By Electronic Submission to Dr. Thomas Armitage, armitage.thomas@epa.gov, Designated Federal Officer for the EPA Science Advisory Board

EPA Science Advisory Board
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Date: January 10, 2020

Re: Comments for the EPA Science Advisory Board Jan. 22, 2020 Teleconference

Dear Science Advisory Board members,

American Council for an Energy-Efficient Economy, Center for Biological Diversity, Chesapeake Bay Foundation, Conservation Law Foundation, Environment America, Environmental Defense Fund, Environmental Law & Policy Center, Natural Resources Defense Council, Public Citizen, Inc., Safe Climate Campaign, Sierra Club, and Union of Concerned Scientists provide the below comments on the Science Advisory Board ("SAB") draft report ("SAB Draft Report")[1] on the scientific and technical basis of the Environmental Protection Agency's ("EPA's") Proposed Rule titled "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks" ("Proposed Rule").[2]

The SAB Draft Report highlights that "[g]iven limited available time" the SAB review focused only on areas of the analysis "where there appear to be significant weaknesses" in the analysis underpinning the Proposed Rule.[3] We note that the scientific and technical basis for the Proposed Rule includes a range of additional, foundational flaws that the SAB Draft Report does not address but that have been raised in public comments and analysis. Specifically, we urge the SAB to at a minimum note some of the additional critical issues with the Proposed Rule, outlined below, in its final report, to avoid creating the misperception that the issues discussed in the SAB Draft Report are the only analytical problems that must be addressed to put any final action on the Proposed Rule on a solid foundation.

Further, given the extensive, foundational changes necessary to address concerns identified by the SAB and public comments, a reproposal with opportunity for public comment and expert review would be required before the administration could proceed to finalize the SAFE rulemaking—particularly to the extent that the agencies employ wholly novel approaches or

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[1] SAB, Science Advisory Board (SAB) Consideration of the 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 (Dated Oct. 16, 2020), available at https://yosemite.epa.gov/sab/sabproduct.nsf/WebBOARD/3BD8A1AEA4943223852584E1005463DE/$File/SAFE+SAB+Draft+Review_10_16_19_.pdf.
[2] 83 Fed. Reg. 42,986 (Aug. 24, 2018).
[3] SAB Draft Report at 1.

assumptions in their revised analysis. Indeed, the SAB Draft Report provides a powerful illustration of the poor analysis that results when agencies fail to rely on robust research and analytical tools, and shortchange public and expert input, as has been the case throughout the SAFE rulemaking.[4] In fact, the SAB Draft Report highlights that "the weaknesses [in the Proposed Rule] are sufficiently important that they could reverse the sign of the result [of the cost-benefit analysis], indicating that the [existing] standards provide a better outcome than the proposed revision."[5] The SAB Draft Report's troubling findings underscore the importance of relying on methodologies that are based on rigorous research and that are properly subject to public comment and expert peer review before their use as a basis for decision-making—particularly in the case of significant policy decisions like the Proposed Rule's recommendation to dramatically weaken EPA's existing greenhouse gas (GHG) standards. We ask the SAB to strongly urge EPA to ensure that any new analytical approaches deployed in any final action on the Proposed Rule are based on established, rigorous science and have been subject to public comment and expert review before being used to justify a policy action.

I. Modeling Approach

The SAB Draft Report notes that EPA has historically utilized its own modeling tools (including in particular EPA's Advanced Light-duty Powertrain and Hybrid Analysis (ALPHA) model and Optimization Model for Reducing Emissions of Greenhouse Gases from Automobiles (OMEGA)) to project technology effectiveness values, technology penetration values, and costs for manufacturers to comply with any given GHG emissions standards through available, cost-effective pathways.[6] The SAB Draft Report also observes that EPA reversed course in the Proposed Rule and—rather than using its own, rigorously developed modeling tools—relied on "only Autonomie and a 2018 version of the CAFE [Corporate Average Fuel Economy] Model" to project technology effectiveness and penetration values and calculate costs to comply with existing and hypothetical GHG emissions standards.[7] EPA did not provide an adequate justification for its decision to abandon its own modeling tools in the analysis underpinning the Proposed Rule.[8] That omission is especially troubling given that the CAFE model was not designed to model EPA's GHG program, but rather the National Highway Traffic Safety Administration's ("NHTSA's") CAFE program, which has different statutory goals, requirements, and constraints. Thus, the model is still wired to impose certain of NHTSA's constraints on EPA's program, even though they do not apply.[9]

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[4] *See, e.g.*, Comment of the Center for Biological Diversity, et al., Docket ID# EPA-HQ-OAR-2018-0283-5070, corrected version at NHTSA-2018-0067-12368, at 189-212 (discussing agencies' failures to conduct a thorough peer review, to timely notify the SAB of the Proposed Rule, to make critical materials available for public comment, and to provide an adequate period for public comment).

[5] SAB Draft Report at 34.

[6] *Id.* at 5-6.

[7] *Id.* at 6.

[8] *See* Proposed Rule, 83 Fed. Reg. at 43,000-02 (describing the CAFE model but failing to give any valid justification for determining not to use the OMEGA model).

[9] *See* SAB Draft Report at 17-18 (noting that the CAFE model does not allow compliance credit trading, even though it is allowed in the GHG standards); Comment of the Union of Concerned Scientists, Docket ID# EPA-HQ-OAR-2018-0283-5840 ("UCS Comment"), at 31 (noting that CAFE model inappropriately

And EPA's choice is even more troubling given the significant problems with NHTSA's CAFE model. The SAB Draft Report describes several of these flaws, and there are numerous others that have been documented in public comments and NHTSA's own peer review of the CAFE Model. As described below, the CAFE Model's compliance cost modeling is fundamentally flawed, causing nonsensical technology application and grossly inflating compliance costs. In addition, the peer review of the CAFE Model's new sales and scrappage models (published 10 months after publication of the Proposed Rule) described basic structural errors in the development of those models and noted that the models' results were inconsistent with economic theory.[10] As the SAB notes, and has been shown elsewhere in the record, these flaws are not trivial. They fundamentally undermine the analytical basis for the Proposed Rule, including its cost-benefits analysis.

