Alliance for Automotive Innovation

Comments

Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards; Proposed Rule

Submitted to Docket ID Nos.
EPA-HQ-OAR-2021-0208
NHTSA-2021-0053

INTRODUCTION

The Alliance for Automotive Innovation ("Auto Innovators") [1] hereby submits comment on the U.S. Environmental Protection Agency ("EPA") proposal to revise light-duty vehicle greenhouse gas ("GHG") standards for model year ("MYs") 2023-2026 (the "GHG NPRM").[2] Due to the limited comment period, supplemental comments may be submitted by Auto Innovators following its closure.[3]

We have evaluated the EPA proposal in the context of ongoing, parallel actions being taken by the National Highway Traffic Safety Administration ("NHTSA") to update their Corporate Average Fuel Economy ("CAFE") regulations (the "CAFE NPRM")[4] and by the State of California to develop their Advanced Clean Cars 2 ("ACC2") proposal.[5] While these comments are specific to EPA's

[1] The Alliance for Automotive Innovation is the singular, authoritative and respected voice of the automotive industry. Focused on creating a safe and transformative path for sustainable industry growth, the Alliance for Automotive Innovation represents the manufacturers producing nearly 99 percent of cars and light trucks sold in the U.S. The organization is directly involved in regulatory and policy matters impacting the light-duty vehicle market across the country. Members include motor vehicle manufacturers, original equipment suppliers, as well as technology and other automotive-related companies. The Alliance for Automotive Innovation is headquartered in Washington, DC, with offices in Detroit, MI and Sacramento, CA. For more information, visit our website http://www.autosinnovate.org.

[2] Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43726 (Aug. 10, 2021). Hereinafter "GHG NPRM."

[3] Executive Order 12866 generally provides a 60-day comment period for significant rulemakings.

[4] Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks, 86 Fed. Reg. 49602 (Sep. 3, 2021). Hereinafter "CAFE NPRM."

[5] *Advanced Clean Cars II Meetings & Workshops*, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii-meetings-workshops (accessed Sep. 14, 2021).

proposal, Auto Innovators also touches upon the central theme of electrification that will play an increasingly important role in the success of each of these regulatory programs.

Auto Innovators supports the goals of EPA's GHG program: to drastically reduce greenhouse gas emissions from light-duty vehicles and to encourage a transition to electric and net-zero emission vehicles, including plug-in hybrid electric vehicles, battery electric vehicles, and fuel cell electric vehicles.

Additionally, it is essential for EPA and NHTSA (collectively "the Agencies") to coordinate with each other in preparing their respective rules through MY 2026 and to set harmonized standards. The Agencies should make every effort to reduce and avoid unnecessary burdens associated with multiple regulations set under the authority of differing statutes that ultimately affect light-duty vehicle design in the same ways. Therefore, we also refer these comments to NHTSA for their consideration in revising CAFE standards. We anticipate submitting additional comments to NHTSA specific to the CAFE NPRM.

We value your careful consideration of our comments. Auto Innovators represents automakers that produce nearly 99 percent of the new light-duty vehicles sold in the United States, Tier 1 suppliers, and technology and mobility companies. The auto industry remains an essential and important part of the U.S. economy and manufacturing sector, supporting more than 10 million jobs, and is responsible for 5.5 percent of our nation's gross domestic product.

Achieving a Net-Zero Carbon Transportation Future

Auto Innovators and its members are committed to achieving a net-zero carbon transportation future for America's cars and light trucks. We are ready to be part of a comprehensive, national strategy to transform our vehicles, our manufacturing, our workforce, and our fueling infrastructure to achieve an exciting, electrified future. For over 100 years, the automobile has evolved to meet the changing needs of our country and its users. This industry is poised to deliver the next phase of transformation, electrifying our fleet to achieve net-zero carbon emissions. We are confident that electrification can be successful, and that electrification will deliver uninterrupted mobility services that American families and businesses will benefit from. Together with public and private stakeholders, we can be successful in this transformation.

On the road today, there are over 280 million cars and light trucks[6] supported by a network of nearly 150,000 fueling stations.[7] Americans traveled almost three trillion miles in 2020 alone.[8]

Transforming our light duty fleet to electrification, and creating an ecosystem in which electrification can thrive, is a task that must be accomplished at scale and in a manner that ensures uninterrupted mobility for American families and businesses. This task is not just building great cars and trucks. It starts with securing access to critical raw minerals and establishing a secure network of logistics and processing that will deliver the flow of materials to new factories that will manufacture advanced batteries and electric drive components. Furthermore, we must train our workforce to build, service, and repair electric vehicles. We must also ensure that the vehicles are handled responsibly at end of life and that critical minerals circulate back into the economy. Our service stations will also need to evolve in order to fuel these new vehicles with electrons and hydrogen. Energy producers must also move in tandem to ensure that the new fuels are sourced from renewables and can be delivered affordably and at scale to our consumers and businesses. Automakers are committed to doing our share. Collectively, automakers have committed to investing more than $330 billion to transforming cars and trucks to an exciting, electrified future.[9] We believe electric vehicles powered by clean electricity, renewable hydrogen and other low- and net-zero carbon fuels will help deliver our contribution to our nation's ambitious climate goals.

We will be successful in this endeavor when we are aligned and moving forward together to achieve our shared goal of cleaner, safer, and smarter vehicles.

President Biden's Vision for a Low Carbon Future

From day one, President Biden has provided this industry with a clear vision to achieve a low-carbon transportation future for American families and businesses. The President has reestablished connections with his partners in the States, many of whom have been active in establishing decarbonization efforts within their own boundaries. He has refocused the efforts of executive branch agencies to develop near and long-term proposals to reduce carbon emissions and further enhance energy security for our cars and trucks. The President has demonstrated an "all-of-government" approach in seeking to implement climate policies throughout the Executive Branch. Furthermore, the

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[6] *U.S. Vehicle Registration Statistics*, Hedges & Company, https://hedgescompany.com/automotive-market-research-statistics/auto-mailing-lists-and-marketing/ (accessed Sep. 22, 2021).

[7] *Service Station FAQs*, American Petroleum Institute, https://www.api.org/oil-and-natural-gas/consumer-information/consumer-resources/service-station-faqs (accessed Sep. 22, 2021).

[8] *Moving 12-Month Total Vehicle Miles Traveled [M12MTVUSM227NFWA]*, U.S. Federal Highway Administration, retrieved from FRED, Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/series/M12MTVUSM227NFWA (accessed Sep. 22, 2021), Dec. 2020 datapoint.

[9] *Automakers and Suppliers Need to Adopt 'All-New Ways of Doing Business' to Master the Conversion to Electric Vehicles, Materials Shortages, the Rise of New Entrants and Other Disruptors Such as Autonomy and Connectivity, Says AlixPartners Analysis*, AlixPartners (Jun. 17, 2021), https://www.alixpartners.com/media-center/press-releases/2021-alixpartners-global-automotive-outlook/ (accessed Sep. 14, 2021).

proposals in the President's signature Build Back Better plan, combined with the bipartisan Infrastructure investment agenda, are seeking to commit once-in-a-generation levels of investment into America's manufacturing, fueling, and roadway infrastructure, and in helping consumers transition to new electric vehicles.

Combined, these efforts demonstrate the sheer scale of work needed to align and fund the many sectors that will be involved in achieving and supporting the successful transformation of our vehicles to electrification. Ambitious regulatory programs coupled with equally ambitious national investment plans signal the level of commitment needed to continue and accelerate our path to achieving our nation's climate goals.

Achieving Electrification Success through Cooperation and Shared Responsibility

Our national success in achieving a zero-emission future is a shared and collective responsibility that will demand immediate and sustained action from many partners. As the President has established an "all of government" approach to addressing climate change, so too must an "all in" approach to transforming America's manufacturing base, workforce, fueling infrastructure and vehicle fleet be established. Necessary actions to support the transition to electric vehicles ("EVs", including battery electric, plug-in hybrid electric, and fuel cell electric vehicles) and to make the proposed GHG standards a success include, but are not limited to:

1. Supporting American drivers with reliable and convenient EV refueling infrastructure

A 2021 National Academies report on improving light-duty vehicle fuel economy (the "NASEM Report")[10] cites location and availability of charging stations as the number one reason for a consumer to avoid an electric vehicle.[11] EV recharging and hydrogen fueling infrastructure availability and visibility will be critical to promoting EV market growth and supporting manufacturer sales targets to both meet the proposed standards and long-term electrification goals. Home charging will cover some needs, but not all. State and federal governments, together with private sector charging companies, have the opportunity to establish a fueling infrastructure plan that will provide confidence to American drivers that they will never be afraid of running out of fuel. Auto Innovators supports the National EV Charging Initiative.[12] In the long run, over 250 million light-duty vehicles will need to be supported with convenient, affordable, and reliable EV and hydrogen fueling.

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[10] *Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2025-2035*, National Academies of Sciences, Engineering, and Medicine, Washington, DC: The National Academies Press, 2021, available at https://doi.org/10.17226/26092 (accessed Sep. 9, 2021). Hereinafter "*NASEM Report"*.

[11] *Id.* at 5-135.

[12] *See EV Charging Initiative,* National EV Charging Initiative, https://www.evcharginginitiative.com/ (accessed Aug. 26, 2021).

2. Helping consumers bridge near-term cost premiums with purchase incentives

There is much uncertainty regarding EV price parity with internal combustion engine ("ICE") vehicles, and while some segments may achieve this earlier than other segments, we do not expect this to occur prior to 2030 for some more popular segments and likely later for others. Many consumers may be unable, or simply unwilling, to shoulder the higher upfront cost premiums. Purchase incentives help to close the price gap and drive EV sales. A study by Resources For the Future finds that federal income tax credits resulted in a 29 percent increase in EV sales.[13] Federal, state, and local governments have the opportunity to put in place rebates and other incentives to drive market share for electric vehicles.

With the goal of significantly increasing the number of EVs on the road, purchase incentives should fully apply to the broadest range of vehicles and be available to the broadest range of consumers. Incentives should be applicable to vehicles produced by all manufacturers (including by raising or eliminating the current per-manufacturer cap), non-discriminatory between companies, and widely available to preserve consumer choice as more EVs come to the market across all models and price points.

3. Fleet purchase requirements

Over 8 million cars and trucks are owned by fleet operators in the U.S.[14] Fleets represent a significant opportunity for electrification given regular routes and often centralized fueling. Federal, state, local, and private fleets have an opportunity to demonstrate leadership in accelerating adoption of EVs. Recently, Auto Innovators wrote to the California Air Resources Board ("CARB") in support of such requirements as part of CARB's ACC2 rulemaking.[15] Fleet purchase requirements are especially logical in jurisdictions that have specific EV sales requirements. Reaching high EV sales goals will require substantial fleet, in addition to retail, market penetration.

4. Policies to support development of EV and battery manufacturing and domestic supply chains, including critical minerals

At present, most critical minerals necessary for the production of advanced EV motors and batteries are mined and processed outside of the United States, primarily in China. Additional domestic sources and processing capacity are needed to supply EV production and encourage domestic manufacturing and jobs.

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[13] Jianwei Xing, Benjamin Leard, Shanjun Lee, *What Does an Electric Vehicle Replace?*, Working Paper 19-05, Resources for the Future (Feb. 2019), https://www.rff.org/publications/working-papers/what-does-electric-vehicle-replace/ (accessed Aug. 26, 2021).

[14] *U.S. Automobile and Truck Fleets by Use,* U.S. Department of Transportation Bureau of Transportation Statistics, https://www.bts.gov/content/us-automobile-and-truck-fleets-use-thousands (accessed Sep. 14, 2021).

[15] Letter from Alliance for Automotive Innovation to Richard Corey, Executive Officer, California Air Resources Board, "Zero Emission Vehicles – Requirements for Fleets" (Aug. 20, 2021).

5. A nationwide low carbon fuel standard program

Low carbon fuel standards are a market-based approach to decarbonizing transportation fuel and driving funds toward incentivizing EVs.

6. Development of a battery and EV recycling system in the United States

As EV manufacturing in the U.S. grows, the demand for critical minerals will also. In addition, as today's EVs are retired, a robust recycling system is required to ensure valuable components of EVs, such as batteries and the metals within them, are reused and recycled. Auto Innovators is actively working with government and recycling industry stakeholders to develop such a system.

7. Increased research and development investments

EVs remain relatively more expensive than equivalent ICE vehicles. Significant additional research is required to achieve the cost reductions projected and hoped for.

8. Consumer education programs

Additional consumer education and advertising campaigns can help promote the purchase of EVs.

9. Continued actions and commitments by automakers to improve the availability, variety, and affordability of EVs in the United States

Manufacturers are on pace to debut almost 100 pure electric models by the end of 2024.[16]

10. Metrics and milestones that align with nationwide EV sales targets

For the nine above action items, development of specific metrics to track progress and identify milestones linked to EV sales targets will be critical. This will ensure the necessary conditions for success are being developed and provide federal, state, and local governments with guidance on policies and funding needed to expand electrification across the nation.

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[16] *Hot, New Electric Cars That Are Coming Soon*, Consumer Reports (Dec. 30, 2019, updated Sep. 9, 2021), https://www.consumerreports.org/hybrids-evs/hot-new-electric-cars-are-coming-soon-a1000197429/ (accessed Sep. 14, 2021).

COMMENTS ON THE PROPOSAL FOR MY 2023-2026 GHG STANDARDS

Executive Summary

- Auto Innovators generally supports EPA's proposed GHG standards with appropriate and necessary flexibilities included in the program.

- Auto Innovators opposes the adoption of the more stringent and less flexible alternatives discussed in the proposed rule.

- Auto Innovators supports the goal of 40 to 50 percent new vehicle market share for EVs (including battery electric, plug-in hybrid electric, and fuel cell electric vehicles) by 2030, but action is needed today to implement ten specific policies to grow EV sales significantly through model year 2026 and beyond.

- Coordination between EPA and NHTSA, and harmonization of the stringency of their respective GHG and CAFE standards, is critical to reducing unnecessary burdens that distract from the common goals of reduced GHG emissions and fuel consumption.

The Need for Near-Term Supportive Actions

Auto Innovators and our member companies are aligned with this Administration's goals and vision for addressing climate change and fostering a strong and competitive U.S. economy. We support the goals of EPA's GHG program: to reduce greenhouse gas emissions from light-duty vehicles and to encourage a transition to EVs, including battery electric, plug-in hybrid electric, and fuel cell electric vehicles.

Actions must start now to ensure the necessary conditions are in place for manufacturers to meet the proposed standards through MY 2026. Meeting the proposed standards will be a challenge, requiring significant increases in EV market share in only four model years. EPA projects a 7.8 percent market share for EVs by MY 2026[17] (a threefold increase from calendar year 2020 at 2.5 percent[18]). NHTSA projects an even higher 13 percent EV penetration by MY 2026[19] (a fivefold increase). According to recent estimates shared by IHS Markit in August 2021, auto manufacturers are planning sales of battery electric and plug-in hybrid electric vehicles to reach approximately 23 percent of new

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[17] *Regulatory Impact Analysis: Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards*, U.S. Environmental Protection Agency, EPA-420-R-21-018 (Aug. 2021), at 4-18 (Table 4-23). Hereinafter "GHG RIA."

[18] *Electric Vehicles Sales Dashboard*, Alliance for Automotive Innovation, https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard (accessed Sep. 24, 2021), at Explore the Electric Vehicle Sales Dashboard, ATV Market Share, Registration Month Jan. 2020 to Dec. 2020, Filter FCEV, BEV, PHEV. Hereinafter "*Electric Vehicle Sales Dashboard*."

[19] CAFE NPRM (*supra* note 4) at 49760 *et seq.* (Tables V-15 and V-18, Alternative 1, model year 2026).

light vehicle sales in the U.S. market in 2026.[20] While such levels are possible, a market and necessary supporting conditions and policies must be in place to achieve them.

Manufacturers are also already announcing plans to reduce or eliminate investments in ICEs.[21,22,23,24,25,26] Some automotive executives are saying that they no longer intend to develop new ICEs, are no longer setting aside significant money for new ICEs, or that ICEs will only get incremental work.[27]

Others, such as policymakers, may suggest that little or no investment is needed in ICE technologies because they are "off-the-shelf" or present in the fleet today. This view ignores that technologies can't simply be "bolted on" to existing engines. Instead, they must be carefully integrated into existing designs, requiring engineering resources, and in many cases, new engine designs. A new engine design can cost as much as $1 billion.[28]

Thus, it is critical that EPA, NHTSA, CARB, Auto Innovators, automobile manufacturers, suppliers, technology companies, and other stakeholders work together to make sure this rule sets the right balance – to provide greater GHG benefits in the near term, to encourage and enable a shift to EVs and other net-zero emission vehicles, and to continue to support U.S. auto jobs. The revised EPA GHG

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[20] IHS Markit Sales Based Forecast June 2021, U.S. sales.

[21] "Mercedes-Benz Prepares to Go All-Electric," Mercedes-Benz Media Newsroom USA (Jul. 22, 2021), https://media.mbusa.com/releases/release-ee5a810c1007117e79e1c871354679e4-mercedes-benz-prepares-to-go-all-electric (accessed Aug. 26, 2021). "Investments into combustion engines and plug-in hybrid technologies will drop by 80% between 2019 and 2026."

[22] Hannah Lutz, "Shifting into E," Automotive News (Jul. 26, 2021). "Some existing vehicles, such as the Chevy Malibu and Camaro, won't stick to the standard cadence of face-lifts and redesigns. Instead, they'll ride out the current generation before making way for EVs."

[23] Jordyn Grzelewski, "Ford Slated to Spend More On EVs Than On Internal Combustion Engine Vehicles in 2023," The Detroit News (Aug. 2, 2021).

[24] Lindsay Chappell, "All-In On EVs," Automotive News (May 17, 2021). "Mini will become an all-electric brand by early 2030, and the British marque *will roll out its last new combustion engine variant in 2025*." (*Emphasis* added.)

[25] Bibhu Pattnaik, "Audi Will Not Introduce ICE Vehicles After 2026, No Hybrid Vehicles Either," Benzinga (Jun. 19, 2021), https://finance.yahoo.com/news/audi-not-introduce-ice-vehicles-160320055.html (accessed Aug. 26, 2021.)

[26] Mike Colias, "Gas Engines, and the People Behind Them, Are Cast Aside for Electric Vehicles," The Wall Street Journal (Jul. 23, 2021). "Auto executives have concluded, to varying degrees, that they can't meet tougher tailpipe-emission rules globally by continuing to improve gas or diesel engines… Over the past several decades, auto makers in most years rolled out between 20 and 70 new engines globally, according to research firm IHS Markit. That number will fall below 10 this year, and then essentially go to zero, the research firm said."

[27] *Id.*

[28] *Id.*

regulations must balance these policy goals with a market and ecosystem for EVs that are still developing and highly uncertain; in the context of major, increasing investments in EVs and declining or eliminated investments in ICEs; and while recognizing the limited opportunity to incorporate major changes through vehicle redesigns between MY 2023 (which starts in as little as three months) and MY 2026 (beginning less than four years from now).

Comments on Greenhouse Gas Standards

In January 2021, Auto Innovators wrote to President Biden in support of "promptly reestablish[ing] a national program for automobile GHG emissions that includes California and all other states," noting that addressing near-term GHG regulations through MY 2026 would "provide regulatory clarity, advance our shared environmental goals, and lay the foundation for future efforts."[29] Our letter highlighted three objectives:

- A revised national program that includes California, brings all automakers under a unified set of common requirements and ensures a level, competitive playing field;
- This program should achieve improvements in GHG emissions roughly midway between current standards and those of the former Obama Administration, and balance environmental progress, safety, affordability, innovation, and jobs; and
- This revised, industry-wide national program should take the opportunity to modernize the current regulatory approach to focus on GHG emissions, which presents one of the most pressing environmental policy goals the nation faces. It should also support vehicle electrification in the market, with a range of compliance incentives, including expanded multipliers for electrification, and reforms that will be complemented by other important federal, state, and local investments and policies that support the transition to a zero-emission future.

EPA's proposal meets many of the broad objectives outlined in that letter. We are therefore generally supportive of the goals and approach of the proposal, but provide the following more specific comments on its details.

<u>The Proposed GHG Standards for MYs 2023-2026</u>

Auto Innovators generally supports EPA's proposed GHG standards with appropriate and necessary flexibilities included in the program.

Auto Innovators generally supports the proposed GHG standards, but complementary policy measures to greatly expand the EV market are critical to manufacturers' ability to meet them. Fueling infrastructure, supply chains, recycling industry, purchase incentives and more will be necessary. Necessary complementary measures also include recognition of the zero tailpipe emissions of vehicles operating on electricity or hydrogen, and various flexibility mechanisms including EV production

[29] Letter from Alliance for Automotive Innovation to President Biden (Jan. 25, 2021).

multipliers for at least model years 2022 through 2025.[30] The proposed targets and flexibilities establish a strong foundation for additional standards in subsequent years.

Meeting the proposed MY 2023 targets will be challenging.

EPA proposes to increase the stringency of MY 2023 targets by 10 percent relative to MY 2022.[31] This unprecedented leap in stringency with virtually no lead-time will be a challenge for at least some manufacturers to meet.

In MY 2019, the last year for which EPA has published data, automakers on average trailed annual performance targets for both the passenger car and light truck fleets,[32] meaning an even greater rate of improvement is necessary to close that gap and achieve performance requirements in future years. Based on estimated targets under the proposal for MY 2023,[33] manufacturers on average will need to improve the passenger car fleet performance by 19%, the light truck performance by 31%, and the overall performance by 21%, relative to MY 2019, in only four years to meet such a target, or will need to continue to consume previously banked over-compliance credits. The future availability of such credits is limited for many manufacturers, and there are no guarantees that credits potentially offered for sale by some manufacturers will be available for all or purchased in advance by a limited few.

According to the most recent IHS Markit "Baseline Study,"[34] fleet average performance improved in MY 2020 but continued to fall short of annual requirements (Figure 1). Comparing MY 2020 values from the Baseline Study to those estimated by EPA for the NPRM, manufacturers would

[30] Please see our additional comments on "Advanced Technology Vehicle Production Multipliers" in the "Comments on Technology Incentives, Technology Credits, and Regulatory Flexibilities" section below.

[31] GHG NPRM (*supra* note 2) at 43731.

[32] *The 2020 Automotive Trends Report*, U.S. Environmental Protection Agency, EPA-420-R-21-003 (Jan. 2021). Hereinafter "*2020 Trends Report*."

[33] GHG NPRM (*supra* note 2) at 43732 (Table 1).

[34] *Model Years 2012 to 2020 Baseline Study*, IHS Markit (Sep. 1, 2021). Hereinafter "*Baseline Study*." Included as Attachment 1. The Baseline Study is sponsored by Auto Innovators. This latest version assesses MY 2020 performance, credits, standards, and compliance based on near final or final data from the manufacturers of approximately 99% of the vehicles sold in the United States. The data is supplemented by IHS Markit with its own vehicle and registration data where manufacturer data was unavailable (*e.g.*, manufacturers that are not members of Auto Innovators).

have to improve U.S. fleet average performance, net of credits, by 18% overall between MY 2020 and MY 2023 to meet the proposed MY 2023 targets.[35]

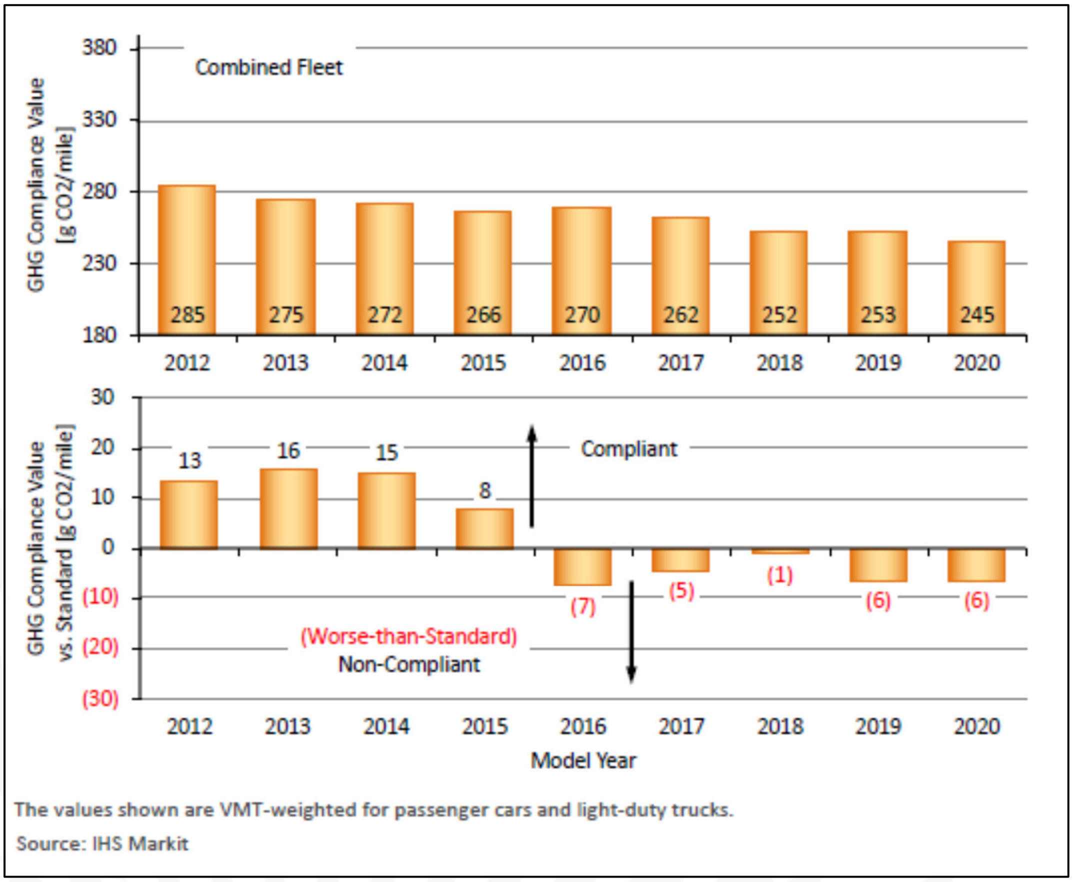

Figure 1: Combined passenger car and light truck annual GHG performance and comparison to annual targets, MYs 2012-2020. Source: Baseline Study (*supra* note 34).

These types of performance gains are usually only obtained through combined vehicle and powertrain redesigns or significant market shifts in powertrain choices. Given that four years is a short time for vehicle redesigns and extremely short for powertrain redesigns, it is unlikely that the entire fleet would be improved to this level. Thus, the burden would fall to a combination of changes to the smaller volume of vehicles actually redesigned and potential fleet mix changes where those actions fall short.

IHS Markit also assessed MY 2020 fleet performance against future targets including MY 2023 (Figure 2). Only 11.6 percent of vehicle production in MY 2020 meets MY 2023 targets. Assuming a normal distribution of vehicles above and below target, this would need to be improved to roughly 50 percent between MYs 2020 and 2023 for the fleet on average to meet its annual target (or higher to generate credit). Note that, despite the presence of some EVs in MY 2020, with only 41 percent of

[35] Calculation by Auto Innovators based on data from *Baseline Study* (*supra* note 34) at 82 and GHG NPRM (*supra* note 2) at 43732, Table 1.

production meeting or exceeding annual targets (Figure 2), the fleet as a whole is still a net deficit generator (Figure 1).

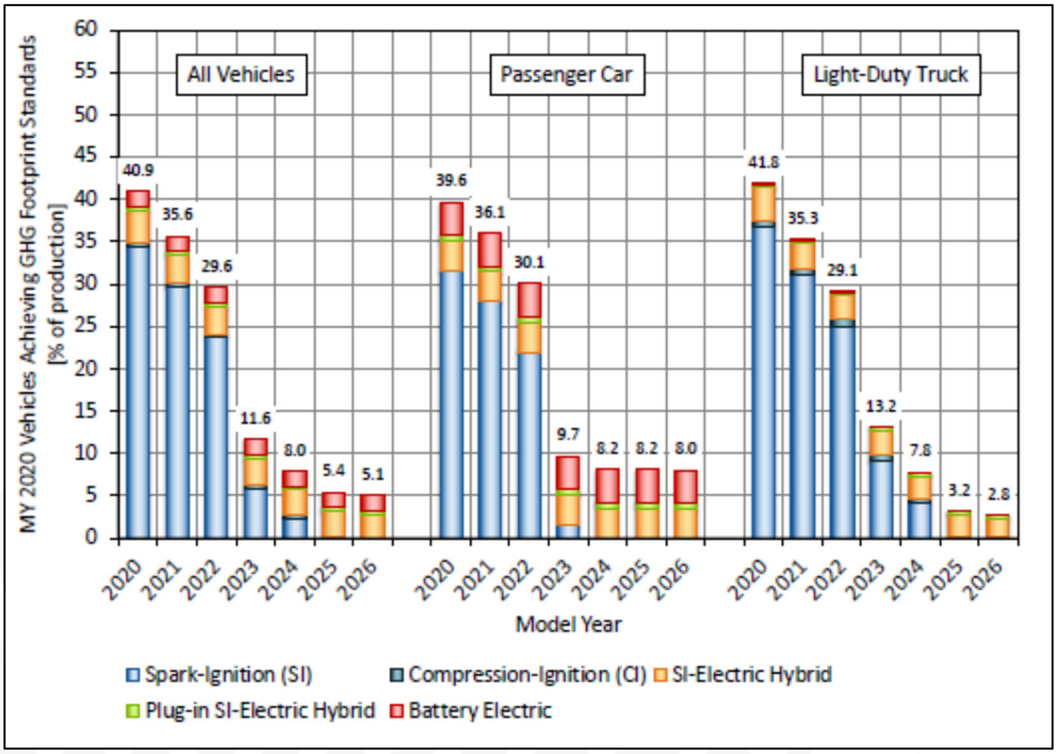

Figure 2: Sales weighted percent of fleet achieving existing (MY 2020-2022) and proposed (MY 2023-2026) GHG targets by powertrain type, assuming MY 2020 credit levels. Source: IHS Markit Baseline Study.

The proposed MY 2026 targets will likely require significant electrification.

As shown in Figure 2, MY 2020 vehicles (many of which already include ICE technologies modeled by EPA) were also assessed against the MY 2026 proposed targets. In the MY 2020 fleet, only EVs are capable of meeting the proposed MY 2026 targets. The same holds true for the proposed MY 2025 targets.

The projections of the Agencies also make it clear that significant increases in the EV market are anticipated. EPA projects a 7.8 percent market share for EVs by MY 2026[36], and NHTSA projects 13 percent.[37] According to recent estimates shared by IHS Markit in August 2021, auto manufacturers are

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[36] *Regulatory Impact Analysis: Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards*, U.S. Environmental Protection Agency, EPA-420-R-21-018 (Aug. 2021), at 4-18 (Table 4-23). Hereinafter "GHG RIA."

[37] CAFE NPRM (*supra* note 4) at 49760 *et seq.* (Tables V-15 and V-18, Alternative 1, model year 2026).

planning sales of battery electric and plug-in hybrid electric vehicles to reach approximately 23 percent of new light vehicle sales in the U.S. market in 2026.[38]

Regarding More Stringent Standards

Other stakeholders, such as environmental and health NGOs, have expressed their desire for EPA to adopt more stringent standards than proposed. These arguments fail to appreciate fundamental engineering timelines, namely that vehicles and powertrains are not redesigned every year, and that even redesigned vehicles have a limited engineering and design budget that must cover every need of a vehicle or powertrain program. Even more importantly, greater stringency will increase electrification needs even further, putting greater pressure on the development of the EV market while government legislators and others continue to debate the need for and quantity of complementary supporting measures.

Auto Innovators opposes adoption of Alternative 2.

EPA considered a more stringent “Alternative 2” that is broadly based on regulations finalized in 2012 (the “2012 Rule”) [39] that include the removal of proposed EV incentives and other flexibilities.[40]

Auto Innovators and its predecessor organizations noted many times during the midterm evaluation process that changes were necessary from the 2012 Rule. We re-affirm that position here, and as such, believe that returning immediately to the stringency of the 2012 Rule would be bad policy.

We therefore cannot support EPA’s Alternative 2. It is broadly the same as the 2012 Rule with an additional year of standards (MY 2026) defined. Moreover, based on the EV market and other challenges described above in our response to the proposed standard, Alternative 2 would be an unrealistic standard to meet in the near-term.

Auto Innovators opposes adoption of more stringent standards specific to model year 2026.

EPA requests comment on increasing the proposed MY 2026 standards by 5-10 g/mile.[41]

Increasing the proposed standards by another 5-10 g/mile in MY 2026 presumes that the lead-time provided is sufficient to make an even larger leap forward in stringency in the next four years. The development of the EV market and complementary policy measures remains highly uncertain. If, over the next several years, such uncertainties are resolved and a robust market for EVs is developing, it may

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[38] IHS Markit Sales Based Forecast June 2021, U.S. sales.

[39] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule, 77 Fed. Reg. 62624 (Oct. 15, 2012). Hereinafter “2012 Rule”.

[40] GHG NPRM (*supra* note 2) at 43738.

[41] *Id.*

be appropriate at that time for EPA to consider whether a stronger standard in subsequent (MY 2027 and later) years is warranted.

Comments on Coordination and Harmonization Between the EPA and NHTSA Proposals

In 2010, EPA, NHTSA, and CARB created the first "National Program" for regulation of fuel economy and GHG emissions. For their part, EPA and NHTSA issued a joint final rule with separate standards that generally accounted for statutory differences, resulting in roughly equivalent required fuel economy improvements under both programs. CARB, for its part, adopted a "deemed-to-comply" provision in its GHG regulation that allowed manufacturers to demonstrate compliance by meeting the EPA's GHG regulation. In the words of the Agencies, the National Program allowed "automakers to produce and sell a single fleet nationally, mitigating the additional costs the manufacturers would otherwise face in having to comply with multiple sets of Federal and State standards."[42]

Coordination among the regulatory agencies can create public and private benefits. Harmonized regulations allow manufacturers to focus their planning and investments to achieve fuel economy and GHG improvements while reducing the added challenge of meeting three differing federal and state regulations. The same environmental and energy-saving benefits can be achieved at a lower cost to consumers while supporting jobs in automobile manufacturing. Lower costs also result in faster fleet turnover by encouraging more new vehicle sales, replacing older vehicles with more efficient, cleaner, and safer new vehicles.

In 2007, the Supreme Court noted that although EPA's obligation to protect the public health and welfare may overlap with NHTSA's obligation to promote energy efficiency, "there is no reason to think the two agencies cannot both administer their obligations and yet avoid inconsistency."[43] It is our belief that, for the subject GHG and CAFE rulemakings, such inconsistency is best avoided by coordination between the agencies and harmonization of stringency to the fullest extent possible.[44]

Coordination and harmonization between EPA and NHTSA should result in GHG and CAFE regulations that allow manufacturers to build a single fleet of vehicles that complies with both regulations, and that does not interfere with the other agency's policy goals and statutory obligations. Developing such harmonized regulations requires the Agencies to assess their policies in the context of the other's proposal.

[42] Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25324, 25326 (May 7, 2010).

[43] *Massachusetts v. EPA,* 549 U.S. 497, 532 (2007).

[44] This approach may not hold for subsequent rulemakings as fleet electrification and use of alternative fuels continues to grow.

Coordination

Coordination between the Agencies should be improved in the development of final GHG and CAFE rules for model years 2023-2026.

It is clear from the Agencies' proposals and supporting analyses that coordination in preparing the proposals was minimal. The Agencies use different versions of the CAFE Compliance and Effects Modeling System ("CCEMS"), begin their analysis with different model year vehicles, and even use different assumptions for what the future mix of vehicles will look like. More importantly, the Agencies both fail to analyze how automakers would comply with the other's proposal, increasing the risk that one agency's proposal may be inconsistent with the other's. This topic is explored more thoroughly in our assessment of the Agencies' technical modeling, below.

Harmonization

Key differences between the Agencies' regulations and governing statutes should be considered when developing harmonized regulations.

Auto Innovators previously identified regulatory and statutory differences between the Agencies that affect harmonization of the stringency of their respective standards.[45] The Agencies should consider these differences and finalize regulations that are harmonized by MY 2026. Of particular concern is the treatment of EVs given the larger role they are expected to play through MY 2026 and beyond. Also, constraints on credit transfers (between compliance fleets) and trades (between manufacturers) have played a significant and growing role in the challenges manufacturers face in planning a single fleet that complies with CAFE, GHG, and other regulations such as the California zero emission vehicle mandate.

Comments on Alternative Standards for Small Volume Manufacturers

Auto Innovators appreciates and supports the inclusion and the maintenance of alternative fleet average standards for manufacturers with limited U.S. sales under the criteria set forth at 40 C.F.R. § 86.1818(g). To comply with provisions on fleet average GHG emissions, small volume manufacturers must intervene on substantial elements related to the primary characteristics of their vehicles. However, these actions must be consistent with their business models and investment sustainability. For these reasons, it is crucial that the option to apply for alternative GHG standards is maintained in this and future rulemakings so that the actions required under EPA's regulations are proportionate to the GHG emissions share for which each stakeholder is responsible.

[45] *See* Letter from Alliance for Automotive Innovation to Pete Buttigieg, Secretary, U.S. Department of Transportation and Michael Regan, Administrator, U.S. Environmental Protection Agency, "Harmonization of Corporate Average Fuel Economy (CAFE) and Light-Duty Vehicle Greenhouse Gas Stringency" (June 28, 2021), Docket ID EPA-HQ-OAR-2021-0208-0130.

Auto Innovators recommends that EPA consider process improvements to speed consideration and approval of petitions for alternative standards to provide more regulatory certainty and business stability.

Comments on Technology Incentives, Credits, and Regulatory Flexibilities

Auto Innovators appreciates and supports the inclusion of technology incentives that encourage the production and adoption of certain higher cost / market-challenged GHG-reducing technologies, credits for technologies such as off-cycle and air conditioning system improvements which provide on-road benefits, and regulatory flexibilities such as the fleet averaging and credit banking and trading program that allow better alignment of product plans to compliance requirements. These collective flexibilities have reduced compliance costs while enabling greater environmental benefits and/or encouraging the development and marketing of technologies expected to play a much greater role in GHG reductions in the future.

Such flexibilities do not "squander" emissions benefits as some stakeholders assert. Rather, they help to ensure a well-balanced program that achieves its near-term goals and enables greater future emissions reductions. EPA has taken care in past rulemakings and in this proposal to evaluate the costs, benefits, and emissions impacts of various flexibilities to ensure policy decisions are well-informed. In such evaluations, it is important for EPA and other stakeholders to understand that it is unlikely that any given manufacturer will fully utilize all potential flexibilities. Each manufacturer creates its own product plan and compliance strategies, utilizing flexibilities as each sees fit.

<u>Advanced Technology Vehicle Production Multipliers</u>

Auto Innovators supports EPA's proposal to extend the advanced technology vehicle production multipliers, particularly those for EVs ("EV Multipliers"). This existing policy flexibility has proven effective in incentivizing increased production and sales of EVs. Auto Innovators is aligned with EPA in recognizing that EV Multipliers have provided, and can continue to provide, a meaningful incentive for manufacturers to help drive additional EVs into the marketplace and to help overcome ongoing market headwinds. Auto Innovators agrees with EPA that electrification will play an increasingly important role, not only for the duration of this rule, but also for 2027 and later. Helping to bring technology to market that will be critical in delivering long-term, sustainable GHG reductions, even at the potential cost of near-term reductions, is a prudent policy choice for the current period during which EVs face higher incremental costs and ongoing challenges with public fueling infrastructure.

EV Multipliers have proven to be a successful incentive

EV Multipliers were originally limited to MYs 2017-2021. Through MY 2021, EVs were expected to be an emerging technology with limited customer acceptance due to higher upfront costs and a lack of sufficient public charging infrastructure. To help overcome these market barriers, the EV Multiplier provided a compliance incentive attractive to manufacturers, which in turn helped drive investment and deployment of volume beyond what might otherwise have been achieved. As EVs were expected to be low-volume through MY 2021, EPA did not cap or otherwise limit the potential effect of the EV Multiplier as there was not a concern for excessive program degradation. Through MY 2019, the 2020 Trends Report demonstrates that the EV Multiplier is being broadly used by many manufacturers, and that the overall levels of credits, while meaningful, are not excessively detracting from GHG reductions.[46] This illustrates that EPA met the two goals of creating a flexibility that is useful and not excessive in impact.

EV Multipliers remain a valuable tool to incentivize deployment of electric vehicles.

Some stakeholders oppose the adoption of EV Multipliers on the principle that excessive crediting of electric vehicles will allow manufacturers to cease improvements in conventional technology or to even "backslide" on emissions.

A recent unpublished paper by Dr. Kenneth Gillingham[47] provides an analysis of the potential impacts of EV Multipliers and potential problems with excessive crediting. Auto Innovators has not fully assessed the modeling presented within the paper, but the paper appears to provide an intuitive assessment that as EV costs (and manufacturer profitability) begin to converge with conventional ICE vehicles, the policy value of an EV Multiplier diminishes and could lead to increased overall fleet emissions. It is important to note, however, that the author appears to focus on cost parity and does not account for challenges with "utility" parity, meaning effects associated with market friction such as consumer concern over lack of public charging or concern with limited EV range or capability are not considered. Environmental advocates have cited this paper in opposition to EV Multipliers. In response, we draw EPA's attention to a key takeaway: when EVs are less profitable in the near-term and market share is low, there is "substantial induced innovation" and EV market share is likely to increase with higher EV Multipliers.[48] We posit that this is the very condition which EV technology and markets have experienced through MY 2021 (i.e. much higher costs and low market share) and that EVs may continue to experience, albeit at a potentially reduced level of disparity, through MY 2026.

Auto Innovators acknowledges that EPA must balance the incentivizing effect of an EV Multiplier in helping to overcome market barriers such as higher costs and limited refueling infrastructure against lower GHG and other benefits. EPA has accounted for these impacts in its benefit-cost analysis. EPA has also outlined the need to examine technology and market conditions anticipated for MYs 2022-2026 relative to today's conditions.[49]

Furthermore, EPA will need to consider the impact of a continued EV Multiplier on broad market success for the time period following this rule. Auto Innovators believes that while many of the underlying conditions of higher costs and consumer concerns will improve through MY 2026, some will

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[46] *2020 Trends Report* (*supra* note 32) at 83 (Figure 5.5).

[47] Kenneth Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," Yale University and National Bureau of Economic Research (2021), https://www.nber.org/papers/w29067 (accessed Sep. 5, 2021).

[48] *Id*. at 20.

[49] GHG NPRM (*supra* note 2) at 43757 *et seq*.

linger in the marketplace and therefore, the multiplier will still play an important role in helping to drive additional EV volume into the market.

Recent market data reveals that across the U.S., the overall adoption rate of electric vehicles remains relatively low at 2.5 percent new vehicle market in 2020.[50] One of the root causes of low adoption has been the higher costs associated with electric drive technology. For example, the National Academies of Sciences, Engineering, and Medicine ("NASEM") reported that in 2018 "[t]he incremental cost for BEVs are at least $8,500 for the medium car (i.e., $36,800 BEV150 versus $28,300 conventional) to about $26,000 for the long-range SUV (i.e., $57,000 BEV300 versus $31,000 conventional)."[51] These values from NASEM indicate cost disparities on an order of one third to over two thirds of the cost of conventional vehicles. This is far from price parity. Even with rapid reductions in annual costs over the past few years, manufacturers and consumers have faced significantly higher costs for EVs.

In the GHG NPRM, EPA describes that due to projected growth and expansion of the EV marketplace, electric vehicles should, through MY 2026, begin moving from an emerging technology into a transitional growth phase.[52] Manufacturer investment and increasing industry scale is expected to deliver cost reductions through the time period covered by the GHG NPRM. The NASEM Report projects that anticipated prices for EVs for segments such as small and medium cars could approach parity by 2024-2026,[53,54] but this would be for shorter range models, which are less attractive in the marketplace. For more popular segments such as crossover, SUV, and pick-up trucks, with ranges of 200+ miles, NASEM projects that these segments may not achieve price parity until 2026-2030,[55] beyond the time period covered by this NPRM. The U.S. new vehicle market has shifted heavily into these segments[56] and further capability associated with increased towing, cold weather performance, and off-road capability may delay these projected price parity timelines even further than what is reported by NASEM. As such, for the duration of this rule, it can be broadly summarized that while improving, there is projected to remain a lingering price disparity between EVs and conventional models. This disparity continues to support the basis of the EV multiplier to deliver "substantial induced innovation."

Separate from the issue of cost, there are several points of friction that EVs have and may continue to struggle to overcome. NASEM includes a summary of EV purchase avoidance reasons in its

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[50] *Electric Vehicle Sales Dashboard* (*supra* note 18).

[51] *NASEM Report* (*supra* note 10) at 5-139.

[52] GHG NPRM (*supra* note 2) at 43758.

[53] *NASEM Report* (*supra* note 10) at 5-140 *et seq*. (Figure 5.37).

[54] Auto Innovators members are still reviewing the NASEM cost projections for EVs, and have raised a number of concerns to the attention of the committee.

[55] *NASEM Report* (*supra* note 10) at 5-140 *et seq*. (Figure 5.37).

[56] *2020 Trends Report* (*supra* note 32) at 14 *et seq.*

report.[57] At the top of the list is location and availability of public charging infrastructure. Auto Innovators recognizes the efforts of many stakeholders, including many of our members, who have committed to expanding and improving the public charging experience. We are confident that efforts to broaden the availability of public charging will eventually help overcome this consumer concern. National recharging plans such as those envisioned within recently proposed Congressional funding bills will help to address this concern from consumers. Nevertheless, these remain significant and demonstrated barriers to adoption, and new charging networks will take many years of planning and construction to come online in the volumes needed to support ubiquitous availability. These are issues that, even with improving EV price parity, may continue to dampen consumer interest and further delay broad market adoption of EVs. Again, EV Multipliers have and will continue to prove to be a valuable compliance incentive that will help drive volume into the market even in the face of these headwinds.

The California Framework Agreements provide a model for EV Multipliers.

The California Framework Agreements,[58] which EPA cites as helping to demonstrate the feasibility of the proposed standards,[59] provide a potential model for EV Multipliers. Those agreements provide enhanced EV Multipliers in MYs 2020-2021 relative to the current EPA GHG rules, and EV Multipliers in general for MYs 2022-2026.[60] The agreements also incorporate a cumulative cap on credits equivalent to approximately 23 g/mile over MYs 2022-2025 (about 5.8 g/mile/year) or 32 g/mile over MYs 2022-2026 (about 6.4 g/mile/year).[61]

In contrast, EPA proposes new EV Multipliers for MYs 2022-2025 (one year less) and a much lower credit cap of 10 g/mile over four years (less than half that included in the California Framework Agreements).[62] We believe the inclusion of EV Multipliers for MY 2026 and a higher cap would better recognize the current state of EV technology and markets, and incentivize additional EV production.

Auto Innovators recommends that EV Multipliers be included through at least MY 2026.

We suggest that EPA include an EV Multiplier in MY 2026, and reconsider the need for such incentives beyond MY 2026 based on technology and market development in a subsequent rulemaking.

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[57] *NASEM Report* (*supra* note 8) at 5-135 (Figure 5.35).

[58] *Framework Agreements on Clean Cars*, California Air Resources Board, https://ww2.arb.ca.gov/resources/documents/framework-agreements-clean-cars (accessed Sep. 24, 2021). Hereinafter "*Framework Agreements*."

[59] GHG NPRM (*supra* note 2) at 43731.

[60] *Framework Agreements (supra* note 58). *See, e.g.,* BMW Framework, paragraph 30 as compared to 40 C.F.R. § 86.1866-12.

[61] *Id.* Calculation by Auto Innovators based on the difference between the "2.7 percent" and "3.7 percent" targets in the agreements, assuming MY 2020 fleet average passenger car and light truck footprints and fleet mix from *Baseline Study* (*supra* note 34).

[62] GHG NPRM at 43757.

This approach would better recognize the uncertain state of the EV market and complementary policies. It would also recognize the heterogeneity of manufacturer EV product plan development, where some manufacturers have already begun introductions and others are still developing EVs and would be most influenced by later incentives. Including EV Multipliers through MY 2026 would also be consistent with the California Framework Agreements, which EPA cites in support of its assessment of the feasibility of the proposed standards.[63]

Auto Innovators agrees that an EV Multiplier credit cap should be calculated on a cumulative basis.

Presuming adoption of an EV Multiplier credit cap, Auto Innovators agrees with EPA's proposed approach to apply the cap on a cumulative basis. The proposed approach provides some flexibility for manufacturers that may not be as prepared as others to immediately introduce additional EVs.

If EPA accepts our recommendation to include an EV Multiplier in MY 2026, the cumulative cap should be increased.

As previously described, Auto Innovators believes that an EV Multiplier will remain an appropriate policy tool to increase EV production in MY 2026. If EPA accepts our recommendation to include an EV Multiplier for MY 2026, we believe a higher cap should also be adopted to account for that additional model year to maintain the incentive value of the EV Multiplier.

The EV Multiplier credit cap should be increased in general.

A cumulative credit cap of 10 g/mile provides little incentive to increase EV production unless the entire incentive is taken in a single or very limited years. Auto Innovators believes additional EV production can be incentivized by a higher credit cap while still balancing with the policy goal to maximize near-term GHG benefits. More specific concepts to balance the incentive aspects of an EV Multiplier with current technology and market conditions, and with the environmental impacts of such an incentive, may be provided by individual manufacturers in their own comments.

EV Multiplier credits should not be considered a means of increasing standard stringency.

Auto Innovators is recommending that the EV Multiplier cap be increased in general, and potentially increased as a conforming change to the recommended inclusion of an EV Multiplier in MY 2026. However, we believe EV Multiplier credits should not be considered as a means of increasing or reason to increase the stringency of the standard.

Including EV Multiplier credits in an evaluation of the potential feasible levels of a GHG standard would effectively remove their value as an incentive, replacing it with a de facto requirement. In addition, not every manufacturer may make use of such incentives at the same time or to the same degree, depending on their product plans and how quickly they can be shifted based on the presence of such an incentive. EPA should keep EV Multipliers as an incentive to achieve the desired policy goal of increasing EV production and market share beyond that which would otherwise occur under the

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[63] GHG NPRM (*supra* note 2) at 43728.

proposed standards. Therefore, Auto Innovators recommends that an increase in the cap should not result in more stringent standards.

Off-Cycle Technology Credits

The off-cycle technology program provides credit for the on-road benefits of GHG technologies that are not observed in standard compliance tests. EPA has taken great care to ensure that credits granted under the program are reflective of on-road emissions reductions. In the case of the pre-defined "menu" of off-cycle technologies,[64] EPA chose conservative credit values and capped the amount of credit that can be claimed regardless of the absolute number of menu technologies incorporated in a manufacturer's fleet. In the case of credits made under an alternative method,[65] credits have only been granted after a lengthy review process. We concur with EPA's assessment that off-cycle credits do not result in deterioration of program benefits.[66]

In response to the off-cycle credit program, manufacturers and suppliers continue to develop innovative technologies that reduce on-road GHG emissions. Auto Innovators supports the continuation of the off-cycle credit program in general, revisions to reflect new technology innovations, and other modifications to allow the program to work more efficiently.

Auto Innovators supports raising the credit cap for on the off-cycle technology menu, effective MY 2020.

Auto Innovators supports raising the credit cap for the off-cycle technology menu. The current 10 g/mile cap was originally promulgated in the 2012 Rule and has become constraining to technology additions, particularly with the addition of new technologies. In the Safer Affordable Fuel-Efficient ("SAFE") Vehicles Rule ("SAFE Rule"), EPA added high efficiency alternator technology but did not raise the menu credit cap.[67] Adding additional technology without increasing the credit cap fails to recognize that additional benefits beyond the original conservative cap may be realized with added technologies.

The addition of high-efficiency alternators to the credit menu without increasing the cap is particularly problematic for manufacturers who have already been granted credit for them outside of the cap using the alternative method process. EPA discusses not allowing manufacturers to generate credit for on-menu technologies through the alternative process unless additional benefits through other

[64] 40 C.F.R. § 86.1869-12(b).

[65] 40 C.F.R. § 86.1869-12(d).

[66] GHG NPRM (*supra* note 2) at 43762.

[67] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks, 85 Fed. Reg. 24174, 25236 (Apr. 30, 2020). Hereinafter "SAFE Rule."

innovations can be demonstrated.[68] If EPA takes this approach, the original credit cap becomes even more constraining.

We recommend that the cap be raised to 15 g/mile, effective MY 2020, aligning with the timeline in the California Framework Agreements.[69]

An increased off-cycle menu cap should not be tied to modified technology definitions.

EPA is proposing to tie the proposed increase in the off-cycle menu cap to modified definitions for certain technologies.[70] We believe that these issues should be considered separately. The cap should be raised regardless of the decision whether to modify technology definitions or not and, if modified technology definitions are adopted, regardless of when a manufacturer applies the modified definitions. As described in our support for raising the cap in general, additional technology has been added to the menu, but the cap was not modified to reflect this addition. In the balance, it is unnecessary to tie an increase in the predefined technology credit cap to proposed modifications to certain technology definitions.

Auto Innovators supports timely additions of technology to the menu, but the cap must be increased as technologies are added.

Auto Innovators fully supports adding technologies to the predefined menu of off-cycle credits, but only if commensurate changes to the credit cap are made. Some technologies have found broad adoption across the industry following approvals under alternative methods. It makes sense to include these technologies in the menu. However, the credit cap should be raised commensurate with the potential benefits of the technologies under such a cap lest manufacturers forego technologies because they would not receive credit. As EPA notes, adding technology to the predefined list reduces the burden on manufacturers and EPA to evaluate off-cycle technologies through either the five-cycle or alternative methods, but potentially exacerbates the credit cap issue for some manufacturers.[71]

The lead-time for the adoption of new technology definitions for passive cabin ventilation, active transmission warm-up and active engine warm-up is insufficient; changes should take effect in MY 2027 or later.

EPA proposes to modify certain technology definitions effective MY 2023 (or sooner if a manufacturer wishes to receive a higher credit cap for predefined off-cycle technologies).[72]

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[68] GHG NPRM (*supra* note 2) at 43765.

[69] *See Framework Agreements (supra* note 58), *e.g.,* BMW Framework, paragraph 31(B).

[70] GHG NPRM (*supra* note 2) at 43763.

[71] *Id*.

[72] *Id*.

Model year 2023 vehicles can be built as soon as January 2022, leaving manufacturers only three to at most nine months to design, validate, and certify vehicles with systems that meet the new definitions. This lead-time is simply insufficient to make the necessary level of changes. In MY 2019, the fleetwide average use of active engine warmup, active transmission warmup, and passive cabin ventilation technologies resulted in a credit of approximately 3.6 g/mile.[73] Modifying definitions without sufficient lead-time would likely result in an immediate loss of most, if not all of this credit, further escalating the challenge of managing the large increase in standard stringency proposed for MY 2023.

The new definitions will require innovative solutions and significant changes to vehicle design to meet them. EPA should consider comments made on modified definitions, but it would be more appropriate to forego making any changes until a subsequent rule with a more typical amount of lead-time than that minimally provided under this rulemaking.

If EPA adopts new definitions for passive cabin ventilation, active engine warm-up, and/or active transmission warm-up technologies, EPA should also continue to recognize existing designs.

EPA justifies its proposal to modify technology definitions on the basis that current system designs are not meeting EPA's original expectations.[74] However, current system designs are providing off-cycle emissions benefits. Given the benefits of such systems, EPA should continue to provide credit for systems that meet existing definitions through the menu, in addition to newly defined systems. If EPA were to instead eliminate credit for existing systems entirely, especially with no lead-time, manufacturers may remove those existing technologies from their vehicles.

Thermal control off-cycle technologies should be combined with credits for improving the efficiency of air conditioning systems.

EPA includes "thermal control technologies" as a set of predefined technologies subject to a separate per-vehicle cap.[75] These thermal control technologies should ideally have been analyzed and administered in combination with the mobile air conditioning ("MAC") efficiency technologies from the earliest stages of the light-duty greenhouse gas regulation since they both address energy usage to power the air conditioning system.

We recommend that EPA move these technologies to the section on improving the efficiency of air conditioning systems (40 C.F.R. § 86.1868-12) and to combine and increase the caps on thermal control and air conditioning efficiency technologies as described below in comments on air conditioning efficiency technology credits.

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[73] *2020 Trends Report* (*supra* note 32) at 92, 95. Sum of active engine and transmission warmup credits (Table 5.3) plus estimate of passive cabin ventilation credits based on 70% application rate and approximately 2.0 g/mile credit for combined cars and trucks assuming a 44% car / 56% truck mix, consistent with overall fleet mix.

[74] GHG NPRM (*supra* note 2) at 43763.

[75] *See* 40 C.F.R. § 86.1869-12(b)(vii).

Auto Innovators recommends that EPA not cap credits for off-cycle electrical load-reducing technologies in MAC systems under the air conditioning ("A/C") efficiency technology menu.

Automakers and suppliers continue to develop technology innovations that reduce electrical energy consumption from various on-vehicle devices. Reductions in electrical energy consumption reduce GHG emissions and fuel consumption associated with alternator load (i.e., electrical generation). Such innovations also reduce stored energy consumption in EVs, improving range and reducing upstream power plant emissions. Whether the electrical load reductions occur in computer modules, electrical actuators, fans, entertainment systems, lights, A/C system clutches, or other areas, the effect is the same – a watt of reduced electrical load provides the same emission and fuel consumption savings benefits by reducing alternator mechanical power consumption.

Recently, EPA has considered alternative method off-cycle credit applications for several electrical load-reducing technologies in MAC systems. These include technologies that reduce A/C compressor clutch electrical (as opposed to mechanical) power consumption[76] and brushless fan motors.[77] EPA has taken the position that because the electrical load reductions are occurring in the A/C system, credits approved for these technologies should be included under the credit cap on the A/C system efficiency menu (40 C.F.R. 86.1868-12(b)). In developing the credit values for the A/C efficiency menu, EPA did consider improvements to A/C blower motor controls to limit wasted electrical energy. However, improvements to blower and fan motors themselves were not considered for the A/C efficiency credit menu, nor were they included in the research studies EPA relied upon in its determination of the maximum amount of A/C operation-related emissions that could be reduced. Similarly, improvements in A/C system compressor clutch designs to reduce electrical energy consumption were not considered.

Electrical load reductions have the same effect on emissions and fuel consumption regardless of what system they are found in, and were not fully considered by EPA in establishing an estimated maximum emissions benefit for A/C system efficiency improvements. Therefore, Auto Innovators recommends that EPA exclude new electrical load reducing technologies from the A/C efficiency menu credit cap.

Timely review, publication, and approval of alternative method off-cycle credit applications is needed.

Time is of the essence when a manufacturer submits an off-cycle credit application for review. Lengthy delays in processing applications and in reviews subsequent to the public notice and comment process introduce uncertainty into compliance planning and reporting for manufacturers. Delays also affect timely determinations of compliance and valuation of credit trades and transfers. They also

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[76] *E.g.,* Alternative Methods for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Applications From Toyota Motor North America, 85 Fed. Reg. 64143, 64144 (Oct. 9, 2020), "Denso LE40 Low Power Compressor Clutch."

[77] *E.g.,* Alternative Method for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Application From General Motors Corporation LLC (GM), 86 Fed. Reg. 17832 (Apr. 6, 2021).

discourage further investments in off-cycle technologies due to the uncertainty of when (or if) credit will ever be granted.

EPA is required to review an application for completeness and to notify the submitting manufacturer if additional information is required within 30 days.[78] Subsequent to determining an application is complete, EPA is required to make the application available to the public for comment within 60 days.[79] These two processes should collectively take a maximum of 90 days. Thus far in 2021, the three applications that reached publication in the *Federal Register* took 111,[80] 290,[81] and 342[82] days. Other applications are still pending review or publication for public comment.[83] We urge EPA to follow its regulations by providing an initial response on the completeness of credit applications within 30 days and to make complete applications available for public comment within 60 days.

Once the public comment period closes, the EPA decision process is also frequently lengthy. For example, EPA published off-cycle credit applications for public comment from Toyota in April 2020[84] and in October 2020,[85] from Nissan in February 2021,[86] and from Stellantis in April 2021.[87] As of September 2021, all are still pending a decision. We recommend that EPA establish a reasonable

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[78] 40 C.F.R. § 86.1869-12(e)(3)(i).

[79] 40 C.F.R. § 86.1869-12(e)(3)(iii).

[80] Alternative Method for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Application From General Motors Corporation LLC (GM), 86 Fed. Reg. 17832 (Apr. 6, 2021). Date of subject application – Dec. 16, 2021 (Docket ID EPA-HQ-OAR-2021-0234-0002).

[81] Alternative Method for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Applications From Nissan North America, Inc., 86 Fed. Reg. 8631 (Feb. 8, 2021). Date of subject application – Apr. 24, 2020 (Docket ID EPA-HQ-OAR-2019-0588-0004).

[82] Alternative Method for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Application From Fiat Chrysler Automobiles NV (FCA), 86 Fed. Reg. 17594 (Apr. 5, 2021). Date of subject application – Apr. 28, 2020 (Docket ID EPA-HQ-OAR-2021-0076-0002).

[83] NHTSA notes that 54 alternative method off-cycle credit requests have been submitted by manufacturers (CAFE NPRM, *supra note* 4, at 49836). Of these 45 have been published, leaving nine still in the initial review process (Auto Innovators review of published applications).

[84] Alternative Methods for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Applications From Toyota Motor North America, 85 Fed. Reg. 18227 (Apr. 1, 2020).

[85] Alternative Methods for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Applications From Toyota Motor North America, 85 Fed. Reg. 64143 (Oct. 9, 2020).

[86] Alternative Method for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Applications From Nissan North America, Inc., 86 Fed. Reg. 8631 (Feb. 8, 2021).

[87] Alternative Method for Calculating Off-Cycle Credits Under the Light-Duty Vehicle Greenhouse Gas Emissions Program: Application From Fiat Chrysler Automobiles NV (FCA), 86 Fed. Reg. 17594 (Apr. 5, 2021).

deadline (e.g., a maximum of 60 days following the close of the public comment period and any manufacturer rebuttal of public comments) to make a decision on alternative method credit applications.

Air Conditioning Efficiency Technology Credits

EPA provides credits for technologies that improve the efficiency of air conditioning systems.[88] Auto Innovators provides the following recommendations to improve implementation of these credits. If such changes cannot be made in the present rulemaking because they were not formally proposed, EPA should indicate in the final rule what changes it may consider in the future and act expeditiously to propose those changes as soon as possible.

The cap on A/C efficiency technology credits should be increased commensurate with more recent data from the National Renewable Energy Laboratory and the inclusion of thermal control technologies.

The basis for predefined A/C efficiency technology credits was EPA's estimate of the total fuel usage from light-duty mobile air conditioner usage in the U.S., which EPA estimated to be 14.3 grams CO_2 per mile, or 3.9% of total national light-duty vehicle fuel usage. [89]

The technologies identified for predefined A/C efficiency credits and the percentage efficiency improvement estimates for these technologies came primarily from the Improved Mobile Air Conditioner ("IMAC") industry-government Cooperative Research Program conducted through SAE International. IMAC was a partnership between EPA, DOE and 28 corporate sponsors, which published its final report in 2007. The IMAC program demonstrated an improvement of 36.4% in MAC efficiency using best-of-the-best designs at the time for these technologies on a test vehicle, compared to a baseline MAC system using a defined list of typical technologies in production at that time, such as a fixed displacement compressor.[90]

EPA estimated from the IMAC work that a 40% reduction in emissions was possible when employing the A/C efficiency menu technologies in the study. That reduction equates to a 5.7 g/mile CO_2 reduction (0.40 X 14.3 g/mi CO_2), which then became the capped credit value for employing the technologies on the A/C efficiency menu in the 2010 rulemaking for MY 2012-2016 vehicles.[91] The cap was modified for MY 2017 and later vehicles to separate caps for passenger cars and light trucks. The cap for predefined A/C efficiency technologies for MY 2017 and later is currently 5.0 g/mile for passenger cars and 7.2 g/mile for light trucks.[92]

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[88] *See* 40 C.F.R. § 86.1868-12.

[89] *Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards Regulatory Impact Analysis*, EPA-420-R-10-009 (Apr. 2010) at 2-30.

[90] *Id*. at 2-30.

[91] *Id*. at 2-40.

[92] 40 C.F.R. § 86.1868-12(b)(2).

EPA based its MAC efficiency credits on estimates of each technology's percentage impact on the total fuel usage by vehicle air conditioner systems in the U.S. However, EPA's 14.3 grams CO_2 per mile estimate of baseline air conditioner energy usage (3.9% of total light-duty fuel consumption) was well below the estimates of others, such as researchers from the National Renewable Energy Laboratory (over 6%), as well as longstanding benchmarks used by industry.

This baseline used by EPA, which was as low as half the baseline MAC energy usage estimated by the other major sources, resulted in MAC efficiency credits and an associated credit cap that are far below the actual real-world fuel savings and CO_2 reductions that are resulting from these technologies.

More recent estimates of baseline U.S. energy usage for light-duty vehicle air conditioners, using updated and refined models, have continued to significantly exceed the EPA baseline. In a series of studies released in 2017 by scientists from the National Renewable Energy Laboratory, the baseline MAC energy usage was calculated as 30.0 gallons of gasoline per vehicle per year, equivalent to 23.5 grams of CO_2 per mile.[93] The updated estimate from NREL of 23.5 grams CO_2 per mile is 64% greater than the EPA baseline of 14.3 grams CO_2 per mile.

The underestimated EPA baseline for MAC energy usage also impacts the credit caps and credit amounts in the off-cycle credit provisions for thermal control technologies, such as solar reflective paint, solar reflective glass, ventilated seats, and active or passive cabin ventilation. These thermal control technologies should ideally have been analyzed and administered in combination with the MAC efficiency technologies from the earliest stages of the light-duty GHG regulation, since they both address energy usage to power the air conditioning system.

Auto Innovators therefore proposes that the MAC indirect credit caps and the thermal control technology off-cycle caps be combined, and that the two lists of technologies be administered under a single set of caps. We further propose that the combined set of caps should be revised to reflect a 64% higher baseline energy usage for air conditioner energy, as shown in Table 1.

[93] C. Kreutzer et al., *U.S. Light-Duty Vehicle Air Conditioning Fuel Use and the Impact of Four Solar/Thermal Control Technologies*, SAE Thermal Management Systems Symposium at 23 (Oct. 10-12, 2017); C. Kreutzer et al., *Impact of Active Climate Control Seats on Energy Use, Fuel Use and CO2 Emissions: Test and Analysis*, SAE Thermal Management Systems Symposium at 26–27 (Oct. 10-12, 2017).

Table 1: Current and recommended MAC efficiency and thermal control credit caps; separate and combined

	Current Credit Caps			Recommended Credit Caps		
	MAC Efficiency	Thermal Control	Total	MAC Efficiency	Thermal Control	Total
Passenger Car	5.0	3.0	8.0	8.2	4.9	13.1
Light Truck	7.2	4.3	11.5	11.8	7.1	18.9

There are additional reasons to consider raising the cap on A/C efficiency credits.

EPA describes in its proposal to increase the off-cycle credit menu cap that the headroom under the cap has closed significantly for some manufacturers.[94] Similarly within the A/C efficiency credit program, some manufacturers have already reached the cap and are no longer able to receive credit for improving their A/C systems further. Manufacturers on average were at 84 percent of the cap in MY 2019.[95] This can lead to manufacturers eliminating or avoiding A/C efficiency technologies that put them beyond the cap, as well as suppliers losing incentives to develop new A/C related technologies with real-world benefits. Manufacturers are less likely to invest resources for implementing technologies on vehicles that have already achieved maximum credits.

EPA also mentions that expanding the number of technologies on the off-cycle credit menu without modifying the cap (such as the inclusion of high-efficiency alternator technology) creates additional difficulty for OEMs to get credit due to the limitations of the credit cap.[96] The A/C efficiency menu has also been expanded recently (i.e., high-efficiency compressor). In addition to the A/C efficiency menu expanding, the EPA has applied the A/C system efficiency menu credit cap for all A/C efficiency technologies approved under the alternative method off-cycle credit program. In some cases, said technologies provide an electrical efficiency benefit to the vehicle, but are counted toward the A/C efficiency cap because they are part of the A/C system. Inclusion of such technologies under the predefined A/C efficiency technology menu cap leads to additional constraints, further deterring manufacturers from making continuous improvements.

For the reasons listed above, it is reasonable to also increase the credit cap on predefined A/C efficiency technologies.

If the A/C efficiency (or combined A/C efficiency and thermal control technologies) menu credit cap is increased, EPA should not use this as a reason to further increase standard stringency.

As described above, it is unlikely that any given manufacturer will fully utilize all potential flexibilities. Increasing standard stringency under the assumption that every manufacturer will fully

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[94] GHG NPRM (*supra* note 2) at 43762.

[95] Calculation by Auto Innovators based on data from *2020 Trends Report* (*supra* note 32), Figure 5.10 (MY 2019 A/C credit data), Table 5.13 (passenger car production), Table 5.15 (light truck production) and 40 C.F.R. § 86.18686-12(b) (credit caps).

[96] GHG NPRM (*supra* note 2) at 43762.

utilize every flexibility ultimately results in a de facto requirement to either use that flexibility or commit to even higher levels of fuel economy technologies.

The Life-Cycle Climate Performance ("LCCP") Model (SAE J2766) should be recognized in regulation or guidance as a core method for determining the benefit of new A/C efficiency technologies that are not on the predefined list.

The LCCP model was developed in 1999, building on the work done by Oak Ridge National Laboratory in developing the Total Equivalent Warming Impact ("TEWI") metric. The model was jointly developed for mobile air conditioning use by GM, SAE, EPA, and the Japanese Automobile Manufacturers Association ("JAMA") to become the Global Refrigerants Energy and Environmental-Mobile Air Conditioning-Life Cycle Climate Performance ("GREEN-MAC-LCCP"). GREEN-MAC-LCCP is a spreadsheet-based emissions estimator that accounts for climate data from around the U.S. and A/C system performance and efficiency data of comparative systems per SAE J2765. SAE developed the J2766 standard that the auto industry uses to estimate MAC emissions today.

The LCCP model considers the variables influencing A/C system operation on an aggregate level, focusing on population centers across the country. Emissions levels are determined by averaging conditions and distribution of vehicles across the country. A key benefit of the LCCP model is that it considers factors influencing MAC operation and can be run from a spreadsheet. Special expertise is not needed, and the SAE specification walks the user through the inputs. A new version of the LCCP model, the IMAC-GHG-LCCP model, has also been developed that is easier to use and has updated climate and usage data and expanded system capability.

Multiple EPA-approved alternative off-cycle credit methodologies have relied on the LCCP including applications associated with Denso SAS high-efficiency compressors (which eventually formed the basis for EPA's standardized indirect air conditioning credit for high-efficiency compressors) and Toyota "S-Flow" technology.

The IMAC-GHG-LCCP model is currently undergoing further updates to include enhancements for EVs including vehicles with heat pumps. In addition, updates and improvements suggested by EPA are planned. The original LCCP model development was a collaboration that included EPA. EPA involvement and input to reach an agency-industry consensus in the current update is requested.

A/C technologies granted credit under an alternative method for generating off-cycle credit should not be subject to the A/C efficiency technology menu credit cap if additional benefits are demonstrated.

The off-cycle credit alternative method is a means by which manufacturers can demonstrate the off-cycle emissions benefits of technologies not included in the predetermined list, or by which manufacturers can demonstrate additional benefits beyond those estimated in the predetermined list. This approach should hold whether the technologies are A/C efficiency related or not. However, EPA has instead made all A/C technologies approved under the off-cycle alternative method subject to the cap on the A/C credit menu, regardless to the benefits demonstrated, under the premise that the cap represents the maximum degree of emissions that can be reduced from A/C system operation.

As we describe above in our request for EPA to increase a combined thermal control and A/C system efficiency cap, more recent studies have demonstrated that greater emissions reductions are possible than those first estimated by EPA in its development of the A/C efficiency cap. Of even greater import, manufacturers have demonstrated additional emission benefits for some A/C efficiency technologies even on vehicles that already included enough other technologies from the predetermined list to be constrained by the cap. Table 2 provides several examples where additional emissions benefits were demonstrated beyond the cap.

We therefore recommend that A/C technologies granted credit under an alternative method for generating off-cycle credit should not be subject to the predefined A/C efficiency technologies credit cap if additional benefits are demonstrated.

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Table 2: A/C efficiency technology credits, caps, and demonstrated additional benefits from an improved A/C compressor (Denso SAS) for exemplar vehicles in alternative method off-cycle credit applications

Technology	**A/C Efficiency Technology Credit for Exemplar Vehicles**[97]			
	2014 Dodge Charger	2017 Lincoln MKC AWD	2013 Cadillac ATS	2017 BMW 430i
Reduced reheat with externally controlled variable-displacement compressor	1.5	2.2	1.5	1.5
Default to recirculated air with closed-loop control	1.5	2.2	---	1.5
Default to recirculated air with open-loop control	---	---	1.0	---
Blower motor controls which limit wasted electrical energy	0.8	1.1	0.8	0.8
Internal heat exchanger	1.0	1.4	1.0	1.0
Improved condenser / evaporator	---	---	1.0	---
Oil separator	0.5	0.7	0.5	0.5
Total predetermined credit	5.3	7.6	5.8	5.3
Capped predetermined credit	5.0	7.2	5.0	5.0
Additional benefit of advanced A/C compressor	3.16 [98]	1.5 [99]	1.3 [100]	1.2 [101]

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[97] Data courtesy of Stellantis, Ford, General Motors, and BMW.

[98] "FCA Group LLC Request for GHG Credit for Variable Crankcase Suction Valve Technology in Denso AC Compressors," FCA Group LLC (March 2, 2017), https://www.epa.gov/sites/production/files/2018-04/documents/fca-us-denso-sas-compressor-off-cycle-credit-apl-2017-03-02.pdf (accessed Sep. 10, 2021) at 3.

[99] "Request for 2017 MY and Beyond Greenhouse Gas (GHG) and Fuel Economy Off-Cycle Credits," Ford Motor Company (Feb. 6, 2017), https://www.epa.gov/sites/production/files/2017-06/documents/fordapl-paint-glass-hea-denso-2017-nc-2017-02-06.pdf (accessed Sep. 10, 2021) at 37.

[100] "Request for GHG Credit for Variable Crankcase Suction Valve Technology," General Motors (Dec. 9, 2014), https://www.epa.gov/sites/production/files/2016-09/documents/gm-sas-compressor-off-cyclecredit-petition-fe6349-2014-12-09.pdf (accessed Sep. 10, 2021) at 6.

[101] "BMW Request for GHG Greenhouse Gas Credit for Variable Crankcase Suction Valve Technology," BMW Group (Jan. 19, 2017), https://www.epa.gov/sites/production/files/2017-06/documents/bmw-requestoffcycle-ghg-credit-var-cs-valve-tech-2017-01-19.pdf (accessed Sep. 10, 2021) at 3.

Credits for Reducing Leakage and Impacts of Air Conditioning Refrigerant

Auto Innovators agrees that if EPA were to remove A/C refrigerant-related credits from the program, the standards would need to be adjusted to reflect their elimination.

EPA notes that A/C refrigerant-related credits were accounted for in setting GHG standards, making them more stringent, and if they were removed, the standards would need to be adjusted or increased to reflect their elimination.[102]

In late 2020, the American Innovation and Manufacturing Act ("AIM Act")[103] was signed into law, requiring a general phasedown in the use of hydrofluorocarbons ("HFCs") in the U.S. EPA recently finalized a rule for the allocation and trading of production and consumption allowances.[104] Furthermore, a group of stakeholders has petitioned EPA to reinstate Significant New Alternatives Policy ("SNAP") rules 20 and 21 under the authority of the AIM Act.[105] If granted, HFC use in new light-duty vehicles would be prohibited.

Similarly, the State of California is considering a prohibition on the use of high-GWP refrigerants (which include HFC-134a) in new light-duty vehicles as part of its ACC2 rulemaking.[106]

If HFCs or high-GWP refrigerants in general are prohibited from use in new light-duty vehicles under state or federal law, there may be calls for EPA to eliminate the credits for reducing leakage and impacts of air conditioning refrigerants. Auto Innovators agrees with EPA that if these credits were eliminated or modified, the standards would need to be adjusted to reflect such changes. Not doing so would result in a change in stringency not considered when the light-duty vehicle GHG standards were set.

Credit Averaging, Banking, and Trading ("ABT") Flexibilities

Auto Innovators supports the proposal to expand carry-forward of credits generated in MYs 2016-2020.

Auto Innovators supports EPA's proposal to expand credit carry-forward provisions for MYs 2016-2020. Credit carry-forward allows manufacturers who over-comply in earlier years to carry those

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[102] GHG NPRM (*supra* note 2) at 43765 *et seq*.

[103] H.R. 133 (116th): Consolidated Appropriations Act, 2021, § 103, Division S, Innovation for the Environment.

[104] *Final Rule – Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program under the AIM Act*, U.S. Environmental Protection Agency, https://www.epa.gov/climate-hfcs-reduction/final-rule-phasedown-hydrofluorocarbons-establishing-allowance-allocation (accessed Sep. 24, 2021).

[105] "Petition to Reinstate HFC Prohibitions from SNAP Rules 20 & 21 Under the Aim Act," Natural Resources Defense Council, et al., (Apr. 13, 2021), Docket ID EPA-HQ-OAR-2021-0289-0007.

[106] *Advanced Clean Cars II Meetings & Workshops*, California Air Resources Board, Public Workshop on Advanced Clean Cars II (Sep. 16, 2020), https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii-meetings-workshops (accessed Sep. 9, 2021), Presentation, at 13.

carbon reductions into future model years to account for product cadence or technology schedules. A limited expansion of credit carry-forward provisions may provide some additional flexibility for a limited number of manufacturers, and in theory could provide some additional credit market liquidity during the rapidly tightening standards in MYs 2023-2026. Credit carry-forward flexibility has been a key component of compliance since MY 2016 when the industry (on average) first moved from general over-compliance to consuming credits on an annual basis.

Carry-forward credits do not reduce the environmental benefits of the standards. These credits represent tons of emissions avoided in advance of requirements. As such, it is appropriate to allow their use as a flexibility for meeting later requirements.

EPA should consider additional deficit carry-forward (i.e., credit carry-back) provisions.

Credit carry-back is an additional ABT mechanism that has proven useful for manufacturers to cover previous year deficits with future year credits. EPA is not directly proposing to adjust the existing credit carry-back mechanism within the GHG NPRM, but Auto Innovators recommends that EPA consider a modification under the broad scope of the GHG NPRM. Our proposal is to supplement the extended carry-forward with a limited allowance for a one-time extended credit carry-back provision. This proposal could provide manufacturers with an additional compliance flexibility through MY 2026 to address the proposed rapid increases in regulatory stringency and an uncertain EV market in the near-term. With regards to future rulemakings covering MY 2027 and later, Auto Innovators also recommends that EPA consider a broader extension of the credit carry-back to five years matching the longer carry-forward allowance.

Credit carry-back is an important mechanism for manufacturers, who may be facing near-term challenges with compliance, but have plans for later introduction of fuel-saving technologies (*e.g.*, vehicle electrification) that can offset the deficits in later years. Like credit carry-forward, credit carry-back flexibility creates no loss in GHG benefits over the duration of the regulated time period. As illustrated in the 2020 Trends Report, an increasing number of manufacturers are not meeting MY 2016-2020 targets and the overall volume of credits available to cover shortcomings is diminishing.[107] With continuing compliance shortfalls and reduced availability of credits, more manufacturers may have to start carrying forward deficits into future model years. These manufacturers will need to plan additional technology for the future, to not only cover future standards, but to also create sufficient carry-back credits to cover historic deficits.

As noted throughout these comments and within EPA's technology projections, an increasing number of manufacturers are expected to rely on higher levels of electrification as investment portfolios shift into this long-term technology trend. Electrification plans will need to be executed within the three-year carry-back time window and at sufficient volume to generate credits to cover earlier deficits. There is an element of timing risk associated with electrification because much of the supply base and industrial capacity, while planned, is yet to be physically constructed or running at scale. Readiness delays with critical supply infrastructure could arise from many different angles including material capacity readiness, factory permitting, construction delays or workforce readiness. Any one of many

[107] *2020 Trends Report* (*supra* note 32) at 119.

potential delays could affect launch dates or volumes, which would put credit carry-back plans at risk. Timing delays would not necessarily impact overall GHG benefits associated with the future vehicles, but delays could result in manufacturers facing a "4th" year of deficits, potentially triggering enforcement proceedings.

Auto Innovators recommends that EPA consider adding an allowance for a limited extension of the credit carry-back allowance. A provision could be added to the regulation to provide a pathway for manufacturers, who may be at risk of exceeding the three-year window to cover a model year deficit to petition the Administrator for one additional model year of credit carry-back. The petition could be required to demonstrate circumstances that may delay or otherwise impact future credit generation. If approved, EPA could grant a conditional allowance for one additional year of credit carry-back. The restriction to a narrow window of extension would limit any negative effects of deferring GHG improvements for longer. Further limits could include mechanisms such as limiting a manufacturer to only one such application through MY 2026 and a limitation of the allowance to credits from a single future model year. Auto Innovators believes this additional flexibility would provide a pragmatic level of additional flexibility for manufacturers, who may face future delays in the yet to be built electrification supply chain, while not impacting overall GHG reductions.

Full-Size Pickup Hybrid and Over-Performance Incentive Credits

Auto Innovators supports the proposed full-size pickup hybrid and over-performance incentive credits through MY 2026.

Auto Innovators supports inclusion of the proposed full-size pickup hybrid and over-performance credits through MY 2026. Although many full-size pickup trucks are quite efficient for their size, weight, and utility, they remain among the highest emitting non-niche vehicles in the fleet. Incentivizing strong hybridization or other technology solutions that yield GHG emission rates 20% or better than their regulatory targets can help encourage manufacturer production and marketing to foster greater long-term consumer market adoption in the transition to EVs.

If minimum production requirements are adopted, Auto Innovators recommends that EPA allow them to be met in combination.

EPA is proposing to require a minimum 10% penetration rate of strong hybrid or over-performance-qualified full-size pickup trucks out of a manufacturer's total full-size pickup truck production to qualify for credits. Given the current niche nature of such technologies in full-size pickup trucks, Auto Innovators recommends that EPA allow manufacturers to combine the production of strong hybrid and 20% over-performance full-size pickup trucks to determine if a single combined minimum production of 10% is reached. Both types of incentivized technology are provided the same proposed credit (20 g/mile) and would likely achieve similar emissions reductions. Such an approach could provide manufacturers with flexibility to develop multiple technical solutions to address different market needs.

EPA should consider expanding hybrid and over-performance credits to other light trucks with similar characteristics to full-size pickup trucks.

EPA notes that full-size pickup trucks face "unique challenges in the costs of applying advanced technologies due to the need to maintain vehicle utility and meet consumer expectations."[108] In recognition that certain other vehicles may face similar challenges, we suggest EPA consider slightly broadening this provision to vehicles with similar customer requirements as full-size pickup trucks. To ensure environmental objectives continue to be met while still providing some additional flexibility with this provision, a utility- and/or weight-based criteria could be developed to determine vehicle eligibility. Individual member companies may choose to comment on more specific concepts to slightly broaden the proposed provision to other vehicles with challenges similar to those of full-size pickup trucks.

Comments on Testing, Compliance, and Reporting Provisions

Upstream Fuel Production and Transport Emissions

Upstream emissions associated with electricity production should not be assigned to EVs for compliance purposes; limitations to this approach should be removed.

Under current regulations, EPA assigns a value of zero grams per mile of carbon-related exhaust emissions to vehicles for the electric portion of their operation.[109] This approach is generally limited to certain model years and, for some model years, to a limited quantity of EVs.

Assigning a compliance value of zero grams per mile is technically correct—an EV operating on electricity has no tailpipe emissions, GHG or otherwise.

The recognition of zero tailpipe emissions from operation on electricity is also consistent with the treatment of vehicle operation on all other fuels—emissions are measