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Summary of Final Rulemaking: Safer Affordable Fuel-Efficient Vehicles for Model Years 2021-2026: Part Two

On April 30, 2020, the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) (together, "the agencies") published the final Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule: Part Two (Final Rule).[1] The Final Rule is the second part of the SAFE Rule. EPA and NHTSA finalized the first part in September 2019, which included regulatory text under the Energy Policy and Conservation Act (EPCA) stating that any regulation of tailpipe carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions from automobiles or automobile fuel economy by a state or local government is expressly and impliedly preempted. The first part also withdrew the waiver for California's Advanced Clean Cars program. The September 2019 rule is currently in litigation in the D.C. Circuit Court of Appeals and D.C. District Court.

This second part of the SAFE Rule sets the Corporate Average Fuel Economy (CAFE) standards, under the jurisdiction of NHTSA, and GHG emission standards, under the jurisdiction of EPA, to increase in stringency by 1.5 percent per year above Model Year (MY) 2020 levels for MYs 2021-2026. The standards correspond to approximately a fleet-wide CAFE equivalent of 40.6 miles per gallon (mpg) and emission standard of 199 grams of CO_2-e per mile across passenger vehicles and light-duty trucks by MY 2026.

The final standards are lower than the 5 percent annual increase in stringency required under the regulations finalized by the Obama administration in the 2012 rule (the "augural standards"), but more stringent than the zero percent increase above 2020 levels, which was proposed by the agencies as the preferred alternative in the proposed SAFE Rule in August 2018 ("proposed standards"). The final standards apply to light-duty vehicles including passenger vehicles and light-duty trucks sold in the United States and maintain the existing vehicle-footprint-based method for calculating CAFE and emission standards.

The Final Rule is effective on June 29, 2020, 60 days after publication in the Federal Register.

Key Takeaways

- While the Proposed SAFE Rule's preferred alternative would have frozen fuel economy and emission standards at MY 2020 levels for MYs 2021-2026, the Final Rule requires an average annual increase in stringency of 1.5 percent for both fuel economy and emission standards above MY 2020 for MYs 2021-2026

[1] U.S. EPA & NHTSA, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks, available at: https://www.govinfo.gov/content/pkg/FR-2020-04-30/pdf/2020-06967.pdf.

for light duty passenger vehicles and trucks. The Final Rule's increase in annual stringency is, however, lower than the 5 percent annual increase required by the 2012 augural standards.

- EPA will continue to allow manufacturers to include air conditioning refrigerant and leakage improvement credits toward GHG compliance and makes no changes to existing methane (CH_4) and nitrous oxide (N_2O) standards.
- Though NHTSA acknowledges that it is statutorily required to set "maximum feasible fuel economy standards" for cars and light trucks, EPA disagrees that section 202(a) of the Clean Air Act (CAA) requires EPA to set standards that result in the greatest degree of emissions control achievable. EPA's modeling shows that on average, automakers will over-comply with the GHG standards.
- While NHTSA recognizes that technologies exist to meet the augural standards, the Final Rule focuses on what should be required to be added to new cars and trucks in order to conserve more energy and how to appropriately balance additional energy conserved and additional cost for new vehicles. Regarding consumer costs, NHTSA makes clear that it believes that consumers generally understand fuel costs and that it is not appropriate to require consumers to save more fuel over the longer term by spending more money upfront on any new vehicle purchase, even if such a purchase would lower overall costs to that consumer. NHTSA concludes that the value of energy conservation to consumers is less important since Congress passed the Energy Policy and Conservation Act.
- EPA also recognizes that technologies exist to lower emissions and meet the augural standards. EPA states that it "is afforded considerable discretion under section 202(a) of the CAA when assessing issues of technical feasibility and availability of lead time" and that it "has discretion in choosing an appropriate balance among the statutory factors." Although EPA notes that compared to the augural standards, the Final Rule will result in increased fuel consumption, emissions, and fuel costs for consumers, EPA states that it has the authority to consider overall cost impacts to consumers and concludes that "the upfront vehicle technology costs (and associated financing costs) are a more important factor."
- Overall, the net impact of the Final Rule, as compared to the augural standards, straddles net costs and net benefits, depending on the discount rate used. The CAFE standards could result in a $13.1 billion decrease in net benefits / increase in net costs (3 percent discount rate) or a $16.1 billion increase in net benefits (7 percent discount rate). The GHG standards are estimated to result in a $22 billion decrease in net benefits / increase in net costs (3 percent discount rate) or a $6.4 billion increase in net benefits (7 percent discount rate).
- The primary net benefits of the Final Rule accrue to automakers in the form of reduced compliance costs. Estimated traffic fatalities also decrease slightly, although it is not clear if these findings are statistically significant. Net costs increase for consumers (accounting for purchase price and fueling cost adjustments, as well as other factors) and emissions increase. The agencies introduce a new category of benefits called "implicit opportunity costs" in a sensitivity case that increases the estimated benefits to consumers from the Final Rule, but this is not a part of the primary cost-benefit analysis.
- Over their lifetimes, the vehicles affected by this rule would emit an additional 922.5 million metric tons of CO_2 (under an analysis of CAFE standards) or 867.2 million metric tons (under an analysis of the GHG standards). Emissions of volatile organic compounds (VOCs), nitrogen oxides (NOx), and particulate matter

(PM) are all also projected to increase as compared to the augural standards, resulting in increased negative health and welfare outcomes.

