Evaluating Automakers' Proposed Changes to Greenhouse Gas Emissions Standards for Light-duty Vehicles

Union of Concerned Scientists Whitepaper

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Automakers have generally distanced themselves from the Trump administration's proposed rollback of light-duty vehicle fuel economy and greenhouse gas emissions standards, claiming they do not support freezing standards at 2020 levels. This analysis examines the alternatives proposed by several major automakers or their trade associations and finds these objections to be inconsistent with their own proposals, which in some cases prove as damaging as the proposed rollback.

The agencies' proposal to freeze fuel economy standards at 2020 and eliminate direct credit for air-conditioning beginning in 2021, thus increasing light-duty vehicle emissions for 2021 through 2025, would result in far-reaching environmental damage and increased costs for consumers. Utilizing the agencies' own compliance models, it can be shown that numerous proposals from automakers and industry representatives do not fare much better (Tables 1 and 2).[1]

TABLE 1. Changes to flexibilities proposed by automakers considered in UCS modeling

Organization	Stringency (2025)	EV multipliers	Hybrid credits	Tier 2/3 fuel flexibility	PC-LT definition
Honda	Current standards†	Extended through 2026	Allow strong HEV PU credit to all LTs	Allow	No change
Global Automakers	PC: 165 g/mi LT: 238 g/mi	Extended through 2026	Expand all PU credits to LTs; Add smaller credit for PCs	Allow	No change
General Motors	5% EVs + 1% per yr ICEV improvement	n/a (no GHG rule)	Expand all PU credits to LTs	Allow	All utility vehicles are LTs
Alliance of Automobile Manufacturers	Current standards††	Extended + increased to: 4.5X (BEV) 4.8X (PHEV)	Expand all PU credits to LTs; Add smaller credit for PCs	Allow	All utility vehicles are LTs

In addition to permanently ignoring emissions from electric vehicle use, manufacturers have asked for a number of changes to so-called "flexibilities" in the light-duty vehicle greenhouse gas program. This table is a subset of those changes which are more readily quantifiable. Impacts of changes to the off-cycle program proposed by the automakers, including "streamlining" the approval process such as EPA's proposed amendment to the 5-cycle credit process, were not quantified.

† Current standards are estimated to require greenhouse gas emissions of 149 g/mi for passenger cars and 204 g/mi for light trucks.
†† The Alliance proposed a reduction in stringency but did not specify, so we did not assume a specific number in our original analysis. In the Volpe modeling, we considered two levels of stringency for the Alliance's proposals, the current standards and that proposed by Global Automakers/Novation.
SOURCE: Kiss 2018, Nevers 2018, Rege and Muskus 2018, and Turley 2018.

The various automaker proposals are summarized in Table 1 and center primarily on adjusting future CO_2 targets (the regulatory curves defined for a given fleet based on footprint and vehicle class), extending and increasing technology incentives, and altering regulatory procedures and definitions in order to effectively reduce the stringency of the regulation.

Even without substantial changes to the target curves of the current program, our compliance modeling shows that changes to flexibilities such as the EV multiplier can have a dramatic effect on emissions

[1] For example, "The Alliance supports the extension and expansion of advanced technology multipliers in the GHG program and their extension to the CAFE program" (p. 11, Nevers 2018) and "the Alliance supports several enhancements to the off-cycle application process" (p. 96, Nevers 2018).

reductions from the program (e.g., Table 2: Honda). Examining the impacts of these proposals in full (Table 2), it is clear that the outcomes of all proposals remain far below the level of benefits of the current standards—in some cases, providing even fewer benefits than the current proposal to freeze standards at 2020 levels—emphasizing the degree to which automakers are seeking to undermine and weaken the strong environmental protection provided by the current standards.

TABLE 2. MY2020-2025 benefits relative to rollback, for proposed light-duty vehicle gas emissions standards

Scenario	High estimate	Low estimate
Augural	911 million metric tons (MMT) (100%)	
Honda	655 MMT (72%)	634 MMT (70%)
Global Automakers	364 MMT (40%)	353 MMT (39%)
Auto Alliance, current standards	147 MMT (16%)	-47 MMT (-5%)
Auto Alliance, weaker standards	70 MMT (8%)	-167 MMT (-18%)
Proposed Rollback	0 MMT (0%)	

Automaker proposals for future light-duty vehicle standards represent a significant erosion of the current rules. Even Honda's proposal, which maintains the current stringency while increasing a handful of incentives, would erode more than one-quarter of the benefits for model years 2020 through 2025. The changes proposed by the Auto Alliance are so egregious that they could actually result in more ***emissions than the rollback proposed by the Trump administration (marked in red). The auto industry's proposals represent a significant step backward at a time when it should be aligning itself with a sustainable path for 2030 and beyond.***

METHODOLOGY

In order to model how manufacturers would comply with the different proposals, we utilized two different versions of NHTSA's Volpe model. Both versions were modified to reflect more reasonable paths to compliance based on UCS analysis, as provided in technical comments to the agencies (Cooke 2016, 2018).

Compliance models selected for this analysis

The first version of the model is based upon Volpe Model v1.2016.6.1, which accompanied the Draft Technical Assessment Report (TAR) jointly drafted by the U.S. Environmental Protection Agency, National Highway Traffic Safety Administration, and California Air Resources Board (EPA, NHTSA, and CARB 2016). This version of the model has been updated to more closely align with EPA's analysis, including the incorporation of California's Zero-Emission Vehicle (ZEV) program, using the Indirect Cost Multiplier (ICM) for costs, enforcing performance neutrality, and updating technology assumptions regarding high-compression ratio engines, cylinder deactivation, and transmissions (Cooke 2016). These changes resulted in costs of compliance with the 2022-2025 program that were virtually identical to those yielded by OMEGA v1.4.56 for the TAR.

The second version of the Volpe model is based upon the version of the Volpe model which accompanied the Notice of Proposed Rulemaking for MY2021-2026. Because this is inexplicably documented as v1.0.0.0, which does not correspond to any reasonable form of version tracking, we will refer to the respective versions of the model as the TAR and NPRM versions for clarity. The NPRM model has been modified for our analysis to more accurately reflect the availability of mass reduction, the utilization of the credit banking and trading provisions, and the cost-optimization strategy utilized by automakers in applying technologies. While these adjustments in no way correct for the myriad of flaws found in the NPRM Volpe model, they significantly reduce the amount of overcompliance modeled by the program (Cooke 2018a).

Accuracy and appropriateness of technology deployment using the Volpe model

Because there are numerous assumptions that go into estimation of the emissions under any given scenario, and differing assumptions related to vehicle use, scrappage, fuel costs, and much more between the two selected models, emissions under each proposal are calculated externally to the Volpe model utilizing the fleet's technology deployment and vehicles' tailpipe emissions and fuel economy.

TAR VOLPE MODEL

The TAR model has not been updated with the latest estimates of technology cost and effectiveness and may overstate the technology deployment required and/or cost of compliance with standards relative to UCS' own estimates. However, its underlying costs are largely in agreement with the most recent consensus report from the National Research Council of the National Academies (2015), and show moderate consistency with EPA's OMEGA model, which help underpin the reasonableness of this compliance model.

Automakers, however, disagree with this analysis, complaining repeatedly that "manufacturers will need to apply much more hybrid and electric-drive technology than the agencies have projected in order to meet vehicle targets" (Rege 2016).[2] For this reason, we believe that the industry would see this as a lower limit on the amount of technology needed to be deployed to meet the targets of a given standard.

Because the amount of real-world reductions given away on paper through the requested flexibilities are proportional to the penetration of the various technologies receiving extra credit, analyses using the modified TAR model represent relatively optimistic outcomes of the automakers' proposals, based on the industry's own reasoning that the model underestimates the technology required.

NPRM VOLPE MODEL

Similarly, while UCS has detailed the innumerable flaws in the NPRM Volpe model, the vast majority of which still remain in the modified NPRM version, automakers have publicly noted the current Volpe model as a significant improvement: "the CAFE model is reasonably accurate in terms of technology efficiency, cost, and overall compliance considerations" (p. 21, Turley 2018); "the improved modeling has reduced, but not eliminated the assessment gap" (p. 7, Stricker 2018); and "we recognize the improvements of the new Volpe model over the Draft TAR version, we continue to believe that the cost and benefits used as inputs to the model are overly optimistic" (p. 82, Chernoby 2018). Therefore, while UCS' own analysis indicates that even after modification the NPRM Volpe model continues to overstate

[2] While this quote comes from comments related to the TAR analysis, similar claims have been repeated in every submission to docket EPA-HQ-OAR-2015-0827 from both the Association of Global Automakers and the Alliance of Automobile Manufacturers and should be seen as generally representative of the industry's stated disposition.

the amount of advanced technology required to comply with the vehicle standards, the model itself appears to be in line with automakers' own analysis of what would be required.

While the results of this modeling may be in line with manufacturer estimates of the impacts of their proposals, it may in fact still ***underestimate*** the negative environmental impacts of the flexibilities requested by the industry based on comments submitted to the agencies.

Modeling the proposed standards

In order to model fleet compliance with the greenhouse gas regulations, we have disallowed the paying of fines in both models. This artificially raises costs by eliminating a flexibility comparable to credit trading and other flexibilities not reflected in the model, but this was done to ensure fleet compliance with the standards. The NPRM Volpe model is run in "CO2" mode, which reflects both our updated compliance algorithm and the fact that we are modeling compliance with EPA's GHG standards.

Many of the flexibilities are modeled easily in both versions of the Volpe model, such as extra credits for hybrids, which can be deployed as an "off-cycle credit" to the requisite technology in its appropriate vehicle class. However, because the Volpe model has been designed around modeling of NHTSA's CAFE standards, some flexibilities such as the EV multiplier are not as easily modeled. Below, we describe the ways in which each flexibility was modeled within the two different Volpe models used.

ADJUSTMENTS TO STRINGENCY

We have modeled two different levels of curve stringency. The first, used to model Honda's proposal and the Alliance "augural" proposal maintain the augural standards through 2025. Thus, any environmental impacts modeled in these scenarios are the direct result of changes to technology incentives or other flexibilities implemented in the analysis.

The other modeled level of stringency is based on the analysis of Novation Analytics, cited by the Association of Global Automakers in its comments (Attachment C, Rege and Muskus 2018). In this analysis, the curves correspond to the values provided by Novation Analytics (slide 17, Pannone 2018), wherein a passenger car fleet dominated by gasoline-powered vehicles achieves 48.7 mpg on the CAFE 2-cycle test in 2025, and light trucks 34.7 mpg, far short of the augural values of 52.9 mpg and 39.0 mpg, as cited in the same analysis (slide 4, Pannone 2018). It should be noted that these targets assume achievement of the ZEV mandate, consistent with our approach to the relative share of EVs in these scenarios in the TAR model. It is also worth noting that this represents approximately a four-year delay on the CAFE standard, as indicated in the chart comparing these levels of achievement with the model year 2021 standards now on the books.

ELECTRIC VEHICLE INCENTIVES

The NPRM Volpe model was used in EPA's recent proposal for greenhouse gas emissions standards for LDVs in 2021-2026, including the use of an EV multiplier—therefore, the only modification necessary to model the various multipliers was by altering the scenarios file. However, the TAR Volpe model has no such ability to replicate the EV multiplier, nor is there a straightforward way to deploy the multiplier by adjusting the cost or effectiveness of the technology because the TAR Volpe model uses the petroleum equivalence factor approach intrinsic to the CAFE calculation.

Three different market assumptions were used for the TAR Volpe model to capture three different levels of ZEV deployment: 1) no ZEV, used only in the rollback scenario; 2) meeting the ZEV standards through 2025; and 3) TAR levels of ZEV deployment in 2025. Because the TAR Volpe model does not directly reflect the value of the multiplier, we utilize the three ZEV scenarios as a pre-processing step to better reflect the technology strategies manufacturers may deploy to comply with different levels of stringencies given available flexibilities. Because the extension of the advanced technology vehicle multiplier results in some of the most drastic reductions in effective stringency, and because the technology remains a high-cost technology to apply before 2025, it is unlikely that manufacturers will need to deploy plug-in electric vehicles at levels above the minimum ZEV requirements unless the stringency of the curves is at least as strong as the standards now on the books. This was borne out in our analysis utilizing the multiplier-enabled NRPM model and is consistent with our analysis of the marginal benefits under different proposed multipliers. It should also be noted that this assumption has only a small impact on the environmental impacts of a given proposal, at least at the levels of EV marketshare anticipated under the various scenarios.

We calculate the emissions reductions given away under each proposal as a result from overcrediting the given number of EVs and then use this to reduce the stringency of the respective curves. For example, Honda's proposal to extend the multipliers through 2026 results in an additional giveaway of emissions (beyond what EPA has already conceded) of just over 10 percent of the greenhouse gas emissions reductions related to fuel economy (i.e. excluding direct A/C reductions)—this results in a lowered stringency of the curves by just over 10 percent, from an improvement of 4.6 percent per year to 4.13 percent per year.

To assess the environmental impacts of the requested EV flexibilities, we calculate the credited value of the EVs present in a modeled fleet and subtract both the true environmental emissions of the electric vehicles (including upstream emissions) and the additional credits that would be received under the status quo credit system to account for only those impacts which would result from a given proposal.

HYBRID CREDITS

As was mentioned above, the credits requested for the use of mild and strong hybrid technology (predominantly in light trucks) are modeled directly in the respective technologies files by adding an off-cycle credit for the given technology. The model will thus apply that extra credit whenever the technology is applied. The rate of application for different proposals is provided in Table 3.

TABLE 3. Extra credits (in g/mi) for the application of different levels of hybridization in the Volpe model

Scenario	SS12V	BISG	CISG	SHEVP2	SHEVPS
Honda PC	0	0	0	0	0
Honda LT	0	0	0	20	20
AAM/AGA PC	0	5	5	10	10
AAM/AGA LT	0	10	10	20	20

No additional credits were given for the simplest hybrid technology (start-stop), but manufacturers have proposed additional credits for both mild and strong hybrids for both passenger cars (PC) and light trucks (LT), expanding upon an advanced technology program for pick-up trucks set to expire in 2021.

Assessing the impact of these credits are straightforward—since the 5, 10, or 20 g/mi credit does not reflect any additional real-world reductions, this giveaway can simply be multiplied by the appropriate vehicle lifetime mileage and number of vehicles with this technology applied to determine the erosion of benefits.

TIER 2-TIER 3 CERTIFICATION FUEL FLEXIBILITY

Industry has requested that EPA not alter its certification procedure to reflect the switch to Tier 3 fuel, instead allowing manufacturers to choose whether to use Tier 2 or Tier 3 fuel for certification. As pointed out in EPA's tests, using Tier 3 fuel for certification results in a 1.4 percent reduction in tailpipe CO_2, on average, compared to Tier 2 fuel. Because the standards were set based on the use of Tier 2 fuel, allowing manufacturers to certify on Tier 3 fuel with no adjustment would result in a 1.4 percent average reduction on the test cycle with zero net benefit in the real world.

To simulate how this would affect manufacturers' compliance with the standards, we reduce fleet emissions by 1.4 percent in the baseline file, and then increase emissions by the same factor after compliance but prior to calculating emissions from the fleet, ensuring that the fleet's modeled emissions are relative to Tier 2 fuel use, as originally designed. To first order, this equates to a 1.4 percent increase in total tailpipe emissions for the fleet, or a reduction in benefits of more than 10 percent of the rule.

CREDIT FOR REDUCTIONS IN AIR-CONDITIONING REFRIGERANT EMISSIONS

All manufacturer proposals called for maintaining credits for reducing greenhouse gas emissions from passenger vehicle air-conditioning systems, either through reduced leakage or switching to refrigerants with lower global warming potential than HFC-134a. Because the CAFE program does not consider direct emissions of greenhouse gas emissions, neither Volpe model is designed to assess the utilization of technologies which directly impact greenhouse gas emissions but not fuel usage.

In our modeling, we consider that manufacturers will maximize the direct emissions reductions credits available under EPA's greenhouse gas emissions program, complying with the Significant New Alternatives Policy (SNAP) which requires that by 2021 the air-conditioning systems in new motor vehicles will no longer utilize HFC-134a.

This assumption may significantly overstate the benefits of these proposals as a result of ongoing litigation. It effectively sets a floor for the effectiveness of any proposal, guaranteeing more than 20 percent of the reductions of the current program which would otherwise be wiped away under the rollback. A recent court decision has vacated the 2015 SNAP rule requiring alternative refrigerants beginning in 2021 (83 FR 18431). While air-conditioning improvements are one of the cheapest methods to reduce greenhouse gas emissions and it is likely that such technology would be deployed under any rule recognizing these benefits due to their low marginal costs, assuming 100 percent deployment reduces the need for the technologies highlighted in various automaker proposals. Because these proposals credit hybrid- and plug-in electric technologies for reductions greater than would occur in the real-world, the assumption of maximizing credits for direct GHG reductions minimizes the deployment of such technologies and thus reduces the need for such artificial credits.

RECLASSIFICATION OF UTILITY VEHICLES

The Auto Alliance has requested that the agencies alter the definition of light trucks to include all utility vehicles (Nevers 2018). This would shift approximately 11 percent of the light-duty vehicle fleet from their current classification as passenger cars to light trucks. The Auto Alliance has proposed this without any changes to the curves, which are based on the average fleet mix and potential within a given vehicle class.

Modeling this technology simply required altering the market data file to reflect this change in classification. In estimating the potential impacts of this, we have assumed that VMT is unchanged as a result of this shift. However, this may represent an underestimate—while there may be no real world growth in VMT, altering a vehicle's classification from passenger car to light truck increases the lifetime VMT associated with that model and thus increases the impact of any credits awarded to that model.

SAFETY TECHNOLOGY CREDITS

Some manufacturers have asked for safety technologies to be added to the off-cycle credit program despite their explicit exclusion when the regulations were finalized and little evidence that such technologies would result in reductions in fuel.[3] The only technology modeled in our analysis was for adaptive cruise control (ACC), which was requested explicitly in the Alliance's proposal, at a credit value of 2 g/mi.

With European and U.S. mandates for safety features like automatic emergency braking already on the books, there is no market barrier to technologies like ACC. In fact, the most recent analysis projects that over 80 percent of the new vehicle fleet will deploy ACC in 2025—in 2017, that share was already over 20 percent (Alexander 2018). Using this projection, which is projected to occur without ***any*** incentives in the fuel economy and greenhouse gas emissions standards, we can estimate the total credits needlessly given away by such incentives with no clear direct environmental benefit.

Because credits for ACC are the only policy modeled, incorporating safety technologies into the off-cycle credit program could result in significantly worse environmental impacts than estimated in this analysis, dependent upon credit value and level of technology deployment as well as unknowable impacts on the transportation system writ large.

ADDITIONAL PROPOSED CHANGES TO THE GREENHOUSE GAS EMISSIONS PROGRAM

There are a number of proposed changes to the program that we were unable to model due to limitations of the models used. For example, the Volpe model does not accurately reflect the use of credit banking and trading. While some manufacturers proposed extending credit lifetimes, our experience shows that the algorithms within the model grossly underestimate the use of such program flexibilities and would thus severely underestimate the impacts of such proposals. For this reason, we

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[3] In fact, by inducing demand, safety-related technologies like the connected and automated vehicles manufacturers claim these credits would incentivize could actually result in large increases in fuel usage (Wadud et al. 2016). Research even shows that advanced cruise control in particular is dependent upon implementation even for any ***direct*** benefits to a vehicle's fuel economy (Mersky and Samaras 2018).

have conservatively chosen not to model these proposed changes rather than attempt to quantify to what degree the model is accurately representing the outcome.

Another limitation of the modeling is simply that the degree of impact of a flexibility depends on effects external to any potential model of compliance. For example, the impacts of any efforts to “streamline” the off-cycle credit program depend on the degree to which off-cycle technologies continue to reflect real-world reductions and how, if at all, those technologies have been incorporated into any stringency. In the case of a proposal to allow off-cycle credits to be granted based on values provided by suppliers, the effect this would have is based on the deviation between a given manufacturer’s implementation of the technology and the testing by a supplier—in the case of the Denso SAS air conditioner compressor with variable crankcase suction technology for which a number of manufacturers have received credit, for example,[4] there was a wide spread in observed benefits between Hyundai’s tests and those of GM, Ford, and BMW, indicating that the performance of it and other off-cycle technologies could be highly variable even for the same technology. A similar logic follows for proposed adjustments to the caps set on specific classes of off-cycle technologies.

There is also simply a lack of specificity in some requests that limits our ability to accurately model the impacts. For example, the Alliance proposed to base the value of technologies that reduce emissions from air-conditioning usage based on an increased estimate of the baseline emissions, but they said nothing about similarly raising the standards to reflect such an increased potential for reduction—the degree to which any such updated information is employed on both the credits under the standards and the stringency of the standards goes directly to the calculation of any such impacts, but not enough specificity was provided in these any many other similar requests to adjust credits for technologies already captured in the off-cycle program.

RESULTS

The results of the modeling show that all automaker proposals will result in significant increases in emissions relative to the status quo and may actually result in outcomes at least as bad as the proposed rollback in fuel economy and greenhouse gas emissions standards for light-duty vehicles.

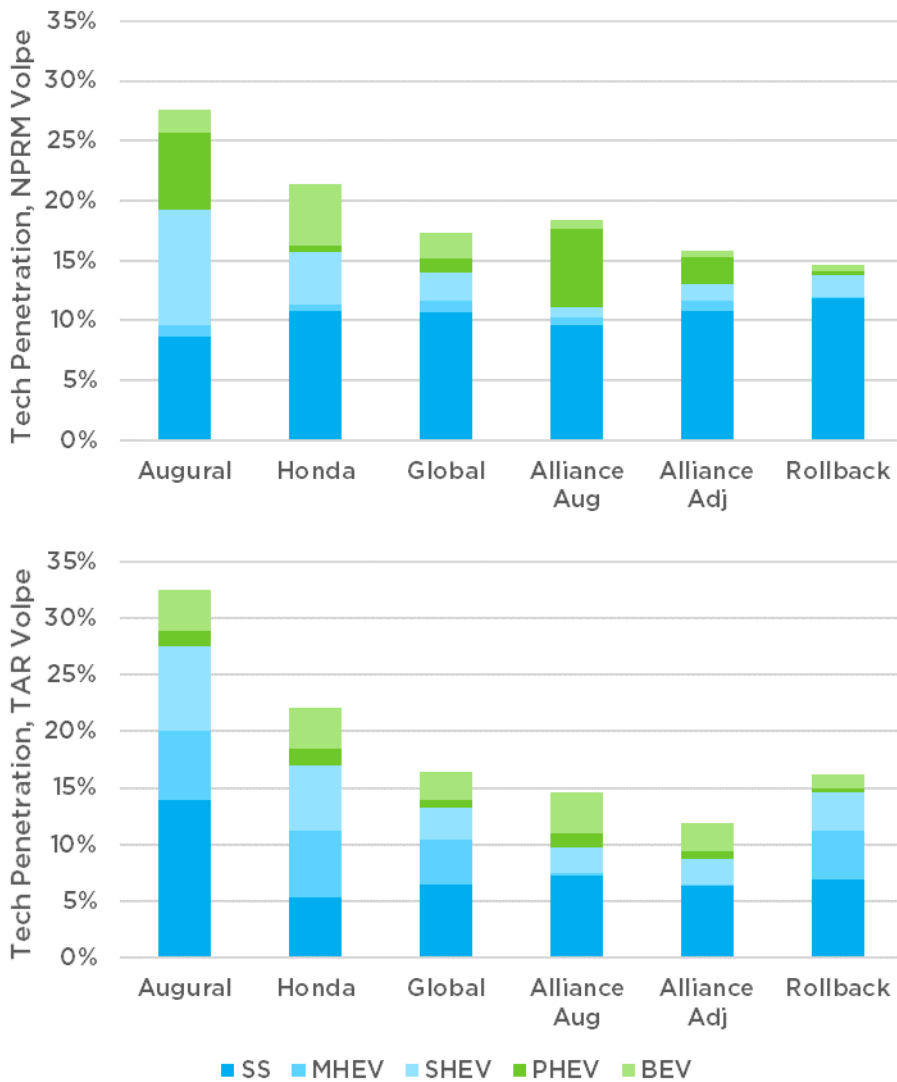
Our analysis also indicates that many scenarios modeled showed a reduction in deployment of the precise technologies purported to be incentivized by the specific proposals. While this may seem counter-intuitive, it is the natural result of two effects of these flexibilities—providing extra credit for a technology 1) reduces the overall stringency of the program and therefore demand for technology overall while 2) increasing the value of the incentivized technology relative to other technologies. The former can be thought of as adjusting the overall technology need of the program and the latter the relative place in queue for a particular technology. What our results indicate is that the marginal deployment (relative value of a given incentivized technology) is not increased generally at a greater rate than the overall technology need is decreased by reducing stringency through the application of

[4] See Dockets EPA-HQ-OAR-2018-0189 and EPA-HQ-OAR-2015-0282 and the supporting documentation provided by manufacturers and contained therein.

extra credits. The net result is predictable: the extra credits are in most cases not affecting marginal deployment as much as they are reducing stringency, thus reducing overall technology deployment.[5]

Technology deployment

FIGURE 1. Technology deployment in 2025 modeled under different automaker proposals



Modeled compliance with various automaker proposals indicates that adoption of any of these automaker proposals would generally result in less penetration of the technologies incentivized compared to keeping the current standards in place. In fact, the Alliance proposal could see even less advanced technology deployed than the proposed rollback.

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[5] For example, in the case of the Honda proposal where stringency remains the same, while battery electric vehicle deployment is increased under the NPRM modeling scenario, the amount of credits given away demand fewer additional reductions and thus far fewer hybrid-electric and plug-in electric vehicles sold, resulting in an overall decrease in plug-in electric vehicles relative to the standards on the books today.

Figure 1 shows the technology deployment resulting from the two different compliance models. The overall difference between the two models is clear: while the overall proportion of vehicles incorporating start-stop technology or some form of hybridization or electrification is actually greater in the TAR model, the NPRM model shows compliance in virtually every scenario requiring a greater share of electric propulsion through either strong hybridization or plug-in electrification.[6] The trends across the proposals are consistent as well—no matter the proposal, the level of technology adoption is significantly reduced from the standards that are on the books today. The TAR modeling indicates that some proposals may even yield a reduction in the overall share of vehicles deploying these more advanced technologies relative to the rollback as a direct result of the extra credits proposed, further showing the principle roll that stringency plays in driving technology adoption, with incentives serving mainly to undermine adoption, not promote it.

The Alliance's proposal is particularly striking as modeled using the modified TAR Volpe model—in this case, there is actually ***less*** technology deployed than in the rollback scenario. The primary reason for this is that the amount of extra credits granted for hybrid- and plug-in electric vehicles, combined with the reclassification of all utility vehicles as trucks, effectively reduces the stringency in tailpipe emissions below 2020 levels. This is even clearer when observing the environmental impacts of all scenarios.

Environmental impacts

Undermining technology deployment of course has real consequences for the environment. Rewarding vehicles with credits that extend well beyond their environmental benefits leads to a weaker overall program, even with the target curves unchanged. However, there are critical lessons to be learned from the range of flexibilities requested by the automakers.

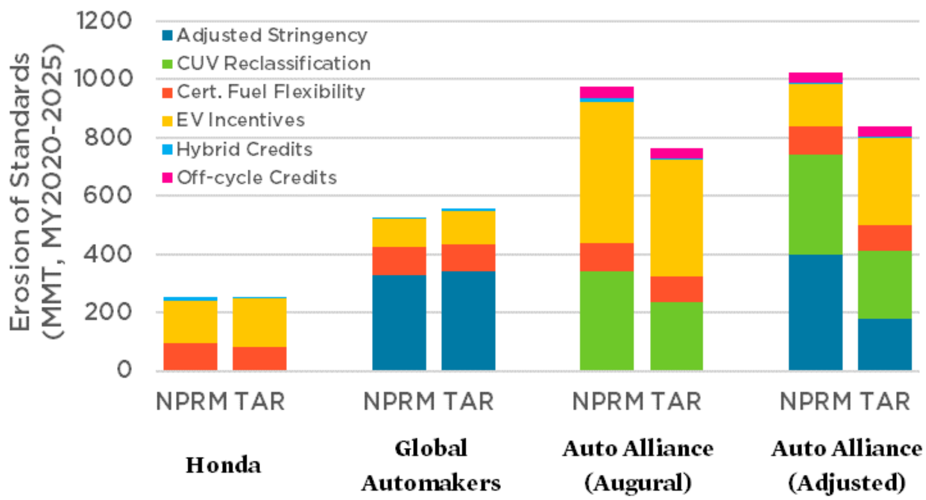
Figure 2 shows the environmental impacts of the CO_2-related flexibilities of each proposal, differentiated by specific flexibility. It should be noted that this breakdown is approximate—while the aggregate losses for a given scenario may be clear, allocating those losses to specific mechanisms is not always well defined. For example, reclassifying vehicles as light trucks has a significant impact on stringency, which means its impacts are not additive to an adjustment of the curves themselves and explains the disparity in magnitude of the impact of stringency adjustment between the Global and Alliance (Adjusted) scenarios, even though the curves are equivalent between the two.

It is clear from Figure 2 that the automaker plans will lead to significant erosion in environmental benefits. However, it is also clear that some of these proposed flexibilities are significantly more detrimental than others. For example, even though there is absolutely no justification whatsoever for the hybrid credits proposed, since they support technology first deployed two decades ago in the U.S.,

[6] The lone exception to the additional technology requirements is the rollback itself, which requires minimal technology application. In this particular instance, the differences in the cost- and effectiveness curves, in addition to the model design itself, result in subtle shifts in the marginal costs of the so-called "lowest hanging fruit," leading to cylinder deactivation, increased aerodynamics, advanced accessories, and advanced transmissions playing a larger role in compliance with the rolled back standards using the NPRM model as compared to the TAR model.

the credit is small enough that in a performance-neutral scenario it neither nets a strong increase in deployment nor a strong backlash in benefits.[7] On the other hand, extension of electric vehicle incentives lead to substantial reduction in benefits in all scenarios, particularly when combined with an increase in the advanced technology vehicle multiplier. The largest loss of benefits, however, stems from the Global Automaker proposal to reduce the stringency of the curves.[8]

FIGURE 2. Environmental impact of automaker-requested flexibilities under two different compliance models



While all modeled automaker requests would result in a weakening of the current standards, the impacts of these requests vary widely, with the levels of stringency, magnitude of advanced technology vehicle multipliers, and reclassification of utility vehicles playing an outsized role in reducing the environmental benefits of any proposal.

