "have already been extensively studied and are already being seen." *Id*. at 2-3. CARB noted that the study concluded that ocean acidification "impacts are likely to accrue faster than and not be as evenly distributed as previously anticipated." *Id*. at 3.

Second, this comment highlights a study by Gleason, et. al. (2019), addressing a feedback loop in which wildfires expedite snowmelt, which then amplifies the frequency and magnitude of wildfires as the climate continues to change. CARB Carbon Comment at 3. As CARB explained, the Northcott and Gleason studies "further illustrate the climate impacts already underway and that finalizing the Proposal would be arbitrary and capricious." *Id.* at 4.

In the Final Rule, EPA does not respond to the CARB Carbon Comment or address the Northcott, et al. and Gleason, et al. studies.

vii. Letter from NGOs, dated August 14, 2019, regarding new climate change reports (Docket #EPA-HQ-OAR-2018-0283-7591) ("NGO Reports Comment")

This comment notifies the agencies of yet more new evidence—which had not been released or available before closure of the formal comment period on the Proposed Rule—"demonstrating that the climate crisis caused by anthropogenic emissions of carbon dioxide and other greenhouse gases is already upon us and will lead to catastrophic consequences unless emissions are steeply reduced within the next decade." NGO Reports Comment at 1. The NGOs note that

"July 2019 appears to have been the Earth's hottest month on record"; they also point out the "massive melting of Greenland's ice-sheet, adding an estimated nearly two hundred billion tons of water into the Atlantic and causing a projected half-millimeter rise of the global sea level in a single month." *Id*. at 2. The NGOs also alerted EPA to a study published in the journal *Nature*, finding "strong evidence that anthropogenic global warming is not only unparalleled in terms of absolute temperatures, but also unprecedented in spatial consistency within the context of the past 2,000 years." *Id*. at 3. The NGOs also submitted written testimony of the Government Accountability Office to the House Budget Committee, which concludes that "the effects of climate change have already and will continue to cause fiscal exposure across the federal government and that exposure will continue to increase," *id*., as well as a research brief prepared by Climate Central that "documents the connection between a warming climate and increased numbers of 'stagnation events' in urban areas, creating conditions for high levels of harmful ground-level ozone pollution," *id*. Finally, the NGOs commented that the Intergovernmental Panel on Climate Change released in summary form a Special Report on climate change impacts. *Id*. That report concluded with "high confidence" that "[d]eferral of GHG emissions reductions from all sectors implies tradeoffs including irreversible loss in land ecosystem functions and services required for food, health, habitable settlements and production, leading to increasingly significant economic impacts on many countries in many regions of the world." *Id*. at 4.

The Final Rule references the NGO Reports Comment, 85 Fed. Reg. at 24,846, in asserting that the agencies supposedly considered recent climate change evidence. The agencies nonetheless incorrectly conclude that the admittedly negative GHG pollution impacts of the Final Rule are somehow too small to matter. *See* 85 Fed. Reg. at 24,846-53. EPA seems to assert that because it cannot solve the entirety of the problem in one step, it may ignore that problem. This is patently unreasonable, and contrary to the EPA's congressional directives, especially in light of the massive toll that climate change is already taking and will continue to take on human health and well-being, as well as the environment, as evidenced in this comment and others. EPA must grapple with this additional evidence demonstrating the flaws in the agency's evaluation of the climate impacts of the Final Rule and the ways in which the Final Rule is directly in opposition to the agency's statutory obligation to protect the public health and welfare.

viii. CARB comment on study connecting climate to California wildfires, dated August 21, 2019 (Docket #EPA-HQ-OAR-2018-0283-7594; #NHTSA-2017-0069-0723) ("CARB Wildfires Comment")

This comment submitted a new study by Williams, et al., which was not released until after the close of the formal comment period on the Proposed Rule. The study found that the area burned annually by wildfires in California increased by 405 percent during 1972 to 2018. CARB Wildfires Comment at 2. The study concluded that the "large increase in California's annual forest-fire area over the past several decades is very likely linked to anthropogenic warming." *Id*. at 3. And the study warns that "if greenhouse gas emissions are not curbed, the damage from wildfires in California will continue to magnify exponentially." *Id*.

In the Final Rule, EPA does not respond to the CARB Wildfires Comment or address the Williams, et al. study.

ix. Environmental Defense Fund Comment on IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, dated October 8, 2019 (Docket #EPA-HQ-OAR-2018-0283-7622) ("EDF Ocean Comment")

The comment notifies the agencies about the IPCC's new "Special Report on the Ocean and Cryosphere in a Changing Climate" ("Special Report") which was released after the close of the formal comment period on the Proposed Rule. "Reflecting the work of 100 leading scientists from 36 countries, and referencing nearly 7,000 scientific publications, the Special Report concludes that climate change is 'resulting in profound consequences for ecosystems and people,' and highlights the urgency of 'prioritizing timely, ambitious and coordinated action to address unprecedented and enduring changes in the ocean and cryosphere.'" EDF Ocean Comment at 2. The comment notes a number of key climate change dangers identified in the Special Report, including sea level rise (now happening twice as fast as it did during the 20th century), extreme sea level events (which are projected to occur 100 times as frequently in many places), and major disruption of the ocean food web, which will directly harm Americans who eat seafood. *Id.* Nonetheless, the Special Report concludes that "strongly reducing greenhouse gas emissions, protecting and restoring ecosystems, and carefully managing the use of natural resources would make it possible to preserve the ocean and cryosphere as a source of opportunities that support adaptation to future changes, limit risks to livelihoods and offer multiple additional societal benefits." *Id*. at 3.

The Final Rule does not respond to the EDF Ocean Comment. While it acknowledges the Special Report, *see* 85 Fed. Reg. 24,849, it does not engage with its findings. Instead, the Final Rule disregards those findings based on the same false argument used to minimize all other evidence about the looming and expanding climate crisis—that the GHG pollution impacts of the Final Rule are supposedly too negligible to matter. *See* 85 Fed. Reg. 24,849-53.

x. NGO Comment on sea level rise, dated November 18, 2019 (Docket #EPA-HQ-OAR-2018-0283-7624) ("NGO Sea Level Rise Comment")

This comment alerts the agencies to a new study by Kulp and Strauss (2019), which was not released until after close of the formal comment period on the Proposed Rule, that provides "new analysis on the number of people who will be affected by global sea level rise caused by climate change." NGO Sea Level Rise Comment at 1. The study "applies CoastalDEM, a new digital elevation model, to predict global and national extreme coastal water level exposures" more accurately than had been done with standard shuttle radar topography mission ("SRTM"). *Id.* at 2. As the comment explains, "under even optimistic conditions, the study found that "the global impacts of sea-level rise and coastal flooding this century will likely be far greater than indicated by the most pessimistic past analyses relying on SRTM." *Id*. The study also concluded that "sea-level rise this century may induce large-scale migration away from unprotected coastlines, redistributing population density across the country and putting great pressure on inland areas." *Id.*

The Final Rule does not respond to the NGO Sea Level Rise Comment or mention the Kulp and Strauss study.

xi. CARB Comment on climate impact analyses, dated December 27, 2019 (Docket #NHTSA-2018-0067-12450) ("CARB Climate Impact Comment")

This comment highlights two analyses of important climate impacts that became available after the close of the formal comment period on the Proposed Rule. First, the comment attaches a *Washington Post* analysis titled "2°C: Beyond the Limit - Fires, Floods and Free Parking: California's Unending Fight Against Climate Change," by Scott Wilson. The comment explains that Wilson "analyzed monthly temperature data from the National Oceanic and Atmospheric Administration at the national, state, and county levels between 1895 and 2018 for the lower 48 states." CARB Climate Impact Comment at 2. Wilson's analysis showed that "coastal Southern California has been warming at twice the rate of the continental United States" *Id.* at 1.

The comment also highlighted a new study by Osborne et al. (2019), which "fills a previously notable knowledge gap by providing a century-long, year-by-year proxy record for ocean acidification in the California Current Ecosystem." *Id*. at 3. The authors measured "the carbonate [which decreases with acidification] in almost 2,000 foraminifera shells collected from core samples of the sea floor off Santa Barbara." *Id.* This analysis showed "these waters off California's coast have seen a 0.21 decline in their pH since 1895-which is over twice the estimated global pH decline of 0.1." *Id.* In other words, the study found that waters off the California coast are acidifying at more than twice the estimated global average.

The CARB Climate Comment and the analyses it cites provide important additional evidence of the devastating impacts of climate change on public health and welfare, and further demonstrate that issuance of the Final Rule—which will worsen those impacts—was arbitrary and capricious. The Final Rule does not respond to the CARB Climate Comment or address the analyses it cites.

xii. NGO Comment on Gap Report and other new climate analyses, dated February 7, 2020 (Docket #NHTSA-2017-0069-0733; #EPA-HQ-OAR-2018-0283-7641) ("NGO Gap Comment")

This comment attaches five climate analyses that were released after the close of the formal comment period on the Proposed Rule, each of which "highlight the extreme costs that the climate crisis will continue to impose on human society—costs that could be exponentially more extreme without near-term, dramatic decreases in anthropogenic GHG emissions." NGO Gap Comment at 2.

- *United Nations Environment Programme's Emissions Gap Report* ("Gap Report"). This report was prepared by an international team of 57 leading scientists from 33 expert institutions across 25 countries. It finds a massive increase in the "emissions gap"—the difference between projected GHG emissions and the Paris Agreement 1.5°C target, above which "the frequency and intensity of climate impacts and risks of catastrophic climate change are expected to increase significantly." *Id.* at 2. The Gap Report

accordingly "warn[s] that, '[u]nless mitigation action and ambition are increased immediately and profoundly,' achieving the Paris Agreement's 1.5°C goal will be impossible, and it will be increasingly difficult to limit warming to well below 2°C." *Id.* at 2-3. The only hope of closing the emissions gap is for G20 countries like the United States to "increase their emission reduction pledges in 2020 more than fivefold." *Id.* at 3.

- *Lenton, et al. tipping point analysis*. This analysis explains "the grave threat of exceeding warming 'tipping points' in the climate system that would trigger self-reinforcing or cascading feedback mechanisms that could have large-scale, irreversible impacts on human and ecological systems." *Id.* The analysis examines the latest data on ice sheet collapse and biosphere boundaries to conclude that "evidence is mounting that [tipping point] events could be more likely than was thought," and that without immediate action, Earth could be headed toward "a global cascade of tipping points" that would present "an existential threat to civilization." *Id* at 4.

- *NASA and NOAA Surface Temperature Analyses.* These analyses, released by the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), "underscore that rapid, significant warming is occurring in the present day, with both agencies finding that 2019 was the second-hottest year on record, below only 2016." *Id.* at 5. NASA's report emphasized that these temperature increases are "persistent, not a fluke due to some weather phenomenon: we know that the long-term trends are being driven by the increasing levels of greenhouse gases in the atmosphere." *Id.* at 6. NOAA's report found that "heating of the oceans is irrefutable" and cited another new study that found ocean heat content "increases evaporation, leading to heavy rains, flooding, and more extreme weather, and is one of the key reasons why the Earth has experienced increasing catastrophic fires." *Id.*

- *Copernicus Surface Air Temperature Analysis.* Echoing NASA and NOAA, the European Union's Earth observation program, known as Copernicus, found that 2019 was the second warmest calendar year on record (behind only 2016); it similarly found that "[w]orldwide, December 2019 was more than 0.7 degrees Celsius warmer than the global December average for 1981 to 2010, tying for the warmest December in the data record." *Id.* at 7.

- *NOAA Arctic Report Card.* This document "provide[s] comprehensive summaries of key land, ice, ocean, and atmosphere observations made throughout the Arctic in the context of historical records." *Id.* Among other facts, the Report Card explains how "the Greenland Ice Sheet is losing close to 267 billion metric tons of ice per year" and that Arctic sea ice levels at the end of the summer of 2019 "tied with 2007 and 2016 as the second lowest since satellite observations began in 1979." *Id.* It also includes "new regional and winter season measurements indicat[ing] that thawing permafrost in the Arctic is now a source of net carbon emissions, potentially releasing an estimated 300-600 million tons of net carbon per year to the atmosphere." *Id* at 8.