Recognizing some of the critical flaws in the CAFE model highlighted by both the peer review and other comments submitted to the rulemaking dockets, the SAB Draft Report states that, "[l]ooking to the future, the SAB recommends that the EPA consider several different analytical strategies."[11] Namely, the SAB Draft Report suggests three "options" for EPA: (1) EPA could return to using its own models and inputs, including ALPHA and OMEGA, to project compliance costs for its GHG emissions standards, while NHTSA uses the Autonomie and CAFE models to project compliance costs for its CAFE standards; (2) EPA could use the CAFE model to project compliance costs for GHG standards, but should work "more closely with NHTSA on the modeling structure and inputs employed in the [CAFE] model"; or (3) both agencies could use EPA's models to project compliance costs for both the GHG and CAFE standards, and "the agencies could work together to enhance EPA's modeling approaches."[12]

The undersigned respectfully submit that the SAB Draft Report's discussion of these three options omits certain key considerations. First, the SAB Draft Report appears to suggest EPA should make a "well-considered decision" on which model to use only for *"future . . .* GHG rulemakings."[13] But EPA is obligated to make a "well-considered decision" on which models to use in *this* rulemaking to most rigorously inform any actions it takes on the existing vehicle GHG emission standards. And EPA has fallen far short on this obligation. Again, EPA did not provide any valid justification for its decision to abandon its own models in the Proposed Rule.[14] And, as evidenced by the peer review of the NHTSA sales and scrappage models, as well as numerous other comments submitted to the rulemaking dockets, the NHTSA models have

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applies CAFE program fines to the GHG standards, even though the CAFE fines are not applicable to the GHG standards).

[10] CAFE Model Peer Review, DOT HS 812 590 (July 2019 (Revised)), Appendix B; *see also* Supplemental Comments of the Center for Biological Diversity, Environment America, Environmental Defense Fund, Environmental Law & Policy Center, Public Citizen, Inc., Sierra Club, and Union of Concerned Scientists, dated Aug. 23, 2019, Docket ID# EPA-HQ-OAR-2018-0283-7593, EPA-HQ-OAR-2018-0283-7596 ("NGO Peer Review Comment").

[11] SAB Draft Report at 9.

[12] *Id.*

[13] *Id.* (emphasis added).

[14] *See* Proposed Rule, 83 Fed. Reg. at 43,000-02.

fundamental flaws that undermine any validity of their results. Given those severe flaws, it is all the more egregious and unacceptable that EPA failed to explain or justify its decision not to use its own modeling tools in its analysis. In its final report, we urge the SAB to clarify that EPA must rely upon the most rigorous and appropriate modeling tools available to the agency in taking any final action on the existing vehicle GHG emission standards, and provide a robust, reasoned scientific explanation for its choice of modeling tools.

Second, the SAB notes that "[t]he second and third options make more sense if the contentious issues relate primarily to choice of model inputs; the first option makes more sense if differences in model structure need to be explored formally and compared," and concludes that "[a] well-considered decision on these options is recommended for future CAFE and GHG rulemakings."[15] But, as discussed above and below, the current modeling suffers from significant problems with *both* model structure and inputs. As such, it is clear that the only proper course is for EPA to return to its own models and model inputs.

And as to the SAB Draft Report's suggestion that EPA could continue using the CAFE model to project the impacts of GHG standards, but should work "more closely" with NHTSA, we note that EPA notified NHTSA of structural problems in the CAFE model during the rulemaking process, and sought revisions—yet NHTSA did not make changes to address those flaws in the Proposed Rule.[16] That EPA knew of many of the model's defects renders its decision to utilize it in the Proposed Rule all the more unreasonable.

EPA has decades of expertise in modeling emissions standards, and already has robust tools in ALPHA and OMEGA, expressly and intently designed to model the emissions impacts of GHG standards. Given the severe flaws in NHTSA's CAFE model, EPA cannot plausibly or permissibly rely on that model without fundamental revisions. In its final report, the SAB should clarify that without those wholesale revisions, EPA's only scientifically reasonable choice is to instead utilize its own, robust ALPHA and OMEGA models to project compliance costs for its GHG standards, and to allow for public and expert comment on that analysis. Further, we ask the SAB to demand the public release of the most up-to-date version of the ALPHA and OMEGA models, something EPA has always done in the past but has refused to do in this rulemaking, to enable stakeholders to evaluate compliance costs using these models.

II. Estimated Cost of Compliance

As the SAB Draft Report acknowledges, EPA projects significantly higher compliance costs in the Proposed Rule than it did in its 2016 analysis of the Model Year 2022-2025 GHG

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[15] SAB Draft Report at 9.