Background

On October 15, 2012, EPA finalized updated GHG standards for MYs 2017-2025, and NHTSA finalized fuel economy standards for MYs 2017-2021 and noted provisional augural standards for MYs 2022-2025.[2] EPA's standards for MYs 2022-2025 were subject to a midterm evaluation by no later than April 1, 2018 to determine whether to amend the standards for MYs 2021-2025. At the time, NHTSA would be required to take additional regulatory action to promulgate its standards for MYs 2022-2025. The finalized standards across light duty vehicles were approximately 54.5 mpg and 163 grams of CO_2-e per mile for MY 2025. On January 12, 2017, former EPA Administrator Gina McCarthy published the midterm evaluation, determining that compliance costs had fallen and the GHG standards for MYs 2022-2025 remained appropriate and should not change.

On April 13, 2018, EPA published a revised midterm evaluation concluding that the standards for MYs 2022-2025 were too stringent and committed to issuing less stringent standards.[3] On August 2, 2018, EPA and NHTSA released the proposed SAFE Rule (Proposed Rule) in which the agencies detailed a number of proposed regulatory alternatives. The proposed standards, referred to throughout as the preferred alternative, would have frozen the CAFE and GHG standards at the MY 2020 levels for MYs 2021-2026.[4]

On September 19, 2019, EPA and NHTSA jointly issued the final SAFE Vehicle Rule Part One Rule, which became effective on November 26, 2019. Part One included two actions: 1) finalization of new regulatory text under the Energy Policy and Conservation Act (EPCA) stating that any regulation by a state or local government that regulates tailpipe GHG emissions from automobiles or automobile fuel economy is expressly and impliedly preempted, and 2) withdrawal of the waiver for California's Advanced Clean Cars program. California's program includes criteria emission and GHG emission standards for passenger vehicles and light trucks model year MY 2009 and later, as well as zero-emissions vehicle (ZEV) targets.[5] Currently, a number of environmental NGOs, cities, states, clean

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2 EPA and NHTSA, Final Rule: 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards," 77 Fed. Reg. 62,624 (October 15, 2012), available at: https://www.gpo.gov/fdsys/pkg/FR-2012-10-15/pdf/2012-21972.pdf.

3 EPA, Mid-Term Evaluation of Greenhouse Gas Emissions Standards for Model Year 2022-2025 Light Duty Vehicles, 83 Fed. Reg. 16,077 (April 13, 2018), available at: https://www.gpo.gov/fdsys/pkg/FR-2018-04-13/pdf/2018-07364.pdf.

4 For a detailed summary of the August 2018 Proposed Rule, see https://mjbradley.com/reports/summary-epa-and-nhtsas-proposed-safe-vehicles-rule.

5 For more information on EPA and NHTSA's SAFE Rule Part One, please see MJB&A's September 2019 summary, available here: https://www.mjbradley.com/sites/default/files/MJBA-Summary_Final-SAFE-Rule-Part-One_2019-09-22.pdf.

energy and advanced transportation associations, and electric utilities and generators are challenging NHTSA and EPA's SAFE: Part One Rule.[6]

Final CAFE and GHG Standards

In this Final Rule, NHTSA and EPA set the annual increase in stringency for MYs 2021-2026 at 1.5 percent above MY 2020 for fuel economy and GHG standards, respectively. Emission and fuel economy standards are based upon a vehicle's footprint, with light trucks having, on average, a larger footprint than passenger vehicles. Using a footprint approach generally results in larger vehicles (i.e., vehicles with larger footprints) being subject to lower CAFE mpg targets and higher CO_2 grams/mile targets than smaller vehicles.

The standards are based on fleet average efficiency and GHG emissions rate for all vehicles produced in a given model year for sale in the United States by a manufacturer (as contrasted with vehicle safety requirements and certain criteria pollution requirements that are applicable on a vehicle-by-vehicle basis). The agencies note that while EPCA requires a lead time of at least 18 months between when the standard is finalized and an affected MY commences, NHTSA has taken the position that this requirement only applies if the agencies are increasing the standard. As the agencies are decreasing the standard, the Final Rule notes, the statutory lead time requirement does not apply.

Table 1 details estimated average orginal engine manufacuters' (OEM) fuel economy and emission standards for passenger vehicles and light duty trucks through MY 2026.[7] There are no changes to standards for MY 2017-2020.

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[6] Environmental NGO petitioners include Union of Concerned Scientists, Center for Biological Diversity, Conservation Law Foundation, Environment America, Environmental Defense Fund, Natural Resources Defense Council, Public Citizen, Inc., and Sierra Club. D.C Circuit, *Union of Concerned Scientists, et al. v. NHTSA*, D.C. Cir. No.19-1230. State and city petitioners include California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Pennsylvania, Maine, Maryland, Massachusetts, Minnesota, Michigan, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, Vermont, Virginia, Washington, Wisconsin, Washington, D.C., Los Angeles, New York City, and San Francisco. Other petitioners include Advanced Energy Economy and National Coalition of Advanced Transportation, which includes several electric utilities among its members, including Exelon Corporation and its regulated utility subsidiaries, Pacific Gas and Electric Company, Edison International, Portland General Electric, and Sacramento Municipal Utility District. Other electric sector petitioners include Calpine, ConEd, National Grid, New York Power Authority, and, through Power Companies Climate Coalition, Los Angeles Department of Water and Power and Seattle City Light. A separate case challenging just NHTSA's portion of the SAFE Vehicles Rule Part One is also pending in U.S. District Court for the District of Columbia, but has been stayed while briefing proceeds in the D.C. Circuit. D.C. District Court, *California, et al. v. Chao, et al.* (1:19-cv-02826).

[7] Actual compliance will vary by OEM and vehicle footprint based on formulas in the final rule; these estimates use an analysis fleet developed using MY2017 compliance data as of summer, 2019.