The Final Rule does not respond to the NGO Gap Comment or address any of the five studies that comment highlights. The NGO Gap Comment further demonstrates that issuance of the

Final Rule represents a "clear dereliction of the Agencies' respective statutory obligations" and is "arbitrary and capricious." *Id.*

xiii. NGO Comment on Lancet Report, dated November 21, 2019 (Docket # EPA-HQ-OAR-2018-0283-7625; #EPA-HQ-OAR-2018-0283-7628) ("NGO Lancet Comment")

This comment notifies the agencies of *The 2019 Report Of The Lancet Countdown On Health And Climate Change: Ensuring That The Health Of A Child Born Today Is Not Defined By A Changing Climate* ("2019 Lancet Countdown"). Published after the close of the formal comment period on the Proposed Rule by *The Lancet*, one of the world's oldest and most prestigious medical journals, this report "draws on the world-class expertise of climate scientists; ecologists; mathematicians; engineers; energy, food, and transport experts; economists; social and political scientists; public health professionals; and doctors." NGO Lancet Comment at 2. The report "confirms that the accelerating impacts of climate change are taking an unparalleled toll on human health and productivity and that the climate crisis will define the lifelong health of children born today." *Id.* The report explores a range of these impacts, including rising food insecurity, respiratory disease, heatwaves, and wildfires. *Id.* The report "emphasizes that the degree of future harm society will experience from climate change depends upon whether effective efforts are taken now to mitigate emissions of climate-destabilizing greenhouse gases." *Id.*

The Final Rule neither responds to the NGO Lancet Comment nor addresses the 2019 Lancet Countdown. Both the comment and the Lancet Countdown further demonstrate that the Final Rule—which calls for *increasing* GHG emissions—is a clear dereliction of EPA's statutory obligations and is arbitrary and capricious.

xiv. Environmental Defense Fund Comment on GHG emissions inventory, dated February 19, 2020 (Docket #EPA-HQ-OAR-2018-0283-7642) ("EDF Inventory Comment")

This comment alerts the agencies to U.S. EPA's "Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990- 2018," which was released after close of the final comment period on the Proposed Rule. This inventory "highlights that U.S. greenhouse gas emissions in 2018 rose for the first time in several years." EDF Inventory Comment at 1. The inventory "finds that the transportation sector is the largest contributor to U.S. greenhouse gas emissions, that these emissions are increasing, and that passenger cars and light-duty trucks account for the majority of transportation greenhouse gas emissions." *Id.* at 2. The comment explained that "these latest findings highlight the importance of addressing the climate pollution burden from passenger cars and trucks and underscore that weakening the existing clean car standards cannot accord with either EPA or NHTSA's statutory mandates." *Id*.

The Final Rule does not respond to the EDF Inventory Comment or address EPA's 1990-2018 draft inventory. This comment letter further demonstrates that issuance of the Final Rule represents a clear dereliction of EPA's statutory obligations and is arbitrary and capricious.

B. Comments related to criteria pollutant impacts of the rollback

EPA must reconsider the Final Rule in light of the additional comments and analyses identified below, as well as the comments submitted during the formal comment period, regarding the impacts of the Proposed and Final Rule on criteria pollutant emissions. These comments and analyses further evidence the arbitrary and capricious nature of EPA's decision-making in setting the Final Rule standards. EPA must address these comments and analyses and the complete record regarding the harmful impacts of its actions on the environment, public health, and welfare.

i. S. William Becker & Mary Becker, "The Devastating Impacts of the Trump Proposal To Roll Back Greenhouse Gas Vehicle Emissions Standards - The Untold Story," docketed April 30, 2019 (Docket #NHTSA-2018-0067-12391, #EPA-HQ-OAR-2018-0283-7458) ("Becker Report")

This Report was prepared by S. William Becker, who served as Executive Director of the National Association of Clean Air Agencies for 37 years, and Mary Becker, an environmental attorney who has worked on environmental law and policy issues for the past 38 years in private practice, at the Environmental Law Institute.

Among other issues, this Report addresses the "emissions of smog-forming pollution, fine particles, sulfur oxides, and air toxics" that would result from the Proposed Rule. Becker Report at 10. First, the Report explains that the Proposed Rule "severely underestimates" such emissions. *Id.* For example, it notes that the Proposed Rule rests on flawed assumptions regarding the location of oil production and refining for U.S. gasoline consumption. *Id.* at 9. As a result, the Proposed Rule understates the "upstream" emissions associated with increased fuel consumption. *Id.* The Becker Report also cites extensive analysis from Environmental Defense Fund (EPA-HQ-OAR-2018-0283-5764) showing that the agencies' estimates of SO_x, VOCs, NO_x, and particulate matter ($PM_{2.5}$) were vastly understated. *See id.* at 11-12.

The Becker Report explains that "[a]ir quality experts project that the cumulative effects (by 2050) of the SAFE Vehicles proposal could cause the premature deaths of up to 32,000 people, and serious illnesses and other harmful effects to tens of millions of others, just from the anticipated increases in PM2.5." *Id.* at 12. These effects include up to "40,089 respiratory emergency room visits; 126,057 cases of acute bronchitis; 10.4 million work loss days; and 2.3 million cases of asthma exacerbation. The monetary cost of these premature deaths and health-related impacts from the weakened standards could be anywhere from $4.4 to 9.8 billion in 2030." *Id.* at 12-13.

Second, the Report explains that "even if one assumes the overall emissions increases are 'small' on a national level, the localized impacts for communities at risk may be quite large." *Id.* at 11. The Report includes an appendix that "quantifie[s] for each of the 48 contiguous states and Washington, D.C., the estimated incidences of the health and welfare effects that will occur if the SAFE Vehicles proposal is promulgated." *Id.* at 14. The effects examined include "premature mortality; respiratory emergency room visits; acute bronchitis; lower respiratory symptoms; upper respiratory symptoms; minor restricted activity days; work loss days; asthma

exacerbation; cardiovascular hospital admissions; respiratory hospital admissions; and non-fatal heart attacks." *Id.*

The Beckers' analysis showed that while the Proposed Rule would cause all states "to experience adverse health and welfare effects," impacts on some states—including Texas, New York, and Pennsylvania—are "especially alarming." *Id.* In Texas, for example, the Report "estimate[s] that over 3,700 people could die prematurely and over 7 million could face "restricted activity days" by 2050 as a result of the SAFE Vehicles rule." *Id*. In significant part, state and local disparities resulted from "the increase in upstream emissions" from the Proposed Rule, which, the Report found, "will adversely affect pockets of the country that already are at risk because they are located near industrial or heavily trafficked areas." *Id.* That means "those most harmed by the increases in criteria pollutants and toxics under the SAFE Vehicles proposal will be those most at risk because of the locations of their communities closest to the source of pollution." *Id.*

The Final Rule does not address the Becker Report. EPA must address the concerns raised in this letter.

ii. Supplemental California Air Resources Board, dated September 18, 2019 (Docket #NHTSA-2018-0067-12433)

This comment corrected the inadvertent omission of two spreadsheets from CARB's October 26, 2018 comments to the agencies on the Proposed Rule. These spreadsheets contained a regional emissions analysis showing the Proposal would produce an additional 1.24 tons per day of NOx pollution in the South Coast air basin. The agencies did not acknowledge the submission of these two spreadsheets in the Final Rule.

iii. CARB Comments on NOx Emissions Analysis, November 6, 2019 (Docket #NHTSA-2018-0067-12447; #NHTSA-2017-0069-0727; #EPA-HQ-OAR-2018-0283-7623 ("CARB NOx Comments")

These comments respond to a letter CARB received from the Alliance of Automobile Manufacturers ("Alliance") dated September 11, 2019, after the close of the formal comment period on the Proposed Rule. First, these comments explain how CARB has clarified and refined certain aspects of its prior NOx emissions analyses, including by providing "a more complete picture of the increase in NOx criteria pollutant emissions in California." CARB NOx Comment at 3. CARB demonstrated that these corrected estimates "show an even greater emissions increase from the proposed SAFE Vehicles Rule than previously stated." *Id.* Specifically, "CARB staff identified a need to make three clarifications to its prior comments, due to the inadequate comment period initially provided on the Proposal." *Id*. at 2. "These clarifications confirm the proposal would have a significant adverse impact on NOx emissions and highlight that staff's original estimates were understated." *Id*.

Second, CARB responded at length to the Alliance's questions about its modeling, including by "rebalancing . . . the ZEV and gasoline vehicle fleet" and providing a more granular breakdown of upstream/WTT NOx emissions. *Id.* at 6-11. CARB concluded that "these

clarifications broadly confirm CARB's original analysis in its directionality and magnitude; of course, any projection of future emissions is necessarily subject to further analysis—but the core scientific point remains the same: The SAFE Vehicles Rule as proposed would substantially increase criteria pollutant emissions." *Id.* at 12.

The Final Rule does not respond to the CARB NOx Comment. This comment further demonstrates that issuance of the Final Rule represents a clear dereliction of EPA's statutory obligations and is arbitrary and capricious. EPA must grapple with its findings.

C. Comment from NGOs on Endangered Species Act violation, dated April 10, 2019 (Docket #NHTSA-2018-0067-12378-84; #NHTSA-2018-0067-12396; #EPA-HQ-OAR-2018-0283-7454) ("NGO ESA Comment")

This comment explains how "finalization of the Rule and the resulting increase in GHG, NOx, SO2 and other air pollution [would] unquestionably affect[] hundreds of federally protected species and their critical habitats—which have been federally listed by the [U.S. Fish and Wildlife Service ("FWS") and National Marine Fisheries Service ("NMFS," collectively, "Services")] as threatened and endangered specifically due to increases in these pollutants—thus meeting the low threshold" for consultation under Section 7 of the Endangered Species Act (16 U.S.C. §§ 1531-44). NGO ESA Comment at 7. As the comment notes, some of the organizations submitting it also submitted comments during the formal comment period that objected to the agencies' lack of Section 7 consultation under the Endangered Species Act and made clear that such consultation was legally required. This supplemental comment letter served to "expand upon the discussion of the Rule's impacts on hundreds of federally listed species and their habitats, and to elucidate the Agencies' violation of the ESA should they choose to finalize the Rule without complying with the statute's consultation requirements." *Id*. at 1. Several studies cited in the comment, including the United States Global Change Research Program's Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States, were released after the close of the Rule's formal comment period.

After reviewing the purpose and structure of the ESA, this comment emphasizes that the Rule will result in "much higher emissions of GHGs, nitrogen oxide ("NOx"), sulfur dioxide ("SO2") and other air pollutants, as compared to leaving the current fuel efficiency and tailpipe standards in place." NGO ESA Comment at 5.

With respect to GHGs, the comment notes that even the agencies recognize that the Proposed Rule "would directly contribute to significantly higher GHG emissions" (although the agencies' figures "gross[ly] underestimate[e]" such emissions). NGO ESA Comment at 7. The comment then "describes the hundreds of federally listed species—including the iconic polar bear—whose very existence is jeopardized by increasing GHG emissions and exacerbated climate change—as legally determined by the Services in response to these species' listing petitions." *Id.*

The comment explains that GHG "emissions harm endangered species in ways that are not only measurable but also causally understood." *Id.* at 11. "Climate change impacts such as sea ice loss, ocean heat stress and ocean acidification, sea level rise, the increasing frequency of extreme weather events, decreasing snowpack, and elevational and latitudinal shifts in habitat are

several of the ways that greenhouse gas emissions harm hundreds of federally protected species—and has been recognized as such in federal listing determinations under the Endangered Species Act." *Id.* at 12. Indeed, "it is precisely this sea ice loss, and the lack of adequate regulatory mechanisms addressing greenhouse gas pollution, that led FWS to list the polar bear (Ursus maritimus) as a threatened species in 2008." *Id.* The comment also notes that it is not too late to act; "aggressive emissions reductions will allow substantially more sea ice to persist and increase the chances that polar bears will survive in Alaska and across their range. *Id.* at 16.

The comment further explains how "[o]cean warming and ocean acidification, two other incontrovertible environmental impacts caused by greenhouse gas pollution, are wreaking havoc on marine ecosystems and causing a global collapse of coral reefs." *Id.* at 17. In addition, "[s]cientific research and federal documents recognize that many coastal listed species are threatened by sea level rise driven by climate change. According to a 2013 analysis, on the current emissions trajectory, rising seas driven by warming temperatures threaten at least 17 percent of our nation's federally protected species, totaling 233 species in 23 coastal states," including sea turtles. *Id.* at 24. The comment then provides a table listing "examples of species listed during 2006 to 2015 for which climate change was a listing factor." *See id.* at 25-30.

The NGO ESA Comment also "describes the numerous federally listed species whose existence is jeopardized by increases in nitrogen oxide (NOx) emissions," which the Final Rule will also substantially increase. *Id.* at 31. These include "the bay and quino checkerspot butterflies and desert tortoise, whose populations are at heightened risk of extinction directly due to increased nitrogen pollution in their locations and critical habitats." *Id.* at 31. A recent study of the effects of nitrogen pollution on federally listed species, based on analysis of [the Services'] documents, found that this threat is "substantial" and "geographically widespread." *Id.*

The comment then "describes the myriad federally listed species whose existence is jeopardized by increases in sulfur dioxide ("SO2") emissions," which will also significantly rise under the Final Rule. *Id.* at 34. The comment explains that "higher SO2 emissions [will] jeopardize numerous critically imperiled bird species and plant species, whose populations are at heightened risk of extinction directly due to increased sulfur dioxide pollution in their locations and critical habitats. *Id.* Indeed, "Federal wildlife agencies, and in particular FWS, have identified numerous federally endangered and threatened species that are negatively affected by atmospheric pollution from SO2 and SOx," including the whooping crane. *Id.* at 35-36.