[16] *See, e.g.*, NGO Comment (corrected) at 18-25; Comment of the International Council on Clean Transportation, Docket ID# EPA-HQ-OAR-2018-0283-5456 ("ICCT Comment") at I-68; E.O. 12866 Review Materials for The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks NPRM, Docket ID# EPA-HQ-OAR-2018-0283-0453, File: "Email 5 - Email from William Charmley to Chandana Achanta - June 18, 2018" (June 18, 2018) ("Charmley Memo")..

standards.[17] This dramatic increase was caused in large part by modeling flaws. Although it may be "beyond the scope" of the SAB review to systematically catalogue all of the flaws causing this increase in compliance costs,[18] we wish to highlight for the SAB several of the most significant flaws that we have identified—flaws that go to both the model's operation, as well as the inputs to the model. These flaws wholly undermine the agencies' compliance cost modeling, and EPA cannot plausibly rely on the CAFE model's compliance cost projections without resolving them. We call on the SAB to highlight that to the extent their report does not incorporate these concerns, it is due to the SAB's lack of time to review this aspect of the proposal.

For example, the CAFE model's ranking algorithm is fundamentally flawed. In the real world, manufacturers will apply technologies based on their cost-effectiveness—that is, the amount of GHG reductions achieved for each dollar invested.[19] But the CAFE model does not rank technologies based on cost-effectiveness. Instead, the model ranks technologies by Effective Cost, which is a technology's costs less the fuel savings and avoided fines it will produce.[20] Therefore, the model will apply cheaper, ineffective or detrimental technologies before technologies that deliver greater emissions benefits but are more expensive. For example, a technology that costs $100 with zero benefits will have a lower "effective cost" than a technology that costs $200 and has $99 of benefits – meaning that the model will cause the manufacturer to choose the technology with no benefit based solely on its faulty algorithm.[21] Indeed, one comment highlighted that altering the CAFE model's ranking algorithm to rank according to "cost per ton" of GHG emissions resulted in substantially reduced costs for nearly every single manufacturer, with many large manufacturers seeing a 20 to 30 percent reduction in costs, and reduced costs for the industry as a whole by 15 percent.[22]

Comments to the docket demonstrated the model's irrationality by observing, for example, that Cooled Exhaust Gas Recirculation (CEGR) as-applied to turbocharged engines is modeled as having *zero* effectiveness at reducing emissions or improving fuel economy, yet the model applied that technology to 38% of the vehicle fleet, and counted its associated cost as a cost of compliance.[23] Thus, removing the technology from the model reduces compliance costs, but that should never be the case.[24] Restricting the pool of technology the model can apply should cause costs to go up (or have no effect). The only way costs can go down by eliminating

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[17] *See* SAB Draft Report at 10.
[18] *See id.*
[19] *See* UCS Comment at 28.
[20] *See* UCS Comment at 29; *see also* NHTSA, 2018 Draft CAFE Model Documentation (July 2018) ("Model Documentation") at 72-76, available at: https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system.
[21] *See* UCS comment at 28-34.
[22] *Id.* at 32.
[23] ICCT Comment at I-62 to 63; *see also* Comment of Meszler Engineering Services, "Technical Memorandum on The NPRM CAFE Model's Treatment of Technology Benefits and Costs," Docket ID# EPA-HQ-OAR-2018-0283-5838 ("Meszler Technical Comment") at 27-28; UCS Comment at 32-33; Comment of the California Air Resources Board (CARB), Docket ID# EPA-HQ-OAR-2018-0283-5054 ("CARB Comment") at 173.
[24] UCS Comment at 32-33; ICCT Comment at I-62 to I-63.

technology availability is if the model inexplicably selects more expensive, less cost-effective technologies, which is completely irrational behavior—and which is what the CAFE model does.[25]

Further, the agencies have applied numerous, unreasonable constraints on technology deployment in the CAFE model, yet the agencies provided no rational or scientific support for those constraints. For example, multiple viable technology combinations are disallowed in the CAFE model, despite already being deployed by automakers in real-world applications. For example, turbocharging and cylinder deactivation (DEAC) are treated as mutually exclusive by the model, as are High Compression Ratio Engines (HCR1) and DEAC.[26] But these combinations have been applied in the real world.[27] Similarly, CEGR is not available on naturally aspirated (NA) engines in the model, even though it has already been deployed on NA engines by automakers in the real world.[28] And the model artificially disallows HCR1 from 70 percent of the modeled fleet,[29] and disallows Advanced HCR engines (HCR2) from the entire fleet, notwithstanding that the agencies' own analyses show this technology to be highly cost-effective, and EPA's own experts concluding that the technology should be included in the modeling.[30] The agencies' own analysis shows that just allowing HCR2 as a compliance option across the entire fleet reduces per-vehicle compliance costs by over $610.[31]

The inputs to the CAFE model also suffer fundamental flaws. For example, the CAFE model uses as inputs the Autonomie model's calculations of effectiveness values for various technologies. But Autonomie produces demonstrably inaccurate projections of efficiency values for technologies,[32] such as CEGR[33] and stop-start systems.[34] Moreover, in their modeling the agencies have relied upon generally older and less applicable engine maps than the EPA data and modeling that underpinned the agency's 2016 Proposed Determination[35] and its 2017 Final Determination[36] that the existing model year 2022-2025 standards remained appropriate.[37] Again, EPA failed to use its own rigorous data and modeling tools in the Proposed Rule, instead relying on NHTSA's flawed data and modeling. Those fundamental flaws contributed significantly to the dramatic increase in modeled compliance costs between the agencies' 2016

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[25] *See* UCS Comment at 32-33.
[26] ICCT Comment at 6; *see also id.* at I-58 (listing technology constraints in the CAFE model).
[27] *Id.* at 6.
[28] *Id.*
[29] ICCT Comment at 2, I-4 to I-5..
[30] *See id.* at 2, I-4 to I-12; NGO Comment (corrected) at 21.
[31] *See* ICCT Comment at I-60.
[32] *See id.* at I-1 to I-44.
[33] *Id.* at I-15.
[34] *Id.* at I-22.
[35] EPA, Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation, EPA-420-R-16-020 (Nov. 2016) ("2016 Proposed Determination"). available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3DO.pdf.
[36] EPA, Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation, EPA-420-R-17-001 (Jan. 2017) ("2017 Final Determination"), available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100QQ91.pdf.
[37] *Id.* at I-45 to I-50.