Note: Due to interaction between the different requests, these bars represent an approximate breakdown of the lost benefits to present an estimate of scale. It does not represent the impact of the various flexibilities/requests in isolation.

Comparison to administration proposals

Much of our analysis has focused on demonstrating the loss in benefits relative to the current standards. However, it is worth considering to what degree these proposals may or may not be an improvement upon the current proposal to freeze standards at 2020 levels.

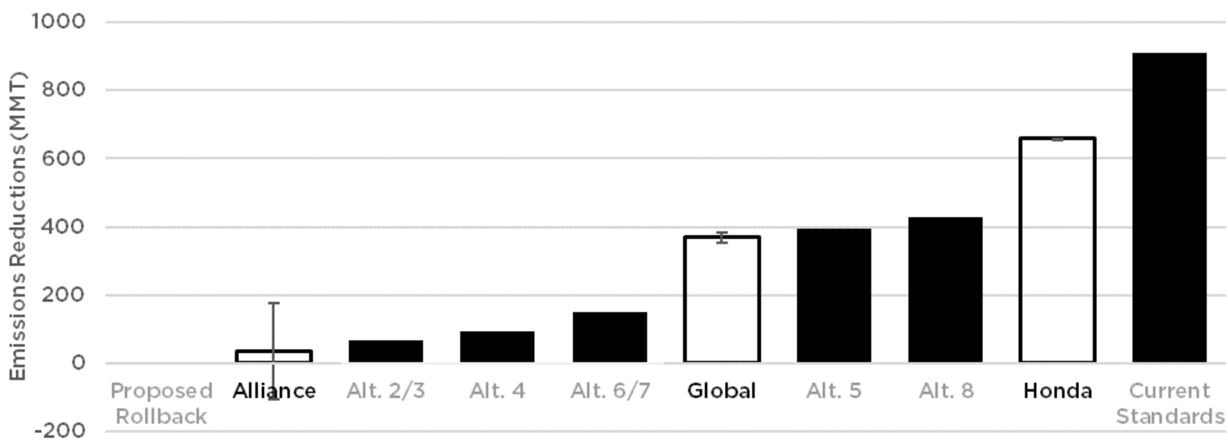
Table 2 shows that all proposals represent a significant shortfall compared to the current standards. However, it is also important to consider these automaker proposals not just in light of what we have

[7] The "performance neutral" aspect of this modeling is important for this particular credit. For example, a manufacturer may decide to deploy strong hybrid vehicles for performance purposes, thus earning credit for a technology even if it does not result in any improvement in fuel economy. Granting this credit may then be used to offset shortfalls in emissions performance elsewhere in its fleet. Our compliance modeling assumes that the technology is used solely for reduction in fuel, which maximizes the deployment of the technology and thus, may actually underestimate the share of vehicles taking advantage of this credit if a manufacturer applies some or all of the technology towards performance.

[8] While the Association of Global Automakers did not endorse a specific target, they cite the Novation Analysis in acknowledging that "year-over-year improvements in fuel economy and GHG emissions reductions are feasible and achievable, though not at the levels required under the current standards."

today, but other proposals from the administration. Figure 3 shows this comparison, using the rollback scenario as a baseline by which to judge the benefits of a given proposal.

FIGURE 3. Benefits of automaker and administration proposals for LDV greenhouse gas emissions regulations



The administration considered a number of alternatives in its proposed rulemaking, though none would yield even half the benefits of the current standards. Proposals from automaker trade groups, it turns out, were not any better. Honda's proposal represents the highwater mark for the industry, though it, too, falls well short of the current standards.

Note: Alternatives 3 and 7 are nearly identical to alternatives 2 and 6, respectively, with the only difference being the loss of credit for off-cycle and air-conditioning efficiency technologies. Because we do not model any voluntary improvement in efficiency, based on a multi-decade history of worsening fuel economy in response to flat standards, we do not consider any change in benefits between the respective alternatives.

From Figure 3, it is clear that though the Alliance may profess that the administration is not giving them exactly what they have asked for, our analysis finds that it is, within error, statistically no different than a rollback.

On the other hand, the Global Automakers proposal would likely yield benefits somewhere between Alternatives 5 and 6—these proposals represent the weakest proposal maintaining the current standards through 2021 and the strongest proposal that begins setting new standards in 2021. Both proposals yield less than half the benefits of the current standards.

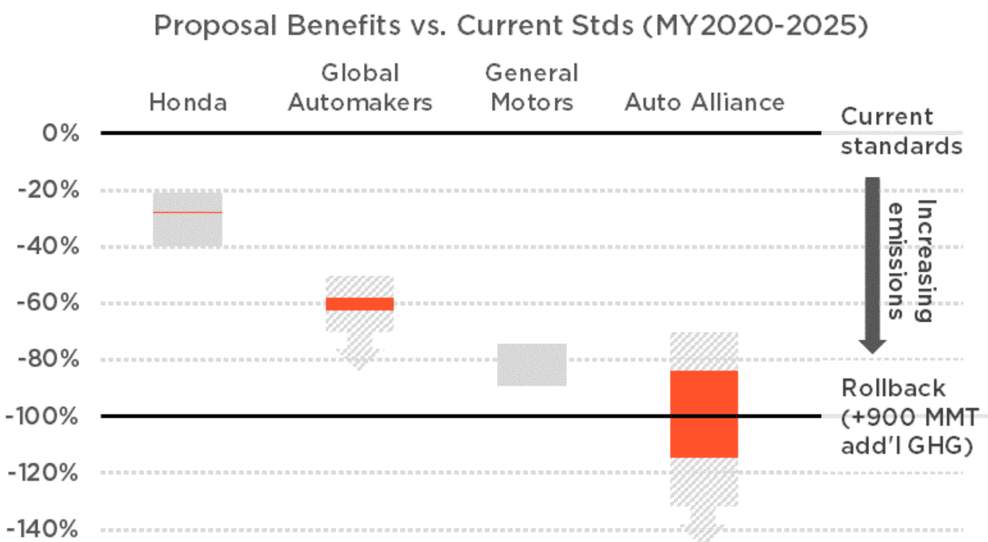
Honda's proposal is considerably better than any alternative proffered by the administration. This is largely because the proposal represents adopting a short list of flexibilities and maintaining the current level stringency. However, even this proposal represents a significant erosion from the current standards.

Alternatives 5 and 8 are nearly identical to alternatives 4 and 7, respectively—the reason for the large disparity in benefits stems from maintaining the current standards through 2021, instead of 2020. This is an indicator of just how lax the administrations' proposals are when compared to the current standards.

Comparison to previous analyses

When the proposals were first submitted to the docket, we estimated the potential impacts based on a range of estimated penetrations in consideration of previous models of potential deployment (Cooke 2018b), including modeling efforts from both the current and previous administration (Figure 4, gray bars). This whitepaper supplants those initial estimates with modeled compliance under the proposed scenarios, which takes a more holistic approach to compliance rather than the previous aggregate estimation of the effects of each proposed flexibility change (Figure 4, red bars). By modeling compliance with the proposals in their entirety, we are able to narrow the range of potential outcomes by including the ways in which various changes to flexibilities may change decisions by automakers on which technologies to deploy.

FIGURE 4. Impact on greenhouse gas emissions of different automaker proposals for 2021-2026 flexibilities



Even the most beneficial positions by major automakers would represent a step backwards from the standards we have today, even if the stringency of the underlying curves were left intact. Our analysis shows that the magnitude of some of these proposals are so large that they could erode the standards as much as the flat-line alternative preferred by the Agency we have noted here as a "rollback."

Note: The hashed boxes indicate uncertainty around the year-over-year improvement requested by the organization, while the ranges reflect uncertainty about technology adoption. Gray boxes represent prior analysis using estimates of technology adoption based on individual flexibilities, while red boxes indicate a range of outcomes based on modeling compliance considering the interaction of various requested flexibilities. Arrows indicate additional, unquantified changes which would further shift the benefits of the proposal, including changes to the off-cycle program. Due to the nature of GM's proposal, which prescribes separate standards for gasoline-powered and electric vehicles, it was not necessary to further model interactive compliance strategies using flexibilities.

Reinforcing the robustness of the current analysis, our more rigorous effort to estimate the impacts of these automaker proposals falls in line with our original estimates, but with a narrower range of possible outcomes (Figure 4).

CONCLUSIONS

The two automaker trade associations, representing between them virtually every manufacturer on the planet, have formally requested that the administration adopt proposals which are comparable, and in some cases worse, than the alternatives examined by this administration for 2021 and beyond.

Though the requests vary in breadth and scope, the technology-specific incentives show little, if any, growth in more advanced powertrains as compared to the standards that are on the books today. Our compliance modeling of the requested flexibilities is an indication that the primary purpose of these “incentives” is to overcredit technologies manufacturers would already adopt under the current standards, undermining the standards in the process. Technology-focused incentives may reward specific technologies, but they undermine the need for technology deployment overall, thus frequently resulting in ***lower*** deployment of the technologies being incentivized.

While the discussion over the requested flexibilities may play a role in the finalization of federal greenhouse gas emissions standards through 2025 or 2026, this analysis serves to identify concerns that could be even more critical beyond 2025. For example, the amount of emissions lost by increasing the advanced technology vehicle multiplier serves as an important reminder of the impact these incentives can have under any significant penetration of electric vehicles and, especially, when magnified by excluding any accounting of the upstream emissions from those vehicles. Similarly, the impact of reclassifying vehicles without altering the standards to reflect such changes in regulatory structure is a critical reminder that the benefits of a rule are not strictly set by stringency of any curves, and altering the rules mid-course can do severe damage. Even the Honda proposals indicate the degree to which altering the flexibilities of a regulation can lead to an erosion of the benefits.

With EPA and NHTSA neglecting their constitutional responsibilities, it is likely that leadership to drive the industry towards a more sustainable future will be left at the state level in the immediate future. If aspects of any of these automaker proposals are to be considered as part of that future, this analysis indicates that increasing stringency must be a necessary component of any adoption, lest such flexibility serve merely to severely diminish the benefits of the rule, as Global Automakers and the Auto Alliance currently propose.

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