Despite the devastating impact that the Final Rule will have on listed species and their critical habitats, the agencies nonetheless concluded that Section 7 consultation was not required; they state the likelihood that the Rule "would jeopardize listed species or adversely modify designated critical habitat is simply too remote to be cognizable under the ESA consultation requirements." 85 Fed. Reg. 25,254. The agencies assert that "[a]ny potential effects of this action on listed species or designated critical habitat would be a result of changes to CO2 or air pollutant emissions that are caused by the individual choices of manufacturers in producing these vehicles and of consumers in purchasing and operating those vehicles. The agencies are not requiring, authorizing, funding, or carrying out the operation of motor vehicles." *Id.*

This is just a ploy to dodge the agencies' statutory obligations and deny the consequences of their actions. Section 7 of the ESA requires federal agencies to "insure that any action authorized, funded, or carried out by such agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [the critical] habitat of such species."[485] An agency must initiate formal consultation with the Services if a proposed "agency action" "may affect" any listed species or critical habitat.[486] Agency "action" is broadly defined in the ESA's implementing regulations to include "the promulgation of regulations" or other "actions directly or indirectly causing modifications to the land, water, or air."[487] The "may affect" threshold is very low and is crossed whenever an agency action has "[a]ny possible effect, whether beneficial, benign, adverse or of an undetermined character."[488] "[A]ctions that have any chance of affecting listed species or critical habitat—even if it is later determined that the actions are 'not likely' to do so—require at least some consultation under the ESA."[489]

Under that standard, the Final Rule unquestionably requires a consultation. It is a discretionary "regulation" that will result in substantially increased GHG and criteria pollutant emissions, which, as the NGO ESA Comment explained, "may affect" hundreds of listed species. The fact that the increased emissions are physically caused by automaker and consumer "choices" does not relieve the agencies of their Section 7 obligations because those "choices" will be made within the radically different regulatory environment imposed by the Final Rule. The agencies' argument would exempt virtually all regulations from Section 7 requirements, even though the definition of "agency action" in 50 C.F.R. § 402.02 expressly includes "promulgation of regulations" (as well as actions that "directly or indirectly" impact air, land, or water).

The White House described the Final Rule as "the largest deregulatory action of [the Trump] Presidency,"[490] and in terms of GHG pollution impact, that statement is correct. If the climate consequences of such a massive GHG pollution increase are "too remote" to warrant consultation under Section 7, then consultation would never be required in connection with climate change hazards to listed species, even though, as the NGO ESA Comment explained, climate change is a significant factor in listing scores of species. In effect, the agencies are attempting to carve climate change impacts out of the ESA, even while the risk climate change poses to species is more dire than ever. And the agencies' attempt to ignore the well-documented effects on endangered species and their habitat from the increases in SO_2 and NOx resulting from this rule similarly violates the ESA.

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[485] 16 U.S.C. § 1536(a)(2); 50 C.F.R. § 402.14(a).
[486] 50 C.F.R. § 402.14(a).
[487] 50 C.F.R. § 402.02 (emphasis added); *see also Pac. Rivers Council v. Thomas*, 30 F.3d 1050, 1054-55 (9th Cir. 1994); *Conner v. Burford*, 848 F.2d 1441, 1453 (9th Cir. 1988); *Nat'l Wildlife Fed'n v. FEMA*, 345 F. Supp. 2d 1151, 1169 (W.D. Wash. 2004).
[488] Interagency Cooperation-Endangered Species Act of 1973, as Amended, Final Rule, 51 Fed. Reg. 19,926 (June 3, 1986), https://s3.amazonaws.com/archives.federalregister.gov/issue_slice/1986/6/3/19922-19963.pdf#page=5.
[489] *Karuk Tribe v. Cal. v. U.S. Forest Serv*., 681 F.3d 1006, 1027 (9th Cir. 2012).
[490] Statement from the Press Secretary of the White House (March 31, 2020), https://www.whitehouse.gov/briefings-statements/statement-press-secretary-124/.

The agencies' failure to consult the Services on the Final Rule violates both the procedural requirements of Section 7(a)(2) of the ESA and the agencies' substantive duty to ensure against jeopardy of federally listed species and the adverse modification of their habitats. EPA must therefore reconsider the Final Rule and comply with the ESA.

D. Comments related to fleet performance in recent model years, technological feasibility, automaker compliance, and crediting provisions of the CAFE and GHG standards

These comments identified centrally relevant information demonstrating that the US fleet had continued to improve its fuel economy and GHG emissions performance in recent model years and that the previous standards remain technologically feasible. Many of these comments provide information directly contradicting the agencies' statements in and justifications for the Final Rule, yet the agencies arbitrarily and unlawfully ignored them or responded inadequately.

i. Supplemental Comment of the Union of Concerned Scientists (UCS), dated November 30, 2018 (Docket #EPA-HQ-OAR-2018-0283-7439) ("Amendments Comment")

This comment concerned technical amendments EPA had proposed for the previous GHG standards. As the comment made clear, the changes proposed in the technical amendments "will also affect the context of the 2021-2026 NPRM" and therefore UCS submitted this comment for consideration in the rulemaking for the Proposal.[491] Further, the comment observed that the proposed technical amendments "have the potential to affect the overall impact and success of the [GHG standards] in significant ways."[492] The comment then discussed each component of the amendments—the clarification of advanced technology vehicle multiplier regulations and off-cycle credit calculations based on the 5-cycle test methodology. And the comment observed that if these changes to the flexibilities "are not considered when setting standards, they have the potential to significantly undermine and erode the benefits by crediting business-as-usual deployment or underestimating the impact of such programs."[493] And it stated that "[a]ny impacts of these proposed amendments will have [sic] affect not only the current rules, but also those under consideration, potentially leading to significant reductions in emissions which the Agency has not yet considered under either rulemaking."[494] Finally, the comment observed that "combined with changes in stringency as proposed by EPA for MY2021-2026, the proposed changes to various flexibilities could severely impact any of the alternatives proposed by the Agency, and therefore must be considered holistically with any proposals" to change the previous GHG standards.

Indeed, the EPA finalized the technical amendments on the same day as it issued the Final Rule. EPA, Light-Duty Vehicle Greenhouse Gas Program Technical Amendments, 85 Fed. Reg. 22,609 (April 23, 2020). And those amendments do change the provisions of the GHG standards in ways that will have significant impacts on the effect of those standards. Yet in the

[491] Amendments Comment at 1.
[492] *Id*. at 2.
[493] *Id*. at 7.
[494] *Id*.

Final Rule, the agencies wholly failed to acknowledge, cite, or respond to the Amendments Comment, and the agencies failed to consider the impacts of the technical amendments in the rulemaking analysis. In fact, in the agencies' modeling analysis they assume that the technical amendments are *not* finalized, and thus treat advanced vehicle technology multipliers and off-cycle programs under the old, outdated structure of those provisions as they existed prior to the technical amendments. For example, had the agencies accurately accounted for the finalized technical amendments, Tesla's bank of overcompliance credits in the modeling analysis would have grown by 40%.[495]

The Amendments Comment is centrally relevant to the agencies' analysis, and the failure to acknowledge or respond to it or its substance is wholly arbitrary and unlawful.

ii. Supplemental Comment of H-D Systems, dated May 23, 2019 (Docket # NHTSA-2018-0067-12395; #EPA-HQ-OAR-2018-0283-7575) ("H-D Systems Comment")

H-D Systems submitted this comment in response to a critique from the Alliance of Automobile Manufacturers regarding a comment H-D Systems submitted during the formal comment period.[496] The H-D Systems comment emphasized that the material in the PRIA and Volpe model files is "opaque at best" and that the Alliance's critique thus focused on establishing what specific cost and effectiveness estimates the agencies actually used in their analysis, rather than on what cost or effectiveness estimates the agencies should use, further demonstrating the inadequacy of the rulemaking process, including the lack of critical information and the inadequate period for public comment.[497]

Moreover, the H-D Systems Comment: (1) clarified issues related to the agencies' failure to correctly model vehicle redesign cycles; (2) showed that the agencies' modeling improperly limited the efficiency of technologies that reduce tractive load, in particular by failing to appropriately downsize vehicle engines and adjust shifting logic in response to reduced tractive load; (3) demonstrated that EPA's lumped parameter model (LPM) has consistently withstood criticism; (4) explained why the agencies erred in omitting the highly cost-effective HCR2 technology as a compliance option in their modeling analysis; (5) reaffirmed that the agencies erroneously limited glider weight in their modeling of mass reduction and that the Alliance's own calculation of mass reduction costs suffered crucial errors; and (6) demonstrated that the Alliance comment revealed inconsistencies in the agencies own presentation of electrification costs in the PRIA.[498]

In the Final Rule, the agencies acknowledge and cite only the second of these issues – that the agencies improperly limited the efficiency of technologies that reduce tractive load.[499] In response to that issue, the agencies simply assert that H-D (and the agencies' prior analyses) did not consider the "extreme complexity or associated costs" of engine resizing, and that the

[495] *See* above, section I(N)(ix) n.432.
[496] *See* H-D Systems' Comment at 1.
[497] *Id*. at 2.
[498] *See id*. at 2-3.
[499] 85 Fed. Reg. at 24,336, 24,463, 24,560.

assumption that an engine should always be resized in response to tractive load changes was "impractical."[500] Thus, without engaging any of the details of the H-D Systems Comment or actually analyzing or addressing the specific "complexity" or "costs" associated with engine resizing, the agencies simply reaffirm the approach to downsizing that they took in the Proposal.[501] This response is wholly deficient, arbitrary, and unlawful.

Likewise, the agencies' failure to acknowledge, cite, discuss, or respond to any of the remaining issues, objections, and analysis raised in the H-D Systems Comment is arbitrary and unlawful.

iii. Supplemental comment from Center for Biological Diversity, et al., dated May 24, 2019 (Docket #NHTSA-2018-0067-12397 to 12402) ("NGO Technology Comment")

This comment highlighted several issues. First, it highlighted automaker announcements and an academic publication released after the close of the formal comment period underscoring that advancing clean car technologies fosters economic strength in the United States.[502] In the Final Rule, the agencies did not acknowledge, cite, or discuss this aspect of the comment.

The comment described an academic publication from researchers at Indiana University and Syracuse University, funded by the Auto Alliance, that found that the previous standards yielded long-term benefits for U.S. economic well-being. The study, Graham et al., *The Macroeconomic Effects of 2017 Through 2025 Federal Fuel Economy and Greenhouse Gas Emissions Standards*, found that the previous standards have positive long-run effects, saving consumers money at the pump because they encourage automakers to produce more fuel-efficient vehicles. The comment also noted that the academic publication in question "still reflected flawed assumptions that drive their finding of limited short-term negative impacts" and that, in particular, "their underlying model does not allow incorporation of vehicle financing, such that short-term employment effects are artificially sensitive to changes in vehicle price."[503] The comment then observed that, "[h]ad the . . . study accurately reflected vehicle financing, the benefit-to-cost ratio would presumably have reflected mitigated up-front consumer costs in the short-term."[504]

In the Final Rule, the agencies appear to refer to this portion of the NGO Technology Comment. The agencies' entire discussion on this score consists of a single sentence: "The Union of Concerned Scientists and Environmental Defense Fund argued that the modeling of short-term job losses in the macroeconomic models is incorrect, and that purchasing a new vehicle, especially if financed, should increase disposable income, because monthly savings at the pump outpace the monthly financed cost of the fuel saving equipment, but also that consumers will not choose this equipment unless a stringent standard is chosen."[505] This response is misleading, inadequate, insufficient, and unlawful. For example, this response failed

[500] *Id*. at 24,561; *see also id*. at 24,336, 24,463.
[501] *Id*.
[502] NGO Technology Comment at 1 - 3.
[503] *Id*. at 3.
[504] *Id*.
[505] 85 Fed. Reg. at 24,738 (citing "NHTSA–2018–0067–12397–4, Environmental Defense Fund, et al.").

entirely to engage with the factual contention made: that monthly fuel savings will often exceed monthly financing expenditures, and that those fuel savings will be greater under the *previous* standards. That is a statement of fact, readily verifiable through agency investigation. But the agency failed entirely to undertake that investigation in response. That failure is arbitrary and unlawful.

The comment also noted a study from the Energy Information Administration finding that maintaining the previous GHG standards would increase new vehicle sales through 2050, contrary to the agencies' findings in the Proposal.[506] "At a minimum," the comment observed, "the EIA analysis conclusively demonstrates that sales effects of the standards are so uncertain that the federal government itself cannot determine with confidence if the effect is to increase or decrease sales."[507] And the comment objected that "[g]iven this fundamental uncertainty, it is arbitrary to rely on projected sales effects to justify a rollback of the standards and a dismissal of the mandates the agencies were given by their respective statutes to reduce harmful pollution and improve fuel economy."[508] In the Final Rule, the agencies wholly fail to acknowledge or respond to this aspect of the NGO Technology Comment – and the EIA study – despite the fact that the agencies continue to rely on projected sales effects to justify the Final Rule. That failure is arbitrary and unlawful.