Table 1: Average OEM Required Fuel Economy and GHG Emission Standard for Light Duty Passenger Vehicles and Trucks

Model Year	Augural Standards (2012)[8]		Final Rule (2020)	
	CAFE (mpg)	CO_2 (g/mi)	CAFE (mpg)	CO_2 (g/mi)
2020	36.8	226	36.8	224
2021	38.8	211	37.3	214
2022	40.5	202	37.9	211
2023	42.4	193	38.5	207
2024	44.4	184	39.1	204
2025	46.5	175	39.8	202
2026	-	-	40.4	199

EPA is revising its regulations to not require manufacturers to account for upstream emissions associated with electricity use for electric vehicles and plug-in hybrid electric vehicles through model year 2026. Rather, compliance will only be based on tailpipe emissions performance and not include emissions from electricity generation until MY 2027. EPA also increases and extends the credit multiplier for natural gas vehicles to 2.0 for MYs 2022-2026 (increasing and extending the existing 1.3 – 1.6 credit in place through 2021).

In the Proposed Rule, EPA and NHTSA had proposed to reduce the stringency of emissions standards by excluding the CO_2-equivalent emissions contributions from air conditioning (A/C) refrigerants (which include hydrofluorocarbons (HFC), potent GHGs) and leakage, as well as N_2O and CH_4 emissions, from the calculation of tailpipe CO_2 emissions to comply with emissions standards. The Proposed Rule noted that these exclusions were "in the interests of harmonizing with the CAFE program," which "cannot account for such issues."

However, the Final Rule states that EPA now believes that "maintaining [the A/C refrigerant and leakage] element of its program is consistent with EPA's authority under section 202(a) of the CAA to establish standards for reducing emissions from [light duty vehicles]." In addition, EPA recognizes the "value of regulatory flexibility and compliance options," and concludes that the "advantages from retaining the existing A/C refrigerant/leakage credit program and associated offset between the CO_2 and CAFE standards... outweigh the disadvantages resulting from the lack of harmonization." Thus, in the Final Rule, EPA maintains the A/C refrigerant and leakage crediting program. EPA also notes that it is retaining the regulatory provisions related to the N_2O and CH_4 standards with no changes, specifically including the existing flexibilities that accompany those standards. Thus, EPA is not adopting its proposal to exclude N_2O and CH_4 emissions from average performance calculations after model year 2020 or any other changes to the program.

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[8] Source: Tables VII-4 and VII-6 of the Final Rule. Note that these values are produced by NHTSA's model, which are consistent with those presented for the Final Rule standards. Furthermore, the agencies have re-run the analysis of the augural standards using the same modeling assumptions as assumed under the final standards. Some may be more familiar with EPA's estimate of the average fuel economy achievement, which reaches 54.5 mpg by 2025. In the Final Rule, EPA and NHTSA note that this value is a laboratory estimate and based on a conversion of a CO_2 equivalent per mile, and not consistent with the NHTSA modeling.

Justification for Final GHG and CAFE Standards

NHTSA Justification

EPCA requires NHTSA to set fuel economy standards at the maximum feasible stringency that NHTSA believes manufacturers can achieve in that model year. EPCA also requires NHTSA to determine the maximum feasible stringency by considering four statutory factors: technological feasibility, economic practicability, the effect of other motor vehicle standards on fuel economy, and domestic energy conservation. The Final Rule notes that NHTSA may also consider factors such as safety and the environment; however, NHTSA states that it does not have the authority to consider compliance flexibilities that would reduce compliance costs.

In terms of lead time, the Final Rule notes that while many commenters argued that changing the MY 2021 standard without the required lead time (18 months) would penalize technologically advanced automakers and part suppliers that have already invested in updating their technology, NHTSA states that the lead time requirement in EPCA is only required for amendments that increase stringency. Because the Final Rule would reduce stringency, NHTSA states that the 18-month lead time is not necessary. The Final Rule makes clear "NHTSA believes that to the extent that some manufacturers have already invested in future fuel economy improvements, those manufacturers will continue to be well-positioned both to respond to increasing standards in the future, and to take advantage of any market demand for higher fuel economy/reduced tailpipe CO_2 emissions from consumers who put a premium on those aspects."

The following highlights some of the key points NHTSA includes related to its consideration of the statutory factors.

Technological Feasibilty

In response to comments that EPCA requires NHTSA to set technology-forcing standards, NHTSA states that the technological feasibility factor allows the agency to set standards that force the development and applications of new fuel-efficient technologies, but economical practicability "might caution the agency against basing standards…entirely on such technologies." The Final Rule further notes that:

> NHTSA continues to believe that, for purposes of this rulemaking covering standards for MYs 2021-2026, the crucial question is not whether technologies exist to meet the standards—they do. The question is rather, given that the technology exists, how much of it should be required to be added to new cars and trucks in order to conserve more energy, and how to appropriately balance additional energy conserved and additional cost for new vehicles. Regardless of whether technological feasibility allows the agency to set technology-forcing standards, technological feasibility does not require, by itself, NHTSA to set technology-forcing standards if other statutory factors would point the agency in a different direction.

Economic Practicability

The Final Rule states that "[e]conomic practicability has traditionally referred to whether a standard is one 'within the financial capability of the industry, but not so stringent as to' lead to 'adverse economic consequences, such as a significant loss of jobs or unreasonable elimination of consumer choice.'" The Final Rule outlines NHTSA's reasoning for this interpretation. For example, the Final Rule states that vehicle manufacturers have fixed research and development and production budgets, and if more of those budgets are directed at fuel economy, less is available to spend on other vehicle characteristics (such as advanced safety features, or better performance or

utility), which NHTSA concludes would improve sales. Additionally, NHTSA states that offering more expensive but more fuel-efficient vehicles "could lead to adverse economic consequences for those manufacturers" in a market where "many consumers are not particularly focused on fuel economy."