Draft Technical Assessment Report ("Draft TAR")[38] and EPA's 2016 Technical Support Document ("2016 TSD")[39], and the Proposed Rule. We urge the SAB to clarify in its final report that the structural flaws in the CAFE model and its inputs inflate the costs of compliance projected by the Proposed Rule, and to reiterate that EPA must remedy these flaws and make the revised models and inputs available for public comment and expert review before taking any final action on the Proposed Rule.

a. Manufacturer Beliefs about Consumer WTP for Efficiency

As comments filed with EPA have made clear, there is no basis for the agencies' assumption that automakers will apply fuel-saving technologies that pay for themselves in 2 ½ years absent regulatory requirements. This assumption dramatically skews the cost-benefit analysis, as described below. Moreover, this is a dramatic departure from EPA's previous approach, and we ask that the SAB revise its discussion of this factor in light of the information provided below.

The analysis for the Proposed Rule assumed "that manufacturers will treat all technologies that pay for themselves within the first 2 ½ years of ownership (through reduced expenditures on fuel) as if the cost of that technology were negative."[40] That is, "the most cost-effective technologies (those that pay back within the first 2 ½ years) are applied to new vehicles [in the CAFE model] even in the absence of regulatory pressure."[41]

The SAB Draft Report suggests that the agencies also modeled an assumption that manufacturers will voluntarily apply technologies with sufficiently short "payback periods" in the Draft TAR, and that in the Proposed Rule the agencies assume automakers will voluntarily apply technologies with a *shorter* payback period than they did in the Draft TAR. Specifically, the SAB Draft Report states that both the Draft TAR and the Proposed Rule "assume that manufacturers believe that consumers will be willing to pay for all fuel efficiency technologies that have short payback periods: within 3 years for the 2016 TAR and 2.5 years for the 2018 NPRM,"[42] and that "manufacturers . . . voluntarily incorporate those technologies into the vehicles in the fleet under both the [existing] and revised standards."[43] We respectfully submit that the SAB Draft Report's description is factually incorrect.

In the Draft TAR, NHTSA applied an "assumption in the model . . . that manufacturers will treat all technologies that pay for themselves within the first three years of ownership (through

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[38] EPA, NHTSA, & California Air Resources Board, 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, EPA-420-D-16-900 (July 2016), available at https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockey=P100OXEO.PDF.

[39] EPA, Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Technical Support Document, EPA-420-R-16-021 (Nov. 2016), available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf.

[40] *See* Proposed Rule, 83 Fed. Reg. at 43,179.

[41] *Id.*

[42] SAB Draft Report at 11.

[43] *See id.*

reduced expenditures on fuel) as if the cost of that technology were negative."[44] However, as NHTSA explained, "[t]his holds true *up to the point at which the manufacturer achieves compliance with the standard* – after which the manufacturer treats all technologies that pay for themselves within the first year of ownership as having a negative effective cost."[45] In other words, NHTSA assumed that, in the absence of regulatory pressure, only those technologies with payback periods of one year or less would be applied by manufacturers.[46] As to NHTSA, the assumption that technology with a 1-year payback period will be voluntarily applied when the stringency of the standards is not increasing is the proper analogy to the Proposed Rule's assumption that technology with a 2.5-year payback period will be voluntarily applied—which is a significant change.

Moreover, in EPA's analyses in the Draft TAR and EPA's 2016 Technical Support Document, the agency projected that *no* technology would be voluntarily applied in the absence of regulatory pressure, regardless of payback period. In fact, EPA expressly rejected an assertion from automakers that EPA should incorporate an assumption about consumer payback periods.[47] EPA also assumed no technology would be voluntarily applied when it set its model year 2017 through 2025 standards in 2012, stating that it did "not have a basis to expect that auto makers will go beyond the standards for [model year] 2016 in the absence of this rule."[48] To the contrary, EPA concluded that "the historical evidence and the footprint-based design of the MY 2016 GHG emissions and CAFE standards strongly support the use of a reference case fleet where there are no further fuel economy improvements beyond those required by the MY 2016 standards."[49]

Therefore, it is incorrect to say that in the TAR the agencies assumed that technologies with a 3-year payback period would be voluntarily applied. In the TAR, EPA assumed that *no* technology would be voluntarily applied. Therefore EPA's assumption in the Proposed Rule that any technology will be voluntarily applied absent regulatory pressure is entirely novel and constitutes a dramatic departure from the agency's prior approach. This fact stands contrary to the Draft SAB Report's conclusion that EPA's approach in the Proposed Rule constitutes "a relatively small change from the prior approach."[50]

Moreover, this new assumption grossly warps the cost-benefit analysis. It causes all the most cost-effective technology to be included in every modeled alternative, including the preferred alternative rolling back and flatlining the standards. Therefore, the fuel savings and emissions reductions associated with those technologies still accrue even in the rollback scenario, making

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[44] Draft TAR at 13-10.
[45] *Id.* at 13-10 to 13-11 (emphasis added).
[46] *See id.* at 13-99 ("NHTSA applies a one-year payback period in its compliance and technology application analysis").
[47] *See* EPA 2016 Technical Support Document (Nov. 2016), EPA-420-R-16-021, at 4-15 to 4-16.
[48] 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, 62,915 (Oct. 15, 2012) ("2012 Final Rule").
[49] *Id.* at 62,843.
[50] SAB Draft Report at 11.