The comment also highlighted several vehicle models announced by automakers after the Proposal demonstrating that automakers continue to make progress in advancing fuel economy and GHG emissions improvements in the U.S. fleet.[509] And the comment observed that automakers continue to make progress in deploying electric vehicles, highlighting several automaker announcements as well as seven distinct reports issued after the close of the Rule's comment period "indicat[ing] that declining costs, especially for batteries, will make electric vehicles equal to or cheaper than internal combustion engine-powered vehicles within the next decade."[510]

And the comment observed that EPA experts "continue to release new technical assessments and other research related to light-duty vehicle emissions" and that "EPA's failure to docket its own assessments before the close of the comment period precluded meaningful public comment on these materials."[511] Moreover, the comment observed that "[t]o the extent any final rule fails to address, explain, analyze, and incorporate the findings of EPA's assessments, it would arbitrarily fail to address highly relevant information. It would also reflect an unlawful delegation to NHTSA of EPA's duty to rely on its own expertise in setting GHG vehicle emission standards and would be arbitrary and capricious.[512] The comment then submitted numerous documents containing test data packages from benchmarking, transmission test data, vehicle test data, technical publications and presentations concerning benchmarking, and additional technical publications by EPA staff – none of which had been submitted to the dockets

[506] NGO Technology Comment at 3.
[507] *Id*.
[508] *Id*.
[509] *Id*. at 3-6.
[510] *Id*. at 6-7.
[511] *Id*. at 8.
[512] *Id*.

by the agencies.[513] But in the Final Rule, the agencies wholly and unlawfully fail to acknowledge, cite, or respond to this portion of the NGO Technology Comment, notwithstanding the fact that the agencies failed in the Final Rule to address, explain, analyze, and incorporate the findings of EPA's assessments, rendering the Final Rule analysis arbitrary for failing to address highly relevant information.

Finally, the comment describes that the current Administration was both misrepresenting the climate impacts of the Proposal and unlawfully failing to disclose communications and meetings with regulated parties regarding the Proposal.[514] The Final Rule entirely ignores and fails to respond to the comment that the Administration was misrepresenting the impact of the Proposal. As to the failure to disclose communications regarding the Proposal, the Final Rule does not offer any substantive response. Instead, it suggests that the agencies construed the comment as a FOIA request and therefore forwarded the comment "to the agencies' respective FOIA offices" for processing.[515] But the comment was not a FOIA request. It was a comment observing the agencies had failed to comply with legal requirements – including provisions of the Clean Air Act – requiring the agencies to disclose and submit to the docket any meetings during the comment period or prior to rule release.[516] In fact, in the agencies' response they make no mention of the Clean Air Act obligations cited by the NGO Technology Comment and instead dismiss the notion that the comment could have been anything other than a FOIA request, because the material described by the comment was "clearly not contemplated by the APA [Administrative Procedure Act] as material necessary for publication along with a proposed rule."[517] The agencies' complete failure to engage with the substance of this comment – including the agencies' failure to cite or respond to the comment's discussion of the EPA's obligations under Clean Air Act – is wholly arbitrary and unlawful (as is EPA's failure to fulfill those Clean Air Act obligations).

As described above, the agencies wholly ignored the vast majority of objections and issues raised in the NGO Technology Comment. In those instances where the agencies purport to acknowledge or respond to issues in the NGO Technology Comment in the Final Rule, they do so inadequately – misconstruing its contents and failing to acknowledge or respond to its substance. The agencies' treatment of this comment is arbitrary and unlawful.

iv. Supplemental Comment of Environmental Protection Network, dated June 3, 2019 (Docket #NHTSA-2018-0067-12413) ("EPN Comment")

This comment observes that EPA had failed to docket several of its own technological assessments, including some that were among those that were also identified and submitted to the docket by the NGO Technology Comment. Specifically, the EPN Comment highlighted technical assessments demonstrating important developments in GHG emission-reducing technology that must be brought to bear in the rulemaking, that demonstrate EPA's technical and engineering expertise in evaluating and assessing control of vehicle emissions and fuel

[513] *Id*. at 10-12.
[514] *Id*. at 12-14.
[515] 85 Fed. Reg. at 25,158, 25,159.
[516] NGO Technology Comment at 12-13 & n.69 & 73.
[517] 85 Fed. Reg. at 25,159.

efficiency, and that refute a number of inaccurate statements and positions taken by the agencies on important technology issues in the Proposal. These materials demonstrated the technological feasibility of several technologies and technology combinations that can provide further improvement in GHG emissions, and therefore are of central relevance to the rulemaking. In particular, the studies demonstrate the large, cost-effective emissions reductions achievable from adding cooled exhaust gas recirculation (CEGR) and cylinder deactivation (DEAC) to high compression ratio engines. But neither of those technologies were allowed to be added to HCR engines in the agencies' analysis for the Proposal, and they are again disallowed in their analysis for the Final Rule. Moreover, the combination of all three of those technologies (referred to as "HCR2" in the agencies' analyses) is particularly cost-effective, and the agencies' own analysis has shown would have an enormous impact on the rule's costs and benefits – but the agencies nevertheless excluded it from the analysis in the Proposal by making inaccurate observations regarding its feasibility.[518] And again in the Final Rule the agencies make inaccurate statements regarding the agencies' own assessments of that technology's viability, including false statements and characterizations of the studies submitted by the EPN Comment.[519] Nevertheless, the agencies wholly and unlawfully failed to acknowledge, cite, or respond to the EPN comment or its specific objections, including the objections regarding EPA's procedural obligation to docket and utilize the products of its own expertise.

v. Supplemental Comment from CARB, dated July 10, 2019 (Docket #NHTSA-2018-0067-12428; #EPA-HQ-OAR-2018-0283-7584) ("Costs Comment")

The Costs Letter explained that the Proposed Rule contained discrepancies in cost for stop-start technology (SS12V) between the PRIA and the CAFE model that stemmed predominantly from a mathematical error.[520] Specifically, the agencies "wrongly used a cost for SS12V in the CAFE Model input file that already includes the cost of electric power steering (EPS) and improved accessories (IACC)."[521] Thus, the comment observed, the model was "double-counting" because it "applie[d] a SS12V cost that includes EPS and IACC on top of, instead of in lieu of, the EPS and IACC costs that were previously added to a vehicle."[522] This double-counting was then "propagated through the rest of the electrification technologies due to the sequential way the CAFE model applies electrification technology costs."[523] Finally, the Costs Comment noted that the public was left without the ability to discover or understand the costs error during the formal comment period, because even the PRIA did not accurately summarize what the agencies actually did.[524] Instead, these errors were only discoverable by digging deep in the CAFE model documentation for the Proposed Rule.[525]

[518] *See, e.g.,* UCS Comment at 16; Comment of the ICCT at I-60.
[519] *See* above, section I(N)(vi).
[520] Costs Comment at 3.
[521] *Id*.
[522] *Id*.
[523] *Id*.
[524] *Id*. at 25.
[525] *See*, *e.g.*, *id.*

In the Final Rule, the agencies acknowledge this comment.[526] However, the agencies fail to address and explain any changes they made in response to the main substance of this comment – that the way SS12V costs were structured caused the model to double-count costs from IACC and EPS. Instead, the agencies observe a subsidiary issue that "the IACC costs in Tables 6–32 and 6–33 of the PRIA did not align with the Technologies central analysis input file."[527] And the agencies observe CARB's objection "that inconsistencies in the model files and PRIA and lack of documentation about how the costs were derived '[left] the public without the ability to understand why the costs are what they are and what should be applied.'"[528] But the Final Rule fails to explain whether and how the double-counting identified in the comment has been eliminated in the Final Rule. Therefore, the agencies have unlawfully and arbitrarily failed to adequately respond to this comment in the Final Rule.

vi. Supplemental comment from CARB, dated November 26, 2019, (Docket #EPA-HQ-OAR-2018-0283-7626) ("Battery Comment")

This comment highlights U. S. Department of Energy presentations noting that battery prices had declined to $197/kWh in 2018, and projecting that battery prices will decline to under $100/kWh by the early- to mid-2020's. Further, the comment noted that agencies relied on a U.S. Department of Energy model to estimate battery costs in the Proposal, and thus U.S. Department of Energy battery cost estimates are of especially central relevance to the rulemaking. In the Final Rule, however, the agencies have entirely and arbitrarily ignored this comment and the referenced and attached presentations in making their battery cost projections.

vii. Supplemental comments from Environment America, et al., dated December 20, 2019 (Docket #EPA-HQ-OAR-2018-0283-7634) ("Mach E Comment")

This article discussed Ford Motor Company's new product development timeline as well as Ford's production of the Mustang Mach-E battery electric vehicle (BEV). The comment observed that manufacturers are capable of developing a variety of advanced low- and zero-emission vehicles that they project will appeal to a broad market. And it observed that Ford's production process for the Mach E represented a "general 'overhaul of the company's product creation process'" and "demonstrates that manufacturers can improve fuel economy and emissions by implementing internal combustion engine and advanced vehicle technologies without excessive lead-time." The comment emphasized that Ford's new development timeline "demonstrates that the refresh and redesign assumptions the Agencies used in the NPRM for both internal combustion engine vehicles and electric vehicles were unreasonably lengthy, undermining central elements of the Proposal's analysis and purported justification." However, the agencies entirely ignored this comment in the Final Rule.

viii. Supplemental Comment from the International Council on Clean Transportation (ICCT), dated June 18, 2019 (Docket #NHTSA-2018-0067-12418) ("ICCT Trends Comment")

[526] 85 Fed. Reg. at 24,576.
[527] *Id*.
[528] *Id*. at 24,516.

This comment responded to a comment submitted by the Alliance of Automobile Manufacturers (AAM) interpreting The 2018 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology since 1975. In AAM's comment, it made several unfounded assertions regarding automakers' compliance status and the ongoing feasibility of the previous fuel economy and GHG standards. Many of these same unfounded assertions have been adopted and repeated by the agencies as central justifications for the Final Rule. However, each of these assertions is misleading, baseless, and unfounded and cannot support the agencies' decision to weaken the previous standards. Yet the agencies wholly ignored ICCT's comment in the Final Rule.

Specifically, AAM asserted that automakers had been unable to meet annual greenhouse gas targets in recent years, and that automakers' use of overcompliance credits from previous years in order to achieve compliance demonstrates incapacity or infeasibility. But as ICCT observed, all the large automakers were in compliance with the GHG standards through the 2017 model year, and use of overcompliance credits to achieve compliance does not demonstrate infeasibility, but rather demonstrates that the program is operating as intended to allow manufacturers to utilize banked credits precisely so that they do not have to achieve compliance each year based on vehicle performance in that year alone.[529] In the Final Rule, the agencies adopt precisely the same line of flawed reasoning that AAM asserted in its comment – that credit usage suggests infeasibility.[530] This rationale is illogical, contrary to the design and purpose of the standards, arbitrary, and unlawful, as demonstrated in the ICCT Trends Comment.

AAM also asserted that an increasing number of manufacturers failed to meet their regulatory targets in MY 2017. But as the ICCT Trends Comment demonstrated, this was again misleading and incorrect. To the contrary, ICCT observed that there was no trend indicating that manufacturers found it any more difficult to comply in MY 2017 than in MY 2016, and the fact "that certain automakers used credits in 2016 and then complied without credits in 2017 demonstrates that they are using credits exactly as the agencies envisioned they would—to enable flexible compliance schedules."[531] Again, in the Final Rule the agencies repeat AAM's unfounded characterization of recent automaker performance, suggesting that the gap between automaker performance and the standards is "increasing."[532] This assertion is patently false, as demonstrated by the ICCT Trends Comment.

And AAM asserted that automakers had become increasingly reliant on off-cycle and A/C credits and flexibilities to comply with the standards, and that that fact demonstrated infeasibility. But again, ICCT responded that "manufacturers are not required to comply only by reducing tailpipe GHG emissions" and that "[f]or purposes of compliance, it does not matter if the standards are achieved by reducing tailpipe emissions or increasing flexibility credits – both types of GHG reductions are designed into the system."[533] Again, in the Final Rule the agencies repeat AAM's characterization that use of off-cycle and A/C credits suggests the previous

[529] ICCT Trends Comment at 2.
[530] *See* 85 Fed. Reg. at 25,117, 25,183.
[531] ICCT Trends Comment at 4.
[532] *See* 85 Fed. Reg. at 25,117, 25,196.
[533] ICCT Trends Comment at 4.

standards are infeasible.[534] As demonstrated in the ICCT Trends Comment, the suggestion that the standards are infeasible because automakers have used the standards' compliance flexibilities designed to enable real-world reductions in fuel consumption and GHG emissions that are not reflected in the two-cycle compliance tests is absurd, arbitrary, and unlawful.

The ICCT Trends Comment also described that significant technology remains available for the automakers to deploy into the fleet, further demonstrating the feasibility of the previous standards.

In sum, the ICCT Trends Comment demonstrates that AAM's characterizations of recent automaker performance as suggesting the previous standards are infeasible are illogical, misleading, incorrect, and arbitrary. Yet the agencies have adopted those same characterizations among their central justifications for the Final Rule – and have done so without acknowledging or responding to ICCT's comments demonstrating that those characterizations are irrational and misleading. As the ICCT Trends Comment demonstrates, the agencies' justification for the Final Rule is arbitrary and unlawful.

ix. Supplemental Comment from Environmental America, et al., dated January 29, 2020 (Docket #NHTSA-2018-0067-12451) ("Feasibility Comment")

This comment responded to a comment from Alliance of Automobile Manufacturers and Association of Global Automakers' (Alliance-Global) again making several of the same unfounded assertions regarding automakers' compliance status and the ongoing feasibility of the previous fuel economy and GHG standards. Specifically, Alliance-Global had again asserted that automakers were underperforming the standards, that automakers had become increasingly "reliant" on off-cycle technology credits as a means of compliance, and that some automakers were using overcompliance credits to comply with the standards. Alliance-Global had suggested that these factors demonstrated the previous fuel economy and GHG standards were not feasible.

The Feasibility Comment observes that Alliance-Global ignored all of the responses to the arguments they make that were presented in the ICCT Trends Comment, above, and demonstrates that the Alliance-Global's arguments are all unfounded, incorrect, misleading, and arbitrary.[535] And the Feasibility Comment again demonstrates that Alliance-Global arguments are fatally flawed. The Feasibility Comment observed that the GHG and CAFE standards are designed to provide compliance flexibilities that allow manufacturers wide discretion regarding when and how to achieve GHG and CAFE targets across their fleets, and the fact that they are using those flexibilities does not and cannot demonstrate that the standards are infeasible.[536] Moreover, the Feasibility Comment observed that – contrary to the Alliance-Global's portrayal – in fact the U.S. fleet was in full compliance with the MY 2017 standards. And Feasibility Comment explained that the fact that automakers are using off-cycle and A/C credits as compliance pathways does not demonstrate that the automakers are unable to comply with the

[534] *See* 85 Fed. Reg. at 25,183-84.
[535] Feasibility Comment at 2-3.
[536] *Id*. at 3-4.

standards – to the contrary, it demonstrates that automakers are using those provisions to achieve real-world fuel economy and GHG improvements and are fully complying with the standards.[537]

Again, in the Final Rule the agencies repeat the same assertions as were made by the Alliance-Global.[538] As demonstrated in the Feasibility Comment, those assertions are incorrect and misleading and the agencies' reliance on them as central justifications for the Final Rule is arbitrary and unlawful. Yet in the Final Rule the agencies have entirely and unlawfully failed to acknowledge or respond to the Feasibility Comment.

x. Supplemental Comment from Center for Biological Diversity, et al., dated March 26, 2020 (Docket #EPA-HQ-OAR-2018-0283-7657) ("Trends Letter")

The Trends Letter addressed the 2019 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology since 1975, issued March, 2020 (Report).[539] The Report and the Trends Letter document that, in MY 2018, real-world CO2 and fuel economy "increased 0.2 mpg to 25.1 mpg compared to" MY 2017, and that "preliminary average estimated real-world fuel economy of all new model year 2019 vehicles is projected to increase again, to 25.5 mpg with a corresponding decrease in average CO_2 emissions to 346 g/mi."[540] The Trends Letter and Report further demonstrated that 10 of the 14 automakers improved fuel economy in MY 2018.[541] Further, as the Trends Comment described, the fleet achieved this result even though light-duty trucks (which have more lenient GHG emissions and fuel economy targets under the GHG and CAFE standards) made up 52% of the MY 2018 fleet – the highest percentage of trucks on record.[542] And it noted that further improvements in truck SUVs and pickups are expected to drive the majority of the projected MY 2019 fleet-wide GHG reductions and fuel economy gains.[543]

Further, as a whole, manufacturers ended MY 2018 with 252 teragrams of credits in the GHG program – which, if applied entirely to MY 2018, would have been equivalent to a fleetwide GHG reduction of about 74 g/mi.[544] Nevertheless, the overall fleet improved tailpipe emissions to, on average, 1 g/mi above the standards in MY 2018 – meaning the industry chose to apply less than 2% of its total GHG credit balance toward MY 2018 compliance.[545] Moreover, "[a]ll manufacturers, except one, ended the 2018 model year with a positive credit balance and are thus in compliance with model year 2018 and all previous years of the GHG program."[546]

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[537] *Id*. at 5.
[538] *See* 85 Fed. Reg. at 25,117, 25,183, 25,196.
[539] The Report is at Docket #EPA-HQ-OAR-2018-0283-7654.
[540] Trends Letter at 2.
[541] *Id*.
[542] *Id*. at 2
[543] *Id*.
[544] *Id*.
[545] *Id*. at 4.
[546] *Id*.

Finally, the Trends Comment noted that EPA Administrator Andrew Wheeler had stated publicly that the Report would play a "key role" in the Final Rule, and that the contents of the report were "top of mind."[547]

However, in the Final Rule the agencies have entirely ignored the Report and the Trends Comment, as there is not one citation to or discussion of either in the Final Rule. This omission is arbitrary and unlawful, particularly given the fact that many of the agencies' central justifications for the Final Rule stand in direct contradiction of the observations in the Trends Comment and the data in the Report. For example, in the Final Rule the agencies assert that "[f]or MYs 2016 through 2019 . . . the combined CAFE performance, including all flexibilities and incentives, of the total fleet has or is expected to be worse than the applicable CAFE standards, and increasingly so;"[548] that the situation is "continuing to get worse in the 2018 and 2019 model years";[549] that model years 2016 through 2019 "involve significant challenges for many vehicle manufacturers;"[550] that "compliance shortfalls represent a growing problem with the current standards and will continue to be a problem if stringency does not converge at least somewhat more closely with what the market appears willing to bear";[551] and that "light truck fleets have fallen below their associated CAFE standards and have had larger performance shortages than either import and domestic passenger car fleets. This trend is expected to continue."[552]

As described above and in the Trends Comment, all of these assertions are demonstrably false. The agencies' failure to acknowledge the facts in the Trends Comment and the Report that undermine their own portrayal of automaker performance in recent and oncoming model years fatally undermines the agencies' justification for the Final Rule. The Final Rule is arbitrary and capricious. It must be withdrawn and reconsidered.

xi. Supplemental Comment from the International Council on Clean Transportation, dated March 26, 2020 (Docket #NHTSA-2018-0067-12387, #NHTSA-2018-0067-12388) ("ICCT Toyota Response"); Supplemental Comment from the California Air Resources Board, dated April 29, 2019 (Docket #NHTSA-2018-0067-12390, #NHTSA-2018-0067-12393) ("CARB Toyota Response"); Supplemental Comment from H-D Systems, docketed April 29, 2019 (Docket #NHTSA-2018-0067-12389) ("H-D Toyota Response")

These three comments were all submitted in response to a supplemental comment from Toyota regarding the emissions and fuel economy performance of Toyota's Atkinson-cycle engines. Notably, in the Final Rule the agencies cite Toyota's comment approvingly,[553] but the agencies make no mention of any of these comments responding to and refuting Toyota's comment. Moreover, Toyota submitted a second supplemental comment responding and citing

[547] *Id*. at 1.
[548] 85 Fed. Reg. at 25,196.
[549] *Id*. at 25,183.
[550] *Id*.
[551] *Id*.
[552] *Id*. at 25,198.
[553] *See, e.g., id*. at 24,579 n.1516; *id*. at 24,414 & n.847, 853, 853.

to the ICCT Toyota Response. Again, in the Final Rule the agencies cite and discuss that second Toyota comment approvingly – without any mention or discussion of the ICCT Toyota Response.[554] The agencies' deferral to Toyota's characterizations, without considering or responding to stakeholders' comments refuting those characterizations, is arbitrary and unlawful.

The ICCT Toyota Response observed that EPA had recently validated and benchmarked its estimates of efficiency synergies underlying the HCR2 technology in the agencies' modeling. And ICCT systematically refuted each of Toyota's assertions regarding the limits of possible efficiency improvements in its vehicles, including in the Toyota Camry and the Toyota Tacoma.

The CARB Toyota Response likewise refutes Toyota's characterization of the current and potential performance of Atkinson-cycle engines in its vehicles, including the Toyota Camry and the Toyota Tacoma. Specifically, CARB observed that Toyota's own comments actually affirm CARB's submitted comments and confirm that the agencies used incorrect estimates and assumptions in their proposed SAFE Vehicles Rule.[555] And CARB observed that "vehicles on the road today are using technologies that the Agencies maintained would not be available before 2030. The Agencies' failure to account for these improvements, and continuing improvements likely over the next decade, critically undermines the Agencies' proposal, which is grounded substantially on these unreasonable assumptions."[556] CARB then systematically refuted several contentions made in the Toyota comment.[557]

The H-D Toyota Response demonstrated flaws in Toyota's analysis of H-D Systems' prior comment, and described that "Toyota's discussion of HCR2 technology . . . in fact supports . . . my conclusion that the Agencies erroneously excluded next-generation Atkinson technology from the Volpe model."[558] And the H-D Toyota Response demonstrated that Atkinson-cycle technology is technologically feasible on pickup trucks as well as passenger cars (contrary to the agencies' assertion in the Final Rule, as discussed elsewhere in this petition).

The agencies' failure to acknowledge or respond to these comments—particularly when the agencies do respond and approvingly discuss and cite the underlying Toyota comments—is arbitrary and unlawful.

E. Comments identifying procedural errors in the rulemaking process

The following comments make clear the significant procedural flaws in the process leading to the Final Rule, which fatally undermine the legality of the Final Rule and the GHG standards. The agencies' failure to consider and/or adequately respond to these comments is arbitrary and unlawful. These procedural errors were "so serious and related to matters of such central relevance to the rule that there is a substantial likelihood that the rule would have been significantly changed if such errors had not been made." *See* 42 U.S.C. § 7607(d)(8).

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[554] *See id*. at 24,344 n.602; id. at 24,384 & n.702; 24,396 & n.744; *id*. at 24,414 & n.847;
[555] CARB Toyota Response at 2.
[556] *Id*.
[557] *Id*. at 2-5.
[558] H-D Toyota Response at 1.

i. Comment of Environmental Defense Fund, dated December 7, 2018 (Docket #NHTSA-2018-0067-12327, #EPA-HQ-OAR-2018-0283-7436) ("EDF Procedural Errors Comment")

This comment urged the agencies to re-open the public comment period to correct numerous errors that hindered the public's ability to participate in the rulemaking process. EDF Procedural Errors Comment at 2. The comment noted that the agencies "withheld substantial amounts of information essential for the public to understand, evaluate, and critique" the Proposed Rule, including the OMEGA model and related EPA modeling tools, the Autonomie model, the data underlying the Volpe sales module, the data used to derive the statistical model that predicts fatality rates by vehicle age, the methodology used to develop the Volpe fleet share model, and the data used to develop VMT schedules by vehicle age. *Id*. at 2-3. The comment also noted that "significant information was placed into the rulemaking docket immediately before the close of the comment period, far too late to allow the public to review it and rely upon it in developing comments," including, among other things, transcripts of all the public hearings. *Id*. at 2 n.4. The comment also noted the insufficiency of the number and location of public hearings that did occur. *Id*. at 3. The comment objected to these failures, noting that they "prevented meaningful public comment on all aspects of the proposal and are especially pernicious given that the agencies' analysis included many novel and untested modeling approaches that have never been subject to peer review; never addressed major concerns raised during the course of inter-agency review; and presented findings directly at odds with preexisting (and longstanding) agency analyses." *Id*. at 3.

The agencies responded to this comment by stating that "[t]he agencies made the [public hearing] transcripts available within a reasonable period," pointing to the dates that the transcripts were certified by the reporters and that "it was reasonable for the agencies to have an opportunity to review the transcripts for errors prior to making them publicly available." 85 Fed. Reg. at 25,156. However, the stretch of time between when those transcripts were certified (September 26, September 27, and October 1, 2018) and when the agencies posted them (October 25, 2018—the day before the close of the comment period) was too great, especially in light of the fact that the agencies had denied requests to extend the comment period. The agencies were obligated to provide this information in a timely manner that allowed the public to consider the comments that had been made in those hearings.

The agencies also recognized that this comment raised objections regarding the lack of peer review for certain elements of the CAFE model. *Id*. at 25,157. However, the agencies' asserted defenses regarding its peer review failures are insufficient, as discussed in more detail below with respect to the NGO Peer Review Procedural Comment.

The agencies unlawfully failed to address the other deficiencies raised in the comment. Doing so would have forced the agencies to confront the grossly inadequate rulemaking process, including the withholding of critical information. EPA must reconsider the Final Rule, release all the information that remains relevant to the rulemaking, allow for a meaningful comment period, and reevaluate the GHG standards in the Final Rule.

ii. Supplemental Comment of the California Air Resources Board, dated December 19, 2018 (#EPA-HQ-OAR-2018-0283-7449) ("CARB Procedural Deficiencies and NERA/Trinity Economics Comment")

In this comment, CARB describes numerous procedural deficiencies with the SAFE rulemaking. The letter notes that it follows CARB's substantive comments on the Proposed Rule, filed on October 2, 2018, and CARB's information request letter (submitted in part under the Freedom of Information Act (FOIA)) to both agencies on September 11, 2018. CARB states that the information it requested still had not been fully provided, even though NHTSA and EPA assert their proposals are based on the information. The information requested includes information about the models and data used to estimate battery costs for electrified vehicles; Polk registration data, including survival rates aggregated by model year, calendar year, and body style, used in developing the scrappage model the agencies utilized in the rulemaking; information regarding the dynamic fleet share model, including the coefficients for the model; the agencies' detailed explanation and derivation of their point estimates for the increase in fatalities per hundred pounds of mass reduction over a constant footprint based on historical crash data, for model years 2004-2011 and calendar years 2006-2012; and modeling tools developed by EPA, including the Advanced Light-Duty Powertrain and Hybrid Analysis ("ALPHA") model and Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA). The letter includes an appeal of several of NHTSA's initial FOIA determinations.

The letter also discusses an analysis by NERA Economic Consulting and Trinity Consultants on behalf of the Auto Alliance that had been previously submitted to the Proposed Rule docket, as discussed more below.