Effect of Other Motor Vehicle Standards on Fuel Economy

Recognizing that fuel economy and CO_2 reductions are inherently related, the Final Rule notes that NHTSA considered EPA's standards in developing the CAFE stringency. However, NHTSA notes that CO_2 stringency "does not and should not, by itself, dictate CAFE stringency." The Final Rule also makes clear that NHTSA does not believe it must consider EPA's standards for non-CO_2 GHG emissions stating that regulation of CH_4, N_2O and HFCs "affects fuel economy only indirectly, if at all." However, NHTSA states it is not appropriate to "reduce stringency below levels it believes to be maximum feasible solely for purposes of accommodating differences between programmatic flexibilities."

NHTSA also disagrees that it must consider state fuel economy or tailpipe standards stating that it would be "illogical for NHTSA to consider legally unenforceable standards to be 'other motor vehicle standards of the Government.'"

Energy Conservation

NHTSA notes that it has historically interpreted "the need of the United States to conserve energy" to mean "the consumer cost, national balance of payments, environmental, and foreign policy implications of our need for large quantities of petroleum, especially imported petroleum." While NHTSA agreed with commenters that consumer fuel costs are relevant to conservation of energy in the U.S., NHTSA also states that future fuel prices are uncertain and U.S. shale development "may reduce the negative price effects of global price swings."

Additionally, the Final Rule notes that historically NHTSA has included consideration of "national balance of payments" due to the concern that "importing large amounts of oil created a significant wealth transfer to oil-exporting countries and left the U.S. economically vulnerable." However, NHTSA concludes that given U.S. oil production, such a concern is reduced for the foreseeable future, and decided to not weigh this factor as heavily.

In response to comments that disagreed with NHTSA's reasoning in the Proposed Rule that increases in U.S. oil production reduced the foreign policy implications relevant to the need of the U.S. to conserve energy, the Final Rule makes clear that NHTSA "simply believes…that the risk is lower than it would have been in the absence of the rapid growth in U.S. oil production, and that the lower risk means that the need of the U.S. to conserve energy, from this perspective, is less dire than it was at earlier points in the program."

Thus, NHTSA states that while consumer fuel costs are a factor in energy conservation, "NHTSA believes…that American consumers generally understand fuel costs and their tolerance for fluctuations, and tend to purchase vehicles accordingly. Requiring consumers to save more fuel over the longer term by spending more money upfront on new vehicle purchases may involve more tradeoffs than suggested in prior rulemakings, and this rulemaking seeks to keep these possible tradeoffs in mind." Therefore, NHTSA reduced the importance of this factor in its consideration of final standards.

Environmental Implications

NHTSA notes that CO_2 emissions will be higher under the Final Rule compared to augural standards but points out that they will be lower than they would have been under the proposed standards. However, NHTSA states that "it does not agree…that Congress intended for NHTSA to set aside other statutory factors in determining what CAFE standards would be maximum feasible" to address environmental concerns such as climate change.

EPA Justification

Section 202(a)(1) of the CAA requires EPA to set technology-based standards based on "the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." Given that EPA has determined that GHGs endanger public health and welfare, EPA notes that section 202(a) requires EPA to issue standards applicable to emissions for GHGs. However, EPA also states that it "is afforded considerable discretion under section 202(a) when assessing issues of technical feasibility and availability of lead time and in weighing these factors." Additionally, EPA states that Congress did not specify the degree of weight for each factor; therefore, EPA concludes it "has discretion in choosing an appropriate balance among the statutory factors."

The factors EPA identifies as weighing in favor of increased stringency are criteria pollutant emissions associated with refining, CO_2 emissions, and consumer fuel expenditures. The factors that weigh toward reduced stringency include manufacturer compliance costs, per-vehicle cost savings, and safety. EPA also notes the goal of establishing GHG standards that are coordinated with NHTSA's CAFE standards. Additionally, while EPA recognizes that some alternative fuel automakers are earning significant tradable credits, EPA states that "building a program around the potential for acquiring credits from competing manufacturers is not the intention of this action."

Based on its consideration of the factors, EPA notes that it is "placing greater weight on the costs to industry and the up-front vehicle costs to consumers." EPA finds the costs to industry and automotive consumers too high under the augural standards and by "lowering the auto industry's costs to comply with the program, with a commensurate reduction in per-vehicle costs to consumers, the final rule is enhancing the ability of the fleet to turn over to newer, cleaner and safer vehicles." The following highlights some of the key points the Final Rule includes for each factor. A more detailed analysis of the quantitative modeling EPA and NHTSA use to argue these points is included in the following section.

Cost of Compliance

EPA recognizes that some commenters argued that the CAA only allows EPA to consider whether costs of compliance make it infeasible for manufacturers to meet standards within the relevant period (i.e., taking into account lead time). However, EPA disagrees with such interpretation, arguing that it "would be tantamount to suggesting that EPA must always set a standard to achieve 'the greatest degree of emission reduction achievable through the application of technology,'" which EPA makes clear is not its approach.

In terms of technological feasibility, in comments on the proposed standards, parties had highlighted that these technologies are available to meet the augural standards. In the Final Rule, EPA concludes that "the majority of these technologies," including engine and transmission technologies, vehicle mass reduction technologies, technologies to reduce aerodynamic drag, and a range of electrification technologies, "have already been developed, have been commercialized, and are in-use on vehicles today." However, EPA does not explain why

additional lead time is necessary to develop and apply the requisite technology, and states that "the final standards are projected to result in more modest penetration rates for advanced technologies that nonetheless will achieve an increased level of technology penetration compared to the standards applicable for MY 2020" and are based on EPA's consideration of costs, emissions impacts, safety, and consumer impacts. EPA also notes that the costs remain significant.

Consumer Costs and Choice

For costs to consumers, EPA highlights that compared to the augural standards, the Final Rule will result in increased fuel consumption and fuel costs for consumers. However, EPA states that it has the authority to consider overall cost impacts to consumers and concludes that "the upfront vehicle technology costs (and associated financing costs) are a more important factor" stating that a "consumer is more likely to buy a new vehicle at a lower up-front price even if that vehicle will incur a more-than offsetting level of fuel costs over its lifetime that will be borne by the first and all subsequent owners of the vehicle." Although some commenters argued that "consideration of consumer costs, including finance and insurance costs, cannot outweigh its public health mandate," EPA states that it "considered the effects of a range of potential standards across this entire set of factors" and took each into consideration in finalizing the standards. (For a more detailed explanation regarding the quantification of consumer impacts of this rule, resulting in net costs for consumers, see following section.)

EPA states that consumer demand is an additional consideration in setting GHG emission standards and, as noted above, EPA decides to place more weight on up-front vehicle cost savings for consumers in light of the "goal of accelerating the turnover of the motor vehicle fleet to safer cars that emit fewer criteria pollutants."

Additionally, EPA believes that the use of credits for compliance with augural standards indicates that those standards were not feasible. EPA states that "while credit trading may be a useful flexibility to reduce the overall costs of the program…[EPA] believes it is important to set standards that preserve consumer choice without relying on credit purchasing availability as a compliance mechanism."

Although some commenters argued EPA did not have the authority to consider consumer choice as factor in setting the standard, and that EPA's conclusions were not supported by evidence, EPA disagreed, stating that the finalized standards "will require more realistic penetration of advanced CO_2 emission technologies such as electrification—better ensuring that manufacturers will be able to provide vehicles that meet consumer demand."

Air Emissions

With respect to GHG and criteria air pollutant emissions, as noted above, the Final Standards are estimated to increase emissions compared the augural standards. Further, EPA acknowledges that the Final Rule analysis projects "increases in premature deaths, asthma exacerbation, respiratory symptoms, non-fatal heart attacks, and a wide range of other health impacts." However, EPA states that its air quality modeling approach overestimates foregone PM premature mortality benefits and that the 2012 rule "overestimated gasoline price projections in its baseline…overestimating the premature mortality benefits in that rule." EPA reasons that it "balances multiple factors in determining what standards are reasonable and appropriate," and disagrees that section 202(a) of the CAA requires EPA to set standards that result in the greatest degree of emissions control achievable. Thus, EPA states "on balance, the final standards…are justified and appropriate" given the lower vehicle purchase costs and associated impacts on consumers.

Safety

For on-road safety, EPA explains it considered changes in the use of vehicles, the relative mass changes, and the turnover of fleet to newer and safer vehicles. In both the Proposed Rule and Final Rule, EPA projects fewer traffic fatalities, which are the result of projected changes in driving behavior—people driving less due to greater fuel requirements and thus more expensive costs per mile. EPA notes that compared to the Proposed Rule, the magnitude of fatality reductions stemming from changes in mobility are less. EPA also states that a less stringent standard will create "less pressure on manufacturers to reduce mass in vehicles, which, for smaller passenger cars has negative safety implications when involved in accidents with heavier vehicles." Additionally, EPA notes that "as vehicle prices decrease compared to the previous standards, more consumers will be able to afford newer vehicles, which are significantly safer." Of note, the analysis recognizes that the fatality rate associated with mass reduction is not statistically significant, though it continues to include the quantification of these lives saved in its cost-benefit calculations.

Energy Security

Finally, with respect to energy security, EPA states that the U.S. has become a net exporter of petroleum, reducing energy security concerns.

Key Aspects of the Technical Analysis and Potential Impacts

EPA and NHTSA use a series of models to calculate the benefits and costs of the Final Rule and a range of alternatives (more detail on the modeling assumptions and modifications below; a list of the alternatives is provided in Appendix A). The agencies calculate social costs and benefits, private costs and benefits, and environmental and energy impacts separately for CAFE and GHG standards defining each regulatory alternative.[9] Given that the final standards and the alternatives are less stringent than the augural standards, the incremental benefits and costs for each alternative are typically shown as negative. In other words, each alternative involves forgone benefits and avoided costs. Environmental and energy impacts are correspondingly negative, involving forgone avoided CO_2 emissions and forgone avoided fuel consumption. The modeling also utilizes a "model year" perspective when reporting impacts as it considers the lifetime impacts attributable to vehicles produced in the model years regulated in this rulemaking, in the context of the vehicle fleet on the road during the production and sale of those vehicles.

[9] In some cases, the results for the CAFE standards vary quite significantly from the results from the CO_2 standards. The agencies explain that this is due to factors regarding how compliance is calculated under each rule. For example, civil penalties—including inputs regarding manufacturers' potential willingness to treat civil penalty payment as an economic choice—apply only to simulation of CAFE standards. On the other hand, some of the same manufacturers recently opting to pay civil penalties instead of complying with CAFE standards have also recently led adoption of lower-GWP refrigerants, and the "A/C leakage" credits count toward compliance only with CO_2 standards, not CAFE standards. The model accounts for this difference between the programs.

Key Benefits and Costs of the Final Rule

Overall, the net impact of the Final Rule compared to the augural standards straddles net costs and net benefits, depending on the discount rate used.[10] The CAFE standards could result in a $13.1 billion increase in net costs (3 percent discount rate) or a $16.1 billion increase in net benefits (7 percent discount rate). The GHG standards are assessed to result in a $22 billion increase in net costs (3 percent discount rate) or a $6.4 billion increase in net benefits (7 percent discount rate). As discussed more below, the primary source of cost reductions is to industry (particularly through reduced compliance costs), while societal benefits decrease signficantly.

Industry Compliance Impact

The agencies note that each technology that is added to a given vehicle increases costs. The modeling finds that the total industry compliance costs decrease by $100.6 billion under the CAFE standards, almost entirely due to technology costs, and by $86.25 billion under the GHG standards (both under a 7 percent discount rate).

The modeling also shows that automakers will continue to adopt efficiency and emissions-reducing technologies (and would do so in the complete absence of standards), though at lower rates than under the augural standards. For example, the modeling projects that under the Final Rule for GHG standards, fully electric vehicles would constitue 3.7 percent of the light duty vehicle market, while under the augural standards they would constitute 5.7 percent (and 2.7 percent under a full freeze of emissions standards).

Additionally, within the industry component of the analysis, the agencies note that the Final Rule would result in a reduction in jobs in the U.S. auto manufacturing sector of about 1.6 percent by 2030. The modeling did not consider labor impacts in adjacent sectors, such as fueling or maintenance. It does not appear that net job losses were monetized and included in the net cost and benefit calculations.

Vehicle Buyers (Consumer) Impact

The agencies' analysis projects net increases in consumer costs under the Final Rule as compared to the augural standard. Under the CAFE standards, average consumer costs decrease by $1,382 to $1,413 (based on discount rate used) over the life of the average vehicle, mostly from a decreased vehicle purchase price. However, at the same time, benefits decrease by $1,493 to $1,912, mostly from a decrease in fuel savings. Net, the analysis projects an increase in consumer costs of $110 to $499 per average vehicle. The consideration of alternatives shows that all other alternatives considered would also increase net costs, but the more stringent targets would have less of a negative impact on consumers (see Appendix A for catalog of the alternatives considered).

The analysis of the GHG standards projects similar results though with even greater costs for consumers, with costs decreasing between $1,258 and $1,286 while benefits decrease more, from $1,538 to $1,965. Thus, the GHG program on a net basis increases consumer costs by between $280 to $678 per vehicle.

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[10] A key sensitivity of the analysis is the discount rate used to translate future costs and, especially, benefits, to current dollars. Because money is more valuable now than later (since it could be invested or put to another use that could generate additional money), it is appropriate to discount future costs and benefits. Because often benefits of a rule accrue over a longer period of time (i.e., more in the future) and costs are often incurred earlier in the analysis period, a higher discount rate can decrease the "total benefits" of the rule compared to the costs. The Final Rule uses 3 percent and 7 percent rates throughout the analysis. A 7 percent annual rate is a commonly used private discount rate (i.e., reflective of private firms' time value of money), and is often used in rulemakings. However, a 3 percent rate is often used for social costs and benefits and/or for longer-term (or intergenerational) costs and benefits.

Societal Impact

Societal impacts in the analysis include changes to traffic crash fatalities, congestion, and emissions of GHGs and criteria pollutants.

These stated totals exclude the results of a new category of benefits described by EPA and NHTSA as an "implicit opportunity cost." The agencies describe this as the value to consumers of forgoing other vehicle attributes in favor of increased fuel economy (or using their scarce financial resources to invest in savings or the purchase of other goods that they prefer more than fuel economy). Such attributes could include trim levels, entertainment systems, crash avoidance technologies, which the agencies argue may be sacrificed to pay for higher fuel economy technology levels (although the analysis holds other technologies constant across the compliance scenarios). The agencies state that since this is "a forgone consumer surplus of other vehicle attributes… As such it is appropriately additive to the technology cost/savings estimated in the primary analysis." The agencies do not quantify the value of this new cost of fuel economy and emission standards, noting that they do not have the capability to do so, but they include an illustrative sensitivity case where they equate this cost to the value of the fuel savings delivered by the standards over the first seventy-two months of vehicle ownership, minus the value of the fuel savings over the first thirty months of vehicle ownership. Because this new category is, by definition, a benefit of less stringent standards compared to augural standards, this sensitivity case shows a significant increase in the benefits of the rule. Including the "implicit opportunity cost," total societal impact shows a net increase of benefits of $45.2 to $55.4 billion under the CAFE standards and $34.9 to $44.7 billion under the GHG standards.

One key component of societal impacts is the effect on emissions of GHGs and criteria pollutants. By 2030, the analysis projects that the Final Rule will increase CO_2 emissions by 4.5 percent, and 9 percent by 2050 (over the emissions calculated under the augural standards). Represented in tons, this means that over their lifetimes, the vehicles affected by this rule would emit an additional 922.5 million metric tons of CO_2 (under the CAFE standards) or 867.2 million metric tons under the GHG standards. In the section below, this summary highlights ways in which the calculation of these emissions estimates changes from previous analyses. One key change is that a greater portion of upstream oil refining is assumed to occur abroad, which decreases upstream total emissions impacts (which are limited to domestic impacts).

Consistent with the Proposed Rule, the agencies frame these emissions impacts in terms of total emissions and projected climate change impacts. For example, the Final Rule states that by 2100, global mean surface temperature will increase by 3.487 degrees (Celsius) under either the proposed or final standards, versus 3.484 degrees under the augural standards. This corresponds to "sea level rise in 2011 [sic – should be 2100] reaching 76.34 cm under the final standards, 76.35 cm under the proposed standards, and 76.28 cm under the augural standards." NHTSA writes that "the current state of science does not allow for quantifying how increased emissions from a specific policy or action might affect the probability and timing of abrupt climate change." It also writes that:

> [t]aking climate change into account elevates the importance of the "need of the United States to conserve energy" criterion in NHTSA's balancing. However, in light of the limits in what the agency can achieve, the potential offsetting impacts to the environment, and the statutory requirement to consider other factors, the impacts of carbon emissions alone cannot drive the outcome of NHTSA's decision-making.