the rollback look less detrimental than in fact it is. Viewed the other way, it makes the existing standards look less beneficial than in fact they are.[51] And this impact is significant—one commenter found that simply altering the model to assume that no technology would be applied absent regulatory pressure switched the sign of the cost-benefit analysis in the later years of the analysis, causing the existing standards to show net benefits as compared to the rollback using a 3% discount rate—without correcting any of the many other errors in the analysis.[52]

In addition, and critically, the assumption that automakers will improve GHG emissions through fuel economy improvements absent regulation is unsupportable and contrary to the evidence of the historical record, which clearly shows that fleetwide fuel economy has not improved in the absence of a regulatory mandate. EPA acknowledged as much in its 2012 Final Rule.[53] As the International Council on Clean Transportation (ICCT) pointed out in its comments on the proposed rule, "[t]he data clearly and unambiguously demonstrate that when fuel economy or GHG standards do not get more stringent, new vehicle fleet-wide fuel economy will not increase and GHG emissions will not decrease."[54] Using EPA's own data from 1975 to 2015, ICCT showed that during "the periods where fuel economy and GHG standards require improvement, improvements in test cycle fuel economy occur," whereas during "the period where standards did not get more stringent, from 1986 through 2004, no fuel economy and GHG benefits are evident."[55] Moreover, as the Environmental Defense Fund stated in its comments, "the majority of this unrequired, 'cost-effective' technology being applied by the [CAFE] Model in 2017 and beyond under the rollback standards has been available for years and has not been extensively applied by manufacturers to date. (Otherwise, it would already be in the 2016 baseline fleet.)"[56]

There is simply no justification for the assumption in the compliance cost modeling that technology will be applied absent regulatory pressure, and that assumption distorts the agencies' analysis of the costs and benefits of the proposed rollback. We urge the SAB to clarify in its final report that the agencies' assumption that manufacturers will significantly improve GHG emissions and fuel economy absent regulatory pressure is novel and unsupported by the historical record, and that this assumption unreasonably skews the results of the cost-benefit analysis, rendering them unreliable and invalid.

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[51] *See, e.g.*, Comment of Meszler Engineering Services, "Technical Memorandum on The NPRM CAFE Model's Vehicle Activity Forecasting Methods," Docket ID# EPA-HQ-OAR-2018-0283-5838 ("Meszler Model Comment") at 26; ICCT Comment at II-1 to II-3; UCS Comment at 37-38; Comment of the Environmental Defense Fund, Docket ID# EPA-HQ-OAR-2018-0283-5775 ("EDF Comment"), Appendix A at 73-75 and Appendix B at 29-32; CARB Comment at 164-66.
[52] Meszler Model Comment at 26, 47 (Table A-11).
[53] 2012 Final Rule, 77 Fed. Reg. at 62,843-44.
[54] ICCT Comment at II-1.
[55] *Id.* at II-1 to II-2; *see also* Meszler Model Comment at 26; Comment of Consumers Union, Docket ID# EPA-HQ-OAR-2018-0283-6175 ("Consumers Union Comment"), at 10; UCS Comment at 37-38; EDF Comment, Appendix A at 73-75 and Appendix B at 29-32; and CARB Comment at 164-166.
[56] EDF Comment, Appendix B at 31 (citations omitted).

b. Treatment of Flexibility Mechanisms

The Proposed Rule's failure to accurately and appropriately model the ability of manufacturers to bank, trade, and use compliance credits also inappropriately causes the model to return unrealistically high projected costs of compliance, further undermining the validity of the model's results. The SAB Draft Report correctly observes that the Proposed Rule does not accurately account for use of compliance credit banking and trading mechanisms by manufacturers, and that the agencies' analysis shows that modeling full use of GHG credits across manufacturers would reduce fleet-wide compliance costs by 12.7%.[57] The SAB then concludes that if, in the real world, use of compliance credits "expands over the 2021-2026 period, the compliance costs estimated in the [Proposed Rule] will be overstated[.]"[58] Finally, the SAB Draft Report notes that "NHTSA is prohibited by statute from considering [credit usage] in setting the stringency of CAFE standards but EPA is under no such restriction."[59]

The undersigned agree that the CAFE model's failure to project efficient compliance credit utilization (including use of credits that have already been banked by manufacturers) exaggerates the costs of compliance by forcing the model to project that manufacturers will incur the cost of applying additional technologies and allow accrued credits to expire, rather than reducing costs by utilizing those credits—something which no rational manufacturer would do.[60] And fixing this error has even greater benefits than the agencies and SAB suggest—one commenter found that by applying a more reasonable (but still sub-optimal) approach to modeling credit usage reduces industry's projected total cost of compliance by $60 billion, or 16% of the compliance costs projected in the Proposed Rule.[61]

Moreover, commenters respectfully submit that EPA's analytical task (scientifically and legally) is to project the cost-effective compliance pathways that reasonable automakers *can* take to comply with the standards—it is not to hypothesize about what manufacturers *will* do to comply with the standards.[62] The compliance credit banking and trading provisions in the Proposed Rule provide automakers with flexibility designed to enable compliance cost reductions. To appropriately project cost-effective compliance pathways, EPA must model rational and effective use of compliance credits and we urge the SAB to emphasize in its final report that unlike NHTSA, EPA has no justification for failing to do so.

III. Fleet Size and Composition

We agree with many of the SAB's findings regarding the flaws in the Proposed Rule's analysis of fleet size and composition under different regulatory scenarios. Specifically, as has been noted by many other experts, the agencies' new vehicle sales model and used vehicle scrappage model are fundamentally flawed and require wholesale revision—particularly as

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[57] SAB Draft Report at 17.
[58] *Id.*
[59] *Id.* at 18.
[60] *See* UCS Comment at 35-46.
[61] *Id.* at 46.
[62] *See* Comment of the Center for Biological Diversity, et. al., at 168-69.

these models are key to the agencies' justification for the proposed revision of the current standards. In addition, however, as EPA noted in the 2012 Final Rule setting the MY 2017-2025 standards, as well as EPA's original Midterm Evaluation of those standards, there is not currently a sufficient analytical basis to quantify these impacts for policymaking purposes, especially with respect to consumers' willingness to pay for vehicle attributes.

a. Sales Model

With respect to the new vehicle sales model, we agree with the SAB that available evidence and analysis demonstrates that an elasticity of demand of -1.0 for new vehicle sales is too high.[63] And while the Proposed Rule's elasticity of -0.2 to -0.3 might be closer to reality, especially for the industry as a whole, we also agree that there are numerous errors in the development of those numbers and the sales model itself. As the SAB notes, these include problems pointed out by Stock, et al., who "discovered that [the sales impact] values are inflated by several errors in the econometric specification, as well as by an incorrect interpretation of coefficients in the underlying regression"—which, when corrected, reduce the "cumulative [sales] impact from 600,000 to 120,000."[64] The SAB also pointed out several of the same errors in estimation of the sales effect as those identified in NHTSA's recent peer review of the sales and scrappage models, including ignoring the interactive effect between vehicle prices and vehicle sales (called simultaneity bias) and omitting key variables that are known to be causally related to new vehicle sales.[65] In addition, we note that the agencies have not sufficiently justified their assumption that 100% of the costs of complying with the standards will be passed through to consumers.[66]

b. Consumer Willingness to Pay for Vehicle Attributes

We also agree with the SAB that the "net price" should be used in any sales impact model—that is, the compliance costs that are passed through to consumers, less the consumers' valuation of fuel savings at the time of purchase. However, we do not believe the literature provides a sufficiently reliable assessment of consumer willingness to pay for fuel efficiency at this time. As discussed in previous comments, the agencies have repeatedly found that the impacts of the

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[63] *See also* 2016 Proposed Determination, Appendix at A-40 ("while EPA and NHTSA have used an elasticity of around -1 in past rulemakings to estimate sales impacts, this assumption is old (stemming from studies conducted two or more decades ago) and is a short run elasticity estimate, which may not be appropriate for standards that apply several years into the future").

[64] SAB Draft Report at 22.

[65] *Id.* at 23; *see also*, NGO Peer Review Comment.

[66] *See, e.g.*, Proposed Rule, 83 Fed. Reg. at 43,083 (acknowledging that technology costs could, among other options, be paid for by manufacturers or dealers rather than be passed on to consumers in their entirety); 2016 Proposed Determination, Appendix at A-35 ("The empirical literature does not provide clear evidence ... on how manufacturer costs are transmitted to prices."); Revised CAFE Model Peer Review at B-55 (James Sallee) (noting that the relevant economic literature "tends to find incomplete pass-through," and that "[e]conomic theory would predict that only true marginal costs (i.e., costs that scale directly with each new unit sold) would impact strategic pricing," not indirect costs, such as research and development; including such indirect costs "likely leads to an exaggeration of the magnitude of impacts on new vehicle sales"); Comments of the Institute for Policy Integrity at New York University School of Law, Docket ID# EPA-HQ-OAR-2018-0283-5083 ("Policy Integrity Comment") at 27-30.

standards on new vehicle sales and used vehicle scrappage are simply too uncertain to quantify for policy-making purposes.[67] And on the specific point of consumers' observed willingness to pay for fuel efficiency, EPA sponsored a review of 27 relevant studies and found "great variability" in the estimates, with some of the studies finding that consumers undervalue the fuel savings, others finding that consumers overvalue such savings, and yet others finding that consumers value such savings approximately correctly.[68] EPA found the variation "so high that it appears to be inappropriate to identify one central estimate of this value from the literature," and called the issue of consumer response to higher fuel economy "unsettled science."[69] In the 2016 Proposed Determination, EPA also noted that "[t]he empirical literature does not provide clear evidence on how much of the value of fuel savings consumers consider at the time of purchase."[70] And it found that the National Academies of Sciences (NAS) 2015 report did "not endorse any particular payback period," and that the NAS concluded that "'How markets actually value increases in new vehicle fuel economy is critical to evaluating the costs and benefits of fuel economy and GHG standards. Unfortunately, the scientific literature does not provide a definitive answer at present.'"[71]

Moreover, it is unclear whether the agencies' finding that sales will increase under the rollback is even directionally accurate. The agencies have offered no empirical evidence that reducing the stringency of fuel economy and GHG emissions requirements will increase sales, and their modeling of this effect could easily yield the opposite result with appropriate inputs. Depending on the willingness to pay estimate that is used, it is possible that the standards' impacts on the "net price" of new vehicles may in fact be negative, especially if the compliance costs are corrected and decreased, as discussed above. This would lead to an increase in sales under the current standards as compared to a rollback.[72]

Regardless, it is critical to distinguish between consumers' valuation of fuel savings at the time of purchase and the actual fuel savings they accrue—the real money in their pockets that any rollback of the current standards will take from them. Moreover, to the extent consumers'

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[67] *See* NGO Comment (corrected) at 165-68.

[68] EPA and NHTSA, *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*, 77 Fed. Reg. 62624, 62914 (Oct. 15, 2012) (citing Greene, David L. "How Consumers Value Fuel Economy: A Literature Review," EPA Report EPA–420–R–10–008, March 2010 (Docket ID# EPA–HQ– OAR–2010–0799–0711), available at https://nepis.epa.gov/Exe/ZyPDF.cgi/P1006V0O.PDF?Dockey=P1006V0O.PDF).

[69] *Id.*

[70] 2016 Proposed Determination, Appendix at A-35.

[71] *Id.*, Appendix at A-31 (quoting National Research Council (2015). *Cost, Effectiveness and Deployment of Fuel Economy Technologies for Light Duty Vehicles*. Washington, D.C.: The National Academies Press).

[72] As the agencies noted in the Preliminary Regulatory Impact Analysis for the Proposed Rule: "Because the values of changes in fuel economy and other features to potential buyers are not completely understood, however, the magnitude – and possibly even the direction – of their effect on sales of new vehicles is difficult to anticipate." NHTSA and EPA, *Preliminary Regulatory Impact Analysis, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021 – 2026 Passenger Cars and Light Trucks* (July 2018, updated Aug. 23, 2018, Oct. 16, 2018) ("PRIA") at 951, available at https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ld_cafe_co2_nhtsa_2127-al76_epa_pria_181016.pdf.

(beyond fuel economy) that are desired by consumers but restrained by federal standard."[79] First, there is significant uncertainty in the degree to which the standards affect the inclusion by automakers of other "desired" attributes. As EPA has noted, "the assumption in the previous research that the tradeoffs among acceleration, fuel economy, and weight are constant does not appear to accurately represent the new technologies, and in fact may substantially overestimate the magnitude of the performance-fuel economy tradeoff."[80] And in the 2016 Proposed Determination, EPA stated that it had "not found any evidence that the technologies used to meet the standards have imposed unavoidable 'hidden costs' in the form of adverse effects on other vehicle attributes."[81]

Second, there is significant uncertainty regarding consumers' relative valuation of the various attributes. As the Preliminary Regulatory Impact Analysis for the Proposed Rule noted, "[t]here are few empirical estimates of these values, and the range of estimates for the values of individual attributes reported in each study is very wide."[82] Indeed, in a study commissioned by EPA on this topic, the authors found "very little useful consensus" regarding these values and such a wide range of estimates that they considered them "of little use for informing policy decisions."[83]

Moreover, even if the agencies were to attempt such an analysis (for which no sufficient analytical basis exists), they would need to include in that analysis both the negative implications of any purported vehicle attributes that would be enhanced absent the standards, as well as the positive performance and other co-benefits of fuel-saving technologies that will accrue because of the standards. For example, after reaching certain thresholds, some performance attributes, including faster acceleration and improved horsepower, have diminished marginal utility, but nevertheless can increase accidents, damages, and fatalities.[84] These impacts therefore must offset any benefit from enhancement of those attributes. And fuel-saving technologies can and do provide significant co-benefits.[85] On this point, the Proposed Rule does not consider the complete spectrum of benefits from efficiency technologies that are valued by drivers beyond those technologies' efficiency benefits.[86] For example, adding more gears to the transmission improves maximum acceleration, improves launch feel due to a lower gear ratio in first gear, reduces noise on the highway by running the engine at lower speed, and reduces vibration and harshness by reducing the change in engine speed between shifts.[87] Variable valve timing (VVT), variable valve lift (VVL), and gasoline direct injection (GDI) technologies increase engine power in addition to reducing emissions and

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[79] SAB Draft Report at 22.
[80] 2016 TSD at 4-6.
[81] 2016 Proposed Determination, Appendix at A-27.
[82] PRIA at 1095.
[83] EPA, *Consumer Willingness to Pay for Vehicle Attributes: What is the Current State of Knowledge?*, EPA-420-R-18-016 (July 2018) at 7-1.
[84] Policy Integrity May 2019 Comment, Appendix at 21.
[85] *See* ICCT Comment at II-11 to II-16.
[86] *Id.*
[87] *Id.* at II-11 to II-12.

improving efficiency.[88] The higher-voltage, higher-power electrical systems on 48-volt hybrids offer many potential features desired by consumers, such as part-time 4-wheel drive, off-board power, heated seats, and other electric amenities.[89] Examples of automakers including these types of benefits in marketing 48-volt systems are the Dodge Ram and Jeep Wrangler, which market their 48-volt hybrid system as "e-Torque."[90] And downsized, turbocharged engines can deliver their maximum power and more torque than naturally aspirated engines at lower engine speeds.[91] Mass-reduction or lightweighting has many benefits beyond fuel savings, including faster acceleration, better ride, handling, braking, increased towing capacity, and greater payload capacity.[92] In addition, aluminum, which is a commonly applied by manufacturers to reduce mass, will not rust.[93] These benefits further counter the agencies' flawed analysis that improving greenhouse gas emissions performance will depress vehicle sales.

c. Consistency of Willingness to Pay Assumptions in Baseline Fleet and Sales Model

We agree with the SAB that if the agencies assume an improvement in fuel economy due to consumer demand in the business-as-usual baseline, then they should also use at least an equivalent willingness to pay for fuel economy improvements in estimating vehicle sales.[94] However, the inverse is not necessarily true. Given historical evidence and market failures, a flat baseline fleet is the appropriate assumption, while some level of consumer willingness to pay for fuel savings should be used in modeling sales. There are two reasons for this.

First, as discussed above, the historical record provides no evidence that automakers will improve fuel efficiency in the absence of standards. Second, there is significant evidence of at least some willingness to pay for fuel efficiency on the part of consumers, with a minimum level of about 2 years. As EPA stated in the 2016 Proposed Determination, it agreed with the NAS that "the role of fuel economy in consumer purchase decisions is not well understood, with estimates ranging from 2 years to the lifetimes of the vehicles."[95]

There is evidence of manufacturer-side market failures, several of which EPA has discussed before, that explain this divergence – specifically, why manufacturers may not provide these fuel-saving technologies, even where consumers would be willing to pay for them. As a result, vehicle sales may be affected by consumers' willingness to pay for fuel economy even if manufacturers would not improve fuel economy absent standards.

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[88] *Id.* at II-12.
[89] *Id.* at II-15 to II-16.
[90] *Id.* at II-16.
[91] *Id.* at II-13 to II-14.
[92] *Id.* at II-14 to II-15.
[93] *Id.* at II-14.
[94] *See* Comments of Consumers Union, et al., Docket ID# EPA-HQ-OAR-2018-0283-6182, Attachment A at 19-20 ("Consumers Union, et al. Comment").
[95] 2016 Proposed Determination, Appendix at A-31.

the agencies attributed to the rollback, which was also central to the agencies' justification in rolling back the existing standards.[103]

IV. Fleet Utilization

A. Use of Fixed Schedules for Vehicle Miles Traveled

The SAB notes numerous comments from the recent peer review of the sales and scrappage model that direct the agencies not to use fixed schedules of vehicle miles traveled (VMT) per vehicle (i.e., schedules that are independent of the size of the fleet), as the agencies did in the Proposed Rule.[104] The agencies' choice to use fixed per-vehicle VMT schedules, combined with the flawed fleet size projections from the sales and scrappage models, led to a prediction that under the existing standards, "when vehicles are more expensive and fewer new vehicles are purchased, the overall demand for transportation (VMT) will be higher than under the revised standards even before accounting for the lower fuel costs of the new vehicles."[105] This "strongly influenced" the cost-benefit analysis of the Proposed Rule.[106] The SAB also notes a 2018 paper by Bento et al. on the Proposed Rule that argues that the purported safety risks the Proposed Rule attributed to the current standards (the non-rebound-related accidents) were "related almost entirely to differences in the size of the fleet and the concomitant change in VMT rather than changes in the mix of vehicles or in vehicle mass."[107] As noted above, this increase in VMT—which stemmed from the increase in fleet size caused by the scrappage model—was central to the agencies' finding of net benefits with a weakening of standards.

We agree with these points, as well as the SAB's finding that the "magnitudes of these impacts indicate the importance of revising the analysis."[108] We also support the SAB's recommendation that the agencies "should follow the recommendations of the peer reviewers and hold aggregate VMT fixed, apart from effects induced by rebound."[109]

B. Magnitude of the Rebound Effect

The SAB Draft Report observes that the agencies doubled their value for the magnitude of the rebound effect between the Draft TAR (and EPA's 2016 TSD) and the Proposed Rule—increasing it from 10% to 20%.[110] The Draft SAB Report notes that the agencies "overlook[ed]

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[103] Global Automakers Comment at A-24 (noting that when the scrappage model is disabled (or turned "off"), "the non-rebound fatality costs and non-fatal crash costs are higher in Preferred Alternative as compared to the augural standards," demonstrating "the importance of the [scrappage] module on driving the results of the cost/benefit analysis").
[104] SAB Draft Report at 25-26.
[105] *Id.* at 25.
[106] *Id.* at 28.
[107] *Id.*; *see also* Bento, A, K. Gillingham, M.R. Jacobsen, C.R. Knittel, B. Leard, J. Linn, V. McConnell, D. Rapson, J.M. Sallee, A.A. van Benthem, and K.S. Whitefoot. 2018. Flawed Analyses of U.S. Auto Fuel Economy Standards. *Science* 362:1119.
[108] SAB Draft Report at 28.
[109] *Id.* at 26.
[110] *Id.*

They instead contort their discussion of the papers to suggest that they defeat, rather than support, the notion that the rebound effect will be smaller in the future than it was in the past.[119]

Finally, the agencies ignored various other reasons that the estimates returned by the rebound effect literature are, at most, an upper-bound on the appropriate rebound effect to use in the rulemaking process. They ignored the broad findings suggesting that the rebound effect in response to changes in fuel economy is smaller than the effect in response to changes in fuel prices, and that some studies even found that fuel economy effect was "statistically indistinguishable from zero."[120] They ignore that the rebound effect is asymmetrical, and the consumer response is smaller for declines in the cost of driving (as is caused by increases in fuel economy) than it is for increases.[121] And they ignore their own projections of increased congestion due to the existing standards, which the literature finds will cause the rebound effect to be smaller.[122]

EPA must correct its reading of the literature as presented in the Proposed Rule, and must weight the literature appropriately based on quality and relevance.[123] As demonstrated by EPA's own prior analyses and by comments submitted to the rulemaking docket, doing so demonstrates that the rebound effect as of today is, at most, 10%, and is declining over time.[124] The agencies' proposed value of 20% is directly contrary to the relevant scientific literature.

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[119] *See* UCS and EDF Rebound Comment at 14-17.
[120] *See id.* at 28-32; Comment of Kenneth A. Small, Docket ID# EPA-HQ-OAR-2018-0283-2698 ("Kenneth Small Comment"), at 2.
[121] UCS and EDF Rebound Comment at 37-39.
[122] *Id.* at 39.
[123] *See, e.g.,* Comment of Joshua Linn, Docket ID# EPA-HQ-OAR-2018-0283-1642; Kenneth Small Comment; Comment of Ken Gillingham, Docket ID# EPA-HQ-OAR-2018-0283-5842 ("Ken Gillingham Comment"), also available at https://ww2.arb.ca.gov/resources/documents/rebound-effect-fuel-economy-standards-comment-safer-affordable-fuel-efficient; UCS and EDF Rebound Comment at 26-28.
[124] Ken Gillingham Comment at 3-7; UCS and EDF Rebound Comment at 26-28.