The agencies arbitrarily and unlawfully fail to acknowledge or respond to this comment in the Final Rule.

iii. NGO Comment on procedural deficiencies and NERA/Trinity analysis, dated December 20, 2018 (Docket #NHTSA-2018-0067-12371, #EPA-HQ-OAR-2018-0283-7443) ("NGO Procedural Deficiencies and NERA/Trinity Comment")

In this comment, the NGOs describe numerous procedural deficiencies with the SAFE rulemaking. First, the NGOs state that "the Agencies must place in the rulemaking docket additional material (described herein) that is 'of central relevance to the rulemaking,' the unavailability of which precluded adequate opportunity for public comment on the Proposed Rule." NGO Procedural Deficiencies and NERA/Trinity Comment at 1. These include the Advanced Light-Duty Powertrain and Hybrid Analysis ("ALPHA") model and Optimization Model for reducing Emissions of Greenhouse gases from Automobiles ("OMEGA"), for which Environmental Defense Fund and the Natural Resources Defense Council had submitted a Freedom of Information Act ("FOIA") request; Polk registration data, including survival rates aggregated by model year, calendar year, and body style, used in developing the scrappage model the agencies utilized in the rulemaking; information regarding the methodology used to develop the agencies' "fleet share" model, which projects the ratio of car and light truck sales by

model year, including the coefficients for the model (and the NGOs also note that the fleet share model has not been peer reviewed, in violation of applicable requirements); information about battery technology and cost modeling, as well as an explanation of how non-battery costs of electric vehicles were developed, including the data used; the fuel economy impact database developed by Argonne National Laboratory (ANL), which is central to the agencies' compliance modeling; disaggregated data on turbocharging and downsizing costs; information related to the agencies' estimates for the safety impacts of mass reduction; and information regarding the agencies' calculations of the social cost of greenhouse gases.

Second, the NGOs state that the agencies must reopen the comment period to provide the public adequate opportunity to comment on both the additional materials noted above, as well as other material that "was not made publicly available until so late in the comment period as to preclude meaningful opportunity for comment." *Id*. These additional materials include transcripts of the public hearings held on the Proposed Rule and an updated Preliminary Regulatory Impact Analysis that was posted to the docket four days before the end of the comment period and that contained material revisions.

The letter also discusses an analysis by NERA Economic Consulting and Trinity Consultants on behalf of the Auto Alliance that had been previously submitted to the Proposed Rule docket, as discussed more below.

The agencies responded to this comment by stating that "[t]he agencies made the [public hearing] transcripts available within a reasonable period," pointing to the dates that the transcripts were certified by the reporters and that "it was reasonable for the agencies to have an opportunity to review the transcripts for errors prior to making them publicly available." 85 Fed. Reg. at 25,156. However, the stretch of time between which those transcripts were certified (September 26, September 27, and October 1, 2018) and when the agencies posted them (October 25, 2018—the day before the close of the comment period) was too great, especially in light of the fact that the agencies had denied requests to extend the comment period. The agencies were obligated to provide this information in a timely manner that allowed the public to consider the comments that had been made in those hearings.

The agencies also recognized that this comment raised objections regarding the lack of peer review for certain elements of the CAFE model. *Id*. at 25,157. However, the agencies' asserted defenses regarding its peer review failures are insufficient, as discussed in more detail below with respect to the NGO Peer Review Procedural Comment.

The agencies also noted that this comment objected to some materials being added to the docket, *id*. at 25,156, n.2831, and that it "invoked requests to the agencies under the [Freedom of Information Act ('FOIA') regarding material sought in connection with the rulemaking," *id*. at 25,158, n.2864. However, the agencies do not respond to the substance of these complaints. In particular, the FOIA request was in part for the OMEGA model, and EDF and NRDC eventually won a lawsuit ordering EPA to release the model, as is discussed more fully with respect to the OMEGA Supplemental Comment, below.

iv. Supplemental Comment and Request for Correction of Center for Biological Diversity, Environmental Defense Fund, Natural Resources Defense Council, Public Citizen, and Union of Concerned Scientists, dated May 31, 2019 (Docket #NHTSA-2017-0069-0716, #NHTSA-2018-0067-12406, #NHTSA-2018-0067-12409) ("OMEGA Supplemental Comment")

This comment highlights several developments postdating the close of the formal comment period, including an April 25, 2019 EPA Science Advisory Board memo that highlights EPA's lack of involvement in developing the inputs and parameters of the CAFE model analysis and several admissions made by EPA in litigation of FOIA claims raised by commenters NRDC and EDF regarding the OMEGA model. OMEGA Supplemental Comment at 3-4. In the FOIA litigation, EPA admitted that it had updated the OMEGA model to assist an EPA decisionmaker in arriving at a decision related to the regulation of new automobile GHG emissions, that EPA used the latest version of the OMEGA model to inform its analysis during the interagency review process, and that EPA had nevertheless not released that version of the OMEGA model to the public. *Id*. at 4.

The comment argues that this new information reinforces that "EPA must release the latest full version of OMEGA and place it in the SAFE rulemaking docket" and that "[t]he agencies must then reopen the formal comment period for at least 60 days so that members of the public can use the updated model to analyze the effects of the SAFE rule and tailor their comments accordingly." *Id*. at 1.

In response, EPA asserts in the Final Rule that "no completed version of an updated OMEGA model even existed for the agencies to publish as part of the notice of proposed rulemaking" and that "even [if] . . . EPA consulted updates to the OMEGA model during the interagency review—such a predicate still would not require the publication of the model during the rulemaking process." 85 Fed. Reg. 25,160. EPA justifies this position by asserting that requiring "every piece of information ever referenced by the agencies or upon which the Agencies drew regulatory experience to be published" would cause "rulemaking dockets . . . to expand to an absurd scope of nearly infinite materials, spanning arguably back to even the school textbooks the rulemaking personnel used to learn the underlying disciplines employed in the rulemaking analysis. Clearly such a scope would frustrate rather than further the provision of proper notice to the public about a proposed rule." *Id*. at 25,160.

The agency's response is both factually incorrect and vacuous. As described in the OMEGA Supplemental Comment, EPA *did* have an updated OMEGA model that it could have made publicly available. In fact, as described elsewhere in this petition, the U.S. Court of Appeals for the 2nd Circuit ruled, just one day after the agencies released the Final Rule publicly, that EPA had illegally withheld the OMEGA model and ordered the agency to disclose it. As is also described elsewhere in this petition, the results of that model show significantly lower compliance costs for the previous GHG standards--which completely undermines EPA's rationale for the Final Rule.

EPA also asserts that "the OMEGA model did not affect any part of the rule, including the methodologies and analysis underlying the formulation of the rule." *Id*. Thus, "even if

consulted, the OMEGA model would exist as, at most, supplementary material which had no influence on the rulemaking methodologies, all of which were fully disclosed." *Id*. But contrary to EPA's contention, this comment demonstrated that EPA *did* utilize the OMEGA model to inform its analysis of the proposed rule, and thus that it *did* have influence on the rulemaking and the methodologies employed.

EPA's response to this supplemental comment is wholly inadequate and unlawful. EPA was legally required to disclose the OMEGA model, and it must fully and publicly consider the model's estimates of compliance costs (which the agency had access to but which they unlawfully withheld from the public). EPA's procedural violation and the substantive results of the OMEGA model further underscore the arbitrary and capricious nature of the EPA's Final Rule weakening the GHG standards.

v. Supplemental Comment of Environmental Defense Fund, Environmental Law & Policy Center, Natural Resources Defense Council, and Sierra Club, dated July 18, 2019 (Docket #EPA-HQ-OAR-2018-0283-7587, #NHTSA-2018-0067-12432, #NHTSA-2017-0069-0720) ("Energy and Commerce Hearing Comment")

This comment argued that relevant information that emerged during the June 20, 2019 hearing of the House of Representatives Committee on Energy and Commerce titled "Driving in Reverse: The Administration's Rollback of Fuel Economy and Clean Car Standards" demonstrated that the proposed rule suffered unlawful procedural and substantive flaws. Specifically, the comment observed:

(1) that former EPA assistant administrator William Wehrum admitted that he and EPA administrator Andrew Wheeler were briefed by EPA staff about flaws in the proposed rule, and had received a memo about those flaws, but unlawfully refused to make that memo public despite requests from congressional leaders and advocacy organizations;

(2) that Mr. Wehrum stated that the regulatory impact analysis supporting the proposed rule is "a document drafted by NHTSA and not by EPA," making clear that EPA failed to conduct its own analysis, and instead unlawfully delegated its duty to NHTSA, demonstrating that EPA must withdraw the proposed rule;

(3) that the Alliance of Automobile Manufacturers' interim CEO, David Schwietert, stated that automakers did not support the proposed rule, indicating yet again that the proposed rule was deeply harmful and unlawfully disregards the rollback's destructive consequences;

(4) that NHTSA's deputy administrator, Heidi King, wrongly stated that the proposed rule would have "no noticeable impact to net emissions of smog-forming or other criteria pollutants" and that "there is very, very little climate impact associated with this rulemaking." Because these statements were contrary to the agencies' own analysis which projected a dramatic increase in pollution from the proposed rule,

the supplemental comment argued that Ms. King's erroneous presentation of basic facts of the administration's proposal is a further example that the administration's reasoning underlying the rollback is arbitrary and capricious; and

(5) that Mr. Wehrum and Ms. King stated that their agencies had not made final decisions about the rule, demonstrating that supplemental comments that had been submitted must be properly considered as part of the agencies' rulemaking.[559]

The agencies unlawfully failed to mention, cite, or respond to this comment or recognize these unlawful procedural errors in the Final Rule.

vi. Supplemental Comment of Environmental Defense Fund Regarding EPA's Unlawful Failure to Disclose Meetings Between Agency Officials and Industry, dated August 7, 2019 (Docket #NHTSA-2018-0067-12435, #NHTSA-2017-0069-0721, #EPA-HQ-OAR-2018-0283-7592, #EPA-HQ-OAR-2018-0283-7597) ("EDF Comment on Undisclosed Meetings")

This supplemental comment raised the failure of EPA to disclose multiple meetings between senior agency officials and industry representatives related to the Proposed Rule. The comment notes, in particular, that "former EPA Assistant Administrator William Wehrum participated in meetings with the Alliance of Automobile Manufacturers—his former client—during the time that EPA was finalizing its Revised Final Determination for the Mid-Term Evaluation of the Clean Car Standards, and preparing its Proposed Rule to significantly weaken the Clean Car Standards."[560] The supplemental comment provides a list of the undisclosed meetings, which includes the date of the meeting and additional details.[561] EDF called on EPA to "immediately publicly disclose the details of all meetings between Mr. Wehrum and the Alliance and to add those records to the docket for the Proposed Rule" and "release any documents or other records that were exchanged during, or created as a result of, those meetings."[562] This supplemental comment was submitted after the close of the comment period because the meetings were brought to EDF's attention by a congressional report that was released in July 2019. The agencies unlawfully failed to respond to this supplemental comment or to the procedural violations it highlighted in the Final Rule.

vii. Supplemental Comment of Environmental Defense Fund, dated September 11, 2019 (Docket #NHTSA-2017-0069-0726) ("Pretext Comment")

This comment submitted evidence demonstrating that the rationales for the agencies' proposal to preempt California's standards and to weaken the federal standards were pretextual. Specifically, the comment noted that the directive from the White House to reconsider the standards came well before any reasoned assessments of the current standards could have been undertaken and that President Trump had reflexively and publicly attacked automakers and California for working together toward more stringent standards than were in the Proposal. The

[559] Energy and Commerce Hearing Comment at 2-4.
[560] EDF Comment on Undisclosed Meetings at 1.
[561] *Id*. at 2-3.
[562] *Id*. at 1.

Pretext Comment explained that a pretextual decision-making process cannot satisfy the reasoned decision-making requirements of federal administrative law.

In the Final Rule, the agencies unlawfully ignore this comment and the evidence of pretext cited therein.

viii. Supplemental Comment of Center for Biological Diversity, et. al., regarding January 22, 2020 Letter from Senator Thomas Carper to the Office of Information and Regulatory Affairs, dated January 31, 2020 (Docket #EPA-HQ-OAR-2018-0283-7637) ("Carper Letter Comment")

This supplemental comment discusses a January 22, 2020 letter from Senator Thomas Carper to the administrator of the Office of Information and Regulatory Affairs in the White House Office of Management and Budget. The supplemental comment observes that Senator Carper's letter described that "the draft final rule appears not to have remedied many of the[] deficiencies" in the August 2018 Proposed Rule and that "some of the changes that were made since the rule was proposed have created additional problems."[563] The comment argues that "the public lacks the information needed to comment further on any 'additional problems' that may have been created by significant 'changes that were made since the rule was proposed.'"[564] And the supplemental comment argues that "[t]o the extent such changes have been made, the agencies cannot finalize a substantially different rule without allowing the public a further opportunity to comment meaningfully;" and that "[t]he agencies thus must re-propose the significantly different rule and re-open the public-comment period so that the public can review and comment on the new approach and its asserted basis, to ensure that the agencies' policies rest on sound legal and technical foundations."[565]

The supplemental comment was submitted after the close of the comment period because Senator Carper's letter was sent to the agencies and publicly disclosed in January 2020. And the comment alerted the agencies to the procedural requirements that applied were the final rule to differ substantially from the proposal. Now that the Final Rule has been published, it is evident that the Final Rule *does* differ substantially from the Proposal – both in the level of stringency of the adopted standards, in the agencies' justifications for rolling back the previous fuel economy and GHG standards, and in the agencies' analytical methodologies underpinning its analysis. Nevertheless, the agencies unlawfully failed to even acknowledge, cite, or respond to this supplemental comment or the procedural errors it highlighted in the Final Rule.

ix. Supplemental Comment of Environmental Defense Fund Regarding Recently Published News Articles, dated February 25, 2020 (Docket #NHTSA-2017-0069-0735, #NHTSA-2018-0067-12454) ("Articles Comment")

[563] Carper Letter Comment at 2.
[564] *Id*.
[565] *Id*.

This supplemental comment explained that two news articles, one published in the New York Times on February 13, 2020, and one published in the Atlantic on February 12, 2020, further highlight that the rulemaking "suffer[ed] from severe procedural and substantive flaws."

The letter observed that the New York Times article, "Trump's Path to Weaker Fuel Efficiency Rules May Lead to a Dead End," described the draft final rule that was sent to the Office of Management and Budget for review as "'Swiss cheese,' sprinkled with glaring numerical and spelling errors (such as 'Massachusettes'), with 111 sections marked 'text forthcoming.'" The article further reported that the accompanying "cost-benefit analysis showed that consumers would lose more money than they would gain," that EPA was being shut out of development of the final rule, and that the draft rule "lacks the detailed technical analyses required by law," such that "the regulations would be unlikely to withstand court challenges."

The Articles Comment also observed that the Atlantic article "highlighted major procedural and substantive flaws in the ongoing rulemaking, detailing how EPA input was shut out of development of the Proposal—contributing to the deep flaws in its underlying analysis." And the comment observed that the article "noted more recent indications that the draft final rule concludes that rolling back federal clean car standards will ultimately result in net costs of tens of billions of dollars."

Along with the articles themselves, EDF also submitted materials referenced in the Atlantic article that were released in response to a Freedom of Information Act request.

The Articles Comment was submitted after the close of the comment period because the articles were published in February 2020. And the comment demonstrates that the agencies' rulemaking process was rife with unlawful procedural flaws and substantive flaws that must be remedied before any final rule could be issued. Yet the agencies unlawfully failed to acknowledge, cite, or respond to this supplemental comment or the procedural errors it identifies in the Final Rule.

x. Supplemental Comment of Environmental Defense Fund regarding February 26, 2020 Letter from Senator Thomas Carper to the EPA Inspector General, dated March 9, 2020 (Docket #EPA-HQ-OAR-2018-0283-7652) ("Carper IG Request Comment")

This supplemental comment discusses a February 26, 2020 letter from Senator Thomas Carper to the Environmental Protection Agency Inspector General. The comment observes that Senator Carper's letter "requests that the Environmental Protection Agency (EPA) Inspector General open an investigation into a range of different on-going procedural and substantive irregularities associated with this rulemaking that indicate that the greenhouse gas standards and the process by which they are being developed violate applicable law including the Clean Air Act."[566] The comment observes that the letter "details reports that the Department of Transportation alone drafted the 'joint' draft final rule and the analysis developed to support it, without EPA staff even having access to the content until it was submitted to the White House Office of Information and Regulatory Affairs, without EPA staff perspectives and expert

[566] Carper IG Request Comment at 1-2.

technical views being included or responded to as the joint rule was developed, and without any EPA authorship of its own GHG regulations."[567] Further, the comment described that the "letter notes that [the] agencies have not followed standard procedures for transmitting comments on a draft rule under inter-agency review, in a manner that suggests an effort to evade eventual public release of critical feedback."[568] In light of the unlawful procedural and substantive deficiencies highlighted in the letter, the supplemental comment called on the agencies "to withdraw the Proposed Rule and cease efforts to roll back the highly beneficial, extensively supported existing clean car standards."[569]

The comment was submitted after the close of the comment period because Senator Carper's letter was sent to the Inspector General and publicly disclosed in February 2020. And, as described above, the comment alerted the agencies to serious and unlawful procedural violations in the rulemaking process. Nevertheless, the agencies unlawfully failed to acknowledge, cite, or respond to the supplemental comment in the Final Rule.

F. Comments discussing the impact of the fuel economy and GHG emissions standards on the economy and jobs

i. Supplemental Comment of Blue Green Alliance, dated August 27, 2019 (Docket #NHTSA-2018-0067-12440) ("BGA Comment")

This comment submits to the docket and describes a report published after the close of the formal comment period titled "Tech@Risk: The Domestic Innovation, Technology Deployment, Manufacturing, and Jobs at Risk in Stepping Away from Global Leadership on Clean Cars," released on August 1, 2019. The comment describes that the report "shows the administration's proposal to greatly weaken augural/existing fuel economy and greenhouse gas standards would dramatically slow adoption of advanced technologies in almost every vehicle subsystem, and cut demand for products made by hundreds of manufacturers and hundreds of thousands of workers all across the country."[570] In addition, the report finds that "between 89,000 and 202,000 of tomorrow's jobs could be lost or foregone as a result of the proposed rollback of existing Clean Car Standards."[571]

The agencies unlawfully failed to consider or respond to this comment or the findings of the report in the Final Rule.

G. Comments regarding the consumer impacts of the fuel economy and GHG emissions, as well as related economic issues

i. Supplemental Comment of the California Air Resources Board, dated December 19, 2018 (#EPA-HQ-OAR-2018-0283-7449) ("CARB Procedural Deficiencies and NERA Economics Comment")

[567] *Id*. at 2.
[568] *Id*.
[569] *Id*.
[570] BGA Comment at 1-2.
[571] *Id*. at 2.

CARB raised numerous issues with an analysis of the Proposed Rule conducted by NERA Economic Consulting and Trinity Consultants ("NERA/Trinity") on behalf of the Auto Alliance that had been previously submitted to the Proposed Rule docket. While the agencies do not rely on the NERA/Trinity analysis in the Final Rule, several of CARB's comments in this letter are relevant to the agencies' analysis. CARB objected to numerous elements of NERA/Trinity's analysis, including problems with the sales and scrappage models included in the analysis, the VMT projections, and the assumed rebound effect. In particular, CARB noted that the elasticities of both the sales and scrappage models appeared too high (based on the limited information available) and identified problems with the use of a -1.0 elasticity for new vehicle sales. CARB also identified problems with the inclusion of only 60-months of fuel savings in the cost-benefit analysis and described why this was not a reasonable or justified limitation; several of these flaws are discussed in more detail above in the section titled, "The Agencies' New 'Implicit Opportunity Cost' Assessment is Baseless, as is Their Focus on 'Upfront Costs.'" CARB included a report by Ken Gillingham, Associate Professor of Economics at Yale University, that provided additional detail on the flaws with NERA/Trinity's analysis.

The agencies arbitrarily and unlawfully fail to acknowledge or respond to this comment in the Final Rule.

ii. NGO Comment on procedural deficiencies and NERA/Trinity analysis, dated December 20, 2018 (Docket #NHTSA-2018-0067-12371, #EPA-HQ-OAR-2018-0283-7443) ("NGO Procedural Deficiencies and NERA/Trinity Economics Comment")

The NGO's raised numerous issues with the analysis of the Proposed Rule conducted by NERA/Trinity on behalf of the Auto Alliance that had been previously submitted to the Proposed Rule docket. While the agencies do not rely on the NERA/Trinity analysis in the Final Rule, several of the NGOs' comments in this letter are relevant to the agencies' analysis. In particular, the NGOs describe the flaws in using a -1.0 elasticity for new vehicle sales, as well as with NERA/Trinity's approach of undervaluing the fuel savings that consumers receive as a result of fuel economy improvements. These are discussed in more detail above in the section titled, "The Agencies' New 'Implicit Opportunity Cost' Assessment is Baseless, as is Their Focus on 'Upfront Costs.'"

The agencies arbitrarily and unlawfully fail to acknowledge or respond to these points from this comment in the Final Rule.[572]

iii. Comment of the Institute for Policy Integrity on NERA/Trinity analysis, dated December 21, 2018 (Docket #NHTSA-2018-0067-12362) ("Policy Integrity NERA Comment")

In this comment, Policy Integrity raises several issues with the analysis conducted by NERA/Trinity on behalf of the Auto Alliance that had been previously submitted to the Proposed

[572] The agencies did discuss some of the procedural issues raised in this comment, as noted above in the section on "Comments identifying procedural errors in the rulemaking process."

Rule docket. While the agencies do not rely on the NERA/Trinity analysis in the Final Rule, several of Policy Integrity's comments in this letter are relevant to the agencies' analysis. In particular, Policy Integrity describes the flaws with NERA/Trinity's approach of undervaluing the fuel savings that consumers receive as a result of fuel economy improvements. These are discussed in more detail above in the section titled, "The Agencies' New 'Implicit Opportunity Cost' Assessment is Baseless, as is Their Focus on 'Upfront Costs.'"

The agencies arbitrarily and unlawfully fail to acknowledge or respond to these points from this comment in the Final Rule.[573]

iv. Comment of Dr. Kenneth Gillingham on NERA's response regarding the NERA/Trinity analysis, dated May 25, 2019 (Docket #NHTSA-2018-0067-12403, #EPA-HQ-OAR-2018-0283-7568) ("Gillingham NERA Responsive Comment")

In this comment, Dr. Gillingham discusses problems with NERA's response to the comments from CARB (which included a report from Dr. Gillingham), several NGOs, and Policy Integrity noted above regarding flaws in the NERA/Trinity analysis. While the agencies do not rely on the NERA/Trinity analysis in the Final Rule, several of Gillingham's comments in this letter are relevant to the agencies' analysis. In particular, Gillingham again points out flaws in using a -1.0 elasticity for new vehicle sales and notes that the paper that NERA provided to support that elasticity "actually used a price elasticity that is one-third the magnitude of the value that NERA is attempting to justify and explicitly rejected using a price elasticity of -1.0." Gillingham NERA Responsive Comment at 7. Gillingham also points out continued flaws with NERA's rebound effect estimate, *see id*. at 12-14, as well as NERA's failure to meaningfully respond to the problems identified with their failure to fully count the fuel savings that consumers receive as a result of fuel economy improvements, *see id*. at 14-16.

The agencies arbitrarily and unlawfully fail to acknowledge or respond to this comment in the Final Rule.[574]

v. Comment of the Institute for Policy Integrity on NERA's response regarding the NERA/Trinity analysis, dated May 31, 2019 (Docket #NHTSA-2018-

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[573] The agencies do cite this comment in a discussion of their use of footprint-based fuel economy and GHG emissions standards. *See* 85 Fed. Reg. at 24,249 nn.236,237; *id*. at 24,250 nn.242,243; *id*. at 24,255 n.261. However, all of the statements the agencies cite were from Policy Integrity's February 2012 comments on the original 2011 proposed rule for the MY2017-2025 standards. Policy Integrity attached those 2012 comments to its December 21, 2018 comments, but for a point unrelated to the agencies' use of footprint-based standards. *See* Policy Integrity NERA Comment at 2 n.9 (noting that "NERA/Trinity rely on the same VOLPE model that overstates the costs of the standards").

[574] The agencies cite this comment in a discussion of the rebound effect. See 85 Fed. Reg. at 24,672, nn.1750,1753. However, from the page numbers cited, it appears that the agencies are actually citing Dr. Gillingham's comments regarding the rebound effect submitted on October 24, 2018 (available at https://ww2.arb.ca.gov/sites/default/files/2020-04/10_24_2018_gillingham_yale_rebound_effect_ac_0.pdf; *see* Docket #EPA-HQ-OAR-2018-0283-5842). The citations in the Final Rule are to pp. 16-30 and to Table 2 at p. 24 of the cited comment; however, the Gillingham NERA Responsive Comment is only 16 pages long, while Gillingham's October 24, 2018 comment is 40 pages long and has a Table 2 on p. 24 that is consistent with the agencies' description of it in the Final Rule.

0067-12407, #NHTSA-2018-0067-12410, #EPA-HQ-OAR-2018-0283-7564) ("Policy Integrity NERA Responsive Comment")

In this comment, Policy Integrity discusses problems with NERA's response to the comments from CARB (which included a report from Dr. Gillingham), several NGOs, and Policy Integrity noted above regarding flaws in the NERA/Trinity analysis. While the agencies do not rely on the NERA/Trinity analysis in the Final Rule, several of Policy Integrity's comments in this letter are relevant to the agencies' analysis. These include flaws with NERA's rebound effect estimate, *see* Policy Integrity NERA Response Comment at 8-10, as well as NERA's failure to meaningfully respond to the problems identified with their failure to fully count the fuel savings that consumers receive as a result of fuel economy improvements, *see id*. at 11-24.

The agencies arbitrarily and unlawfully fail to acknowledge or respond to these points from this comment in the Final Rule.

vi. Supplemental Comment of Consumer Reports, dated February 27, 2019 (Docket #NHTSA-2018-0067-12374) ("CR Comment")

This comment responded to the Alliance of Automobile Manufacturers' critique of a study submitted to the dockets entitled "Auto Buyers' Valuation of Fuel Economy: A Randomized Stated Choice Experiment."[575] Specifically, the comment described that the study was conducted using sound research methodology and a representative sample of participants, and that the overall relative findings of the study are both valid and useful.[576] The comment then provided detailed, point-by-point responses to the Alliance of Automobile Manufacturers.

In the Final Rule, the agencies did not acknowledge or discuss this comment nor the underlying study that Consumers Reports had submitted to the docket. That failure is arbitrary and unlawful.

vii. Supplemental Comment of Consumer Reports, docketed August 23, 2019 (Docket #NHTSA-2018-0067-12437)

The agencies justify the Final Rule in part by emphasizing the costs to consumers of the existing standards. This comment speaks directly to the issue of consumer costs by submitting a study entitled "The Un-SAFE Rule: How a Fuel Economy Rollback Costs Americans Billions in Fuel Savings and Does Not Improve Safety." That study evaluated the effects of the Proposal using a total-cost-of-ownership model to evaluate the economic effects of standards ranging in stringency and a simplified safety model to evaluate the safety effects in each scenario. The study found significant negative impacts on consumers from the Proposal, including that the rollback would cost buyers who finance their vehicle more in monthly costs starting from the first month they own their vehicle. And it found that the rollback would dramatically increase fuel consumption and GHG emissions while harming the auto industry and decreasing sales and causing no improvement in auto safety.

[575] CR Comment at 1.
[576] *Id*.

The agencies arbitrarily and unlawfully fail to acknowledge or respond to this comment in the Final Rule.

H. Comments regarding the CAFE Model Peer Review Update

i. Supplemental Comment of Center for Biological Diversity, et al., dated August 23, 2019 (Docket #NHTSA-2018-0067-12439, #EPA-HQ-OAR-2018-0283-7593, #EPA-HQ-OAR-2018-0283-7596) ("NGO Peer Review Substance Comment")

This letter addresses NHTSA's post-Proposal July 2019 update of the peer review for the CAFE model, originally conducted in July 2017. The update added the findings of a peer review of the sales and scrappage models used prominently in the Proposed Rule.

The letter states that, "[s]ubstantively, the peer review strongly reinforces the commenters' criticisms of the major flaws with the scrappage and sales models, flaws which severely undermine the validity of their projections and reliance on those projections in this rulemaking." NGO Peer Review Substance Comment at 4. These included the models being too closely "fit" to historical data but unable to reliably predict future effects; the omission of numerous key variables in models that should directly affect the impacts being estimated; and the models operating in ways that directly contradicted the agencies' statements regarding how they should operate.

In addition, the letter notes how the reviewers pointed out (as commenters had previously) that the sales and scrappage models led to implausible results—in particular that the assumptions in the agencies' modeling should have led to an increase in the size of the vehicle fleet under the proposed standards, but they instead led to a decrease in the fleet size. The letter further states:

> the reviewers' comments make clear that simply increasing elasticity of demand for new cars to secure similar scrappage results while eliminating the current model's implausible effects of changes in new vehicle prices on scrappage rates of existing vehicles would not be an acceptable approach. [John] Graham [one of the peer reviewers] notes that a new car sales elasticity of -1 "does not have a solid grounding in economic evidence," and based on the relevant literature it is likely "well below" that level.

Id. at 18-19. Yet despite these explicit warnings, this appears to be exactly what the agencies have done in the Final Rule, by employing an elasticity for new vehicle sales of -1.0 (among other flaws with the new sales modeling approach, as discussed elsewhere in this petition), while continuing to rely on a deeply flawed scrappage model. While the agencies made some changes to the scrappage model in response to the flaws identified by the peer reviewers and commenters, the scrappage model in the Final Rule still contains many of those same flaws.

The agencies do not respond to this comment except to note that the comment, like others, points out that certain elements of the CAFE model were not previously subject to peer review,

85 Fed. Reg. at 25,157, n.2836, and to cite this letter in attempting to minimize their peer review failures by claiming to have "continued to receive comments on the new peer review materials, which they have considered in issuing this final rule, *id*. at n.2846. However, the agencies' decision to use a -1.0 elasticity of demand for the new vehicle sales model in the Final Rule, without discussing this comment in any way, is clear evidence to the contrary. The agencies' asserted defenses regarding its peer review failures are insufficient, as discussed in more detail below with respect to the NGO Peer Review Procedural Comment. And the agencies' failure to address the other elements of this letter is arbitrary and unlawful in light of the significant issues this comment raises that are of central relevance to the rulemaking.

ii. Supplemental Comment of Environment America, et al., dated August 27, 2019 (Docket #NHTSA-2018-0067-12441, #EPA-HQ-OAR-2018-0283-7609) ("NGO Peer Review Procedural Comment")

This supplemental comment informs the agencies that their "dissemination in the Proposed Rule of unreviewed, novel sales and scrappage modules, as well as the analysis based on these modules, remains in clear violation of the Information Quality Act and implementing regulations and policies—notwithstanding a July 2019 post-hoc peer review of these two modules conducted by reviewers under NHTSA's direction." NGO Peer Review Procedural Comment at 1-2. The comment states that, in light of these errors, "[t]he agencies must withdraw these modules, related analysis, and the proposal to weaken existing vehicle greenhouse gas emission ("GHG") and fuel economy standards." *Id*. at 2. The procedural errors discussed in the comment were "so serious and related to matters of such central relevance to the rule that there is a substantial likelihood that the rule would have been significantly changed if such errors had not been made." *See* 42 U.S.C. § 7607(d)(8).

The agencies responded to this supplemental comment (and others like it) by stating that they disagree with any suggestion that the Information Quality Act ("IQA") required a full peer review of all aspects of the CAFE model prior to the Proposal. 85 Fed. Reg. 25,157. However, while NHTSA had the new sales and scrappage models peer reviewed following the close of the public comment period, it still did not have other new models the agencies relied upon peer reviewed, including the dynamic fleet share model and the fatality rate model, as noted in comments submitted during the comment period.

In addition, NHTSA's post-hoc peer review of the sales and scrappage model was procedurally flawed in consequential ways. In addition to being conducted only after the rule was proposed, the agencies denied the public any ability to participate in the peer review process. This violates provisions of OMB's Peer Review Bulletin and EPA's Peer Review Handbook, which specify the right to public participation in all phases of the peer review process, such rights, including, inter alia, the right to comment on the peer review plan, the choice of peer reviewers, and the charge questions to the peer reviewers. Opportunity is also to be provided for the public to submit oral and written comment to the peer reviewers themselves. NGO Peer Review Procedural Comment at 5-6. Exercise of these procedural rights was consequential, since comment could have materially influenced the peer review process and the ultimate substance of the peer review. The agencies did not address this point from the NGO Peer

Review Procedural Comment. The agencies' failure to do so is arbitrary and unlawful in light of the significant issues and procedural failings that are of central relevance to the rulemaking.

As also described in the comment, because the peer review of the sales and scrappage models were conducted after the dissemination of the Proposed Rule and the close of the formal comment period, the public was "deprived of the opportunity to consider and debate a reasonable proposal, versus the critically flawed Proposed Rule." NGO Peer Review Procedural Comment at 7. Moreover, the agencies' unexplained "disagree[ment]" that "the Information Quality Act required a full peer review of all aspects of the CAFE model prior to the proposal" is an ipse dixit. As both OMB's Peer Review Bulletin and EPA's Peer Review Handbook make clear, pre-proposal peer review is essential. These failures are centrally relevant to the rulemaking and demonstrate the arbitrary and unlawful nature of the Proposed and Final Rules.

The agencies also stated that the IQA itself does not create a cause of action. 85 Fed. Reg. at 25,157. Although this is correct, there is recent case law that a claim under Administrative Procedure Act section 706(a)(2) can lie where the claim relates to violations of a statutory provision even where that statute itself does not provide a cause of action. *Union of Concerned Scientists v. Wheeler*, 954 F. 3d 11, 20 (1st Cir. 2020) (cause of action under APA section 706(a)(2) for violation of Federal Advisory Committee Act can exist even though Federal Advisory Committee Act itself does not provide a cause of action). Moreover, agency rules and policies implementing such a statute, like the OMB Guidelines and EPA Peer Review Handbook, can create "judicially manageable standards" for ascertaining whether the agency's actions were arbitrary and capricious. *Physicians for Soc. Responsibility v. Wheeler*, 956 F.3d 634, 643 (D.C. Cir. 2020) (quotation and citation omitted). Since these cases were decided after the period for public comment, Petitioners could not have raised them previously to the agencies. The cases are of central relevance here given that they call into question the agencies' apparent premise that its violations of the IQA are not subject to judicial review.

I. Comments regarding the EPA's Science Advisory Board's review of the Proposed Rule and the agencies' modeling and analysis

i. Supplemental Comment of the Center for Biological Diversity, et. al., dated January 22, 2020 (Docket #NHTSA-2018-0067-12452) ("NGO SAB Draft Report Comment")

This comment was in response to the EPA Science Advisory Board (SAB) Draft Report, "Consideration of Scientific and Technical Basis of the EPA's Proposed Rule Titled The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks" (SAB Draft Report). The comment "highlighted the analytic flaws in the Proposed Rule raised by the SAB and others, as well as the procedural deficiencies shown by EPA's delay of and response to the SAB's review."[577] Specifically, the report summarized the SAB's findings, which addressed only a portion of the flaws in the analysis supporting the Proposed Rule, as the SAB Draft Report acknowledged.[578] The comment also summarized technical comments submitted by several of the letter's signatories and other experts to the

[577] NGO SAB Draft Report Comment at 2.
[578] *Id*.

SAB,[579] and discussed the serious procedural deficiencies related to the EPA's handling of the SAB's review.[580] The comment letter explained that the agencies must withdraw the proposal in light of these and other serious deficiencies, and that "[i]f the agencies move ahead to make any changes to the clean car standards for model years 2021-2026, they must issue a new proposal, along with an updated preliminary regulatory impact analysis that fully addresses the issues raised by the SAB, and provide the public with an opportunity to comment on the updated analysis."[581]

In the Final Rule, the agencies have unlawfully failed to acknowledge or respond to this comment.

ii. Supplemental Comment of the Center for Biological Diversity, et. al., dated March 26, 2020 (Docket #EPA-HQ-OAR-2018-0283-7655) ("NGO SAB Final Report Comment")

This comment discusses the SAB's final report, "Consideration of Scientific and Technical Basis of the EPA's Proposed Rule Titled The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks" (SAB Final Report). The comment describes that, like the SAB Draft Report, the SAB Final Report recognizes and describes analytic flaws in the Proposed Rule. And, like the SAB Draft Report, the SAB Final Report finds that collectively these analytic weaknesses "are of sufficient magnitude that the estimated net benefit of the proposed revision may be substantially overstated," and could even reverse the result of the Proposed Rule's cost-benefit analysis, indicating that "the standards in the 2012 rule might provide a better outcome for society than the proposed revision."

The comment incorporated and reiterated as to the SAB Final Report the NGO SAB Draft Report Comment, including that comment's discussion of EPA's procedural errors in unlawfully impeding and delaying both the SAB's review of the Proposed Rule and the release of the SAB Draft Report, and in announcing that EPA did not intend to consider or address the SAB's analysis in its final rule. In addition, the SAB made several revisions to its report between the draft and final versions that further highlight the fundamental flaws in the agencies' analysis underpinning the Proposed Rule, and the comment highlighted several of these revisions.

In light of the serious deficiencies raised in the SAB Final Report, the comment explained that the agencies must withdraw the Proposed Rule, and—before moving forward with any changes to the standards for model years 2021-2026—issue a new proposal along with an updated analysis that relies on methodologies that are based on rigorous research and are properly subject to public comment and expert peer review before they are used as a basis for decision-making. Given the significant changes to the technical analysis required to address the problems raised by the SAB Final Report and other commenters, the commenters respectfully submitted that finalizing the rule without taking these steps would be unlawful.

[579] *Id*. at 2-6.
[580] *Id*. at 6-9.
[581] *Id*.

In the Final Rule, the agencies acknowledge the SAB Final Report. However, they unlawfully fail to acknowledge or respond to the NGO SAB Final Report Comment or to the substantive or procedural issues it raised as-distinct from the SAB Final Report. The agencies' failure to respond to the NGO SAB Final Report Comment is unlawful and arbitrary.

iii. Comment of the Institute for Policy Integrity, dated March 25, 2020 (Docket #EPA-HQ-OAR-2018-0283-7656) ("Policy Integrity SAB Comment")

This comment submitted to the docket comments that the Institute for Policy Integrity had submitted to the SAB on the SAB Draft Report. As the comment described, "Policy Integrity's comments . . . provided supplementary information to reinforce many of the key conclusions presented in the draft report, but also encouraged the SAB to reconsider its discussion of the social cost of carbon."[582] And, as described in the comment, "[t]he conclusions and analysis in the Final SAB Report are generally consistent with the conclusions and analysis presented in the [SAB] draft report. As a result, Policy Integrity's comments on the draft report provide important information for the agencies to consider in any final rule that relies on the same or similar scientific or technical basis as the Proposed Rule."[583]

Specifically, Policy Integrity provided detailed comments regarding the cost of compliance, fleet size and composition, fleet utilization, and handling of uncertainty.[584]

In the Final Rule, the agencies unlawfully fail to acknowledge, consider, or respond to the Policy Integrity SAB Comment.

[582] Policy Integrity SAB Comment at 1-2.
[583] *Id*. at 2.
[584] *Id*., Attachment A at 1-12.