The agencies also note that "because new vehicles are so much cleaner than older models, it is expected that under any of the alternatives considered here for fuel economy and GHG standards, emissions of smog-forming pollutants would continue to decline nearly identically over the next two decades." The agencies also state that "although many believe that more fuel-efficient vehicles are, by definition, 'cleaner,' most pollutants impacting air quality are regulated on an average per-mile basis, such that vehicles' 'cleanliness' is effectively independent from vehicles' fuel economy." However, the analysis estimates that the majority of criteria pollutants would increase under the Final Rule as compared to the augural standards (see Table 2). The agencies estimate that smog forming emissions would increase by 0.4 percent by 2030 and 2.2 percent by 2050.

Table 2. Change in Total Emissions Attributable Over the Lifetimes of Vehicles through MY 2029 (metric tons, compared to augural standards)

	CAFE Standards	GHG Standards
CO	-1.0	-1.0
VOC	174.4	147.5
NOx	20.5	25.5
SO_2	-7.2	22.4
PM	5.9	5.1

Table 2 shows the combined impact of both upstream and downstream criteria emissions. Of note, the rule specifies that NOx emissions are projected to decrease in early years as compared to the augural standards, but delayed adoption of electric vehicles drives up emissions over long term. The one exception to the general trend is sulfur dioxide (SO_2) emissions, which show a decrease under the Final Rule as compared to the augural standards due to upstream emissions. The agencies state that delaying the shift to electric vehicles leads to delays in emissions from electricity generation, and for SO_2, these emissions from electricity generation are large enough to reverse trends in overall emissions changes.

This increase in critiera pollutant emissions is projected to increase premature deaths, asthma exacerbation, respiratory symptoms, non-fatal heart attacks, work loss and minor activity days, and a wide range of other health impacts. For example, premature deaths are expected to increase by 164 to 1,000 (under the CAFE standards and GHG standards, respectively) and cases of asthma exacerbation are projected to increase by 5,000 or 14,000, in addition to increases in all other health impacts. The agencies use a value of statistical life (VSL) of $8.7 million to convert these deaths to societal costs and discount these values.

Key additional societal impacts of specific categories covered in the analysis of societal impacts include:

- Crash Fatalities: the analysis estimates that there will be between 3,269 to 3,344 fewer crash fatalities over the life of vehicles included in the analysis, mostly as a result of the model assuming that, with less efficient vehicles, consumers will drive less. Unlike the method used to convert the increase in projected fatalities due to air pollution (a societal *cost*) to dollars, these avoided fatalities (a societal *benefit*) are converted into dollars using a Department of Transportation-recommended VSL of $10.4 million per life, and are not discounted. Additionally, the agencies note that a portion of these results associated with vehicle mass reduction are not statistically significant at the 95-percent confidence level (though they are at

the 85-percent level, which the agencies state "are the best and most up-to-date estimates available... [and] offer a stronger statistical representation of relationships among vehicle curb weight, footprint and fatality risk than an assumption of no correlation whatsoever.")

- Vehicle Miles Traveled (VMT): the analysis estimates that the standards will result in 587 to 605 billion fewer VMT, again due to a decrease in vehicle efficiency (and thus an increase in the costs to drive).
- Fuel Consumption: the final standards are estimated to increase fuel consumption by 78.3 to 84.4 billion gallons, which includes fuel consumed by cars and light trucks produced during model years 1978-2017 that are on the road today during their remaining lifetimes, as well as fuel consumed by cars and light trucks projected to be manufactured during model years 2018-2029 over their entire lifetimes.

Key Assumptions and Modeling Changes

In the Final Rule, NHTSA and EPA state that their analysis of the final rule represents the best available science, evidence, and methodologies for assessing the impacts of changes in CAFE and GHG emission standards. They further state that the analysis represents an improvement over that of prior rulemakings. The agencies highlight three main categories of changes: changes in conditions, changes in assumptions, and changes in methods.

Conditions

The Final Rule considers how conditions have changed since the 2012 rule that impact fuel economy and GHG emission standards. For example, the agencies note that many alternative and electric vehicle models are now offered by manufactures that were not widely available when the 2012 rule was promulgated. The agencies note that with more alternative fuel and electric vehicles offered, manufacturers have increased the average fuel economy of their fleets since the 2012 rule. Additionally, the agencies note that not only has median fuel economy improved under the 2012 rule, but the range of available fuel economies for each vehicle class (passenger, SUV, pickup, etc.) has increased as well. The agencies write that "the range of fuel economies available in the new market is already sufficient to suit the needs of buyers who desire greater fuel economy rather than interior volume or some other attributes."

Additionally, the Final Rule notes that the fuel price projections for the 2012 rule compared to current fuel price projections vary significantly stating that "[l]ong term predictions are challenging and the fuel price projections in the 2012 rule were within the range of conventional wisdom at that time. However, it does suggest that fuel economy and tailpipe CO_2 regulations set almost two decades into the future are vulnerable to surprises…and reinforces the value of being able to adjust course when critical assumptions are proven inaccurate."

Assumptions

The Final Rule details four areas of assumptions that have changed between the modeling supporting the Final Rule and the augural standards: the value of fuel savings, technology costs, the application of the social cost of carbon (SCC), and safety neutrality.

The analysis of the augural standards projected steadily increasing fuel costs using NEMS, which resulted in larger consumer benefits as a result of fuel savings due to more stringent fuel economy standards. However, fuel price projections have dropped significantly since the 2012 analysis. The Agencies note that even under identical discounting methods and otherwise identical inputs in the 2012 version of the CAFE Model, the current (and historical) fuel price forecast reduces the value of fuel savings by $150 billion—from $525 billion to $375 billion

(in 2009 dollars). Furthermore, the agencies note that the model must acknowledge that fuel economy would continue to improve in the baseline under the fuel price forecast used in the Final Rule. In other words, all fuel savings under the Final Rule are not attributable to the regulation itself, but in some part due to an underlying market/preference for fuel economy. The agencies write that this "erodes the value of fuel savings attributable to the preferred alternative, and the number of gallons saved by the preferred alternative selected in 2012 drops from about 180 billion to 50 billion."

Second, the modeling for the Final Rule notes that fuel saving technology is responsive to applicable fuel economy standards, and that inclusion of a market response in all scenarios (including the baseline augural standards) has changed the total technology cost associated with a given alternative. By including a modest market for fuel economy, and preserving all other assumptions from the 2012 final rule, the incremental cost of technology attributable to the preferred alternative decreases from about $140 billion to about $72 billion. Another consequence of these changes is that the incremental cost of fuel economy technology is responsive to fuel price.

Third, the agencies reconfirm their use of a domestic-only calculation of the SCC. They note that if the analysis of the 2012 augural standards had utilized the same perspective on the social cost of carbon, the benefits associated with the preferred alternative would have been about $11 billion, rather than $53 billion.

Finally, the Final Rule notes that the analysis of the augural standards rule implied a "'safety neutral' compliance solution; that is, a compliance solution that produced no net increase in on-road fatalities for MYs 2017-2025 vehicles as a result of technology changes associated with the preferred alternative." However, the Final Rule disagrees with the 2012 rule that mass reduction technology (reducing the average weight of a vehicle) does not have safety implications. The Final Rule notes that "removing the restrictions on the application of mass reduction technology results in an additional 3,400 fatalities over the full lives of MYs 2009-2025 vehicles in the baseline, and another 6,900 fatalities over those same vehicles lives under the preferred alternative. The result [is] a net increase of 3,500 fatalities under the preferred alternative relative to the baseline." The agencies estimate that this produces a net social cost of $18 billion. As noted above, the factors used to calculate a small portion of these projected deaths are acknowledged to be not statistically significant but are included regardless; in addition, this calculation uses a different (higher) value of statistical life that that used for increased deaths due to air emissions increases.

Model Changes

Both agencies used the CAFE model to estimate manufacturers' responses to new CAFE and GHG standards and estimate various impacts, while EPA also uses the EPA's MOVES model to estimate tailpipe emission factors, DOE/EIA's NEMS to estimate fuel prices, and Argonne National Labs GREET model to estimate downstream emissions rates. EPA relied upon two purpose-built EPA models, ALPHA and OMEGA, in promulgating prior GHG emission standards.

Some environmental commenters, however, had noted that any EPA emission standard that relies on "any models other than ALPHA and OMEGA for CAA analysis would constitute an arbitrary and capricious delegation of EPA's decision-making authority to NHTSA, if NHTSA models are used for analysis instead." EPA and NHTSA reject this argument. In the Final Rule, the agencies emphasize their discretion to determine which models are reasonable and appropriate, with EPA noting that nothing in section 202 of the CAA mandates that EPA "use any specific model or set of models for analysis of potential CO_2 standards for light-duty vehicles," and that use of the

CAFE model allows for consideration of a number of factors in determining vehicle emission standards that are not assessable using the EPA ALPHA and OMEGA models. The agencies note that use of the CAFE model by both agencies also makes sense given that vehicle fuel economy and vehicle emissions are inextricably linked. Furthermore, the agencies note that the CAFE model is more user-friendly than the EPA's models.

Next Steps

The Final Rule becomes effective 60 days after its publication in the Federal Register, and litigiation is expected to commence once the rule is effective.

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Appendix A. Regulatory Alternatives Considered

The Final Rule includes consideration of regulatory alternatives including a no-action alternative (maintaining the 2012 rule) and six other action alternatives, with the final regulatory action referred to throughout as the "preferred alternative." The preferred alternative, the standard adopted in the Final Rule, was not included in the Proposed Rule.

Alternative	Changes in Stringency
Baseline No-Action	MY 2021 standards remain in place; MYs 2022-2025 augural CAFE standards are finalized and GHG standards remain unchanged; MY 2026 standards are set at MY 2025 levels
Alternative 1 (Proposed Rule, August 2018)	Existing standards through MY 2020, then 0%/ year increase for both passenger vehicles and light trucks for MYs 2021-2026
Alternative 2	Existing standards through MY 2020, then 0.5%/ year increase for both passenger vehicles and light trucks for MYs 2021-2026
Alternative 3 (Final Rule, March 2020)	Existing standards through MY 2020, then 1.5%/ year increase for both passenger vehicles and light trucks for MYs 2021-2026
Alternative 4	Existing standards through MY 2020, then 1%/ year increase for passenger vehicles and 2%/ year increase for light trucks for MYs 2021-2026
Alternative 5	Existing standards through MY 2020, then 1%/ year increase for passenger vehicles and 2%/ year increase for light trucks for MYs 2022-2026
Alternative 6	Existing standards through MY 2020, then 2%/ year increase for passenger vehicles and 3%/ year increase for light trucks for MYs 2021-2026
Alternative 7	Existing standards through MY 2020, then 2%/ year increase for passenger vehicles and 3%/ year increase for light trucks for MYs 2022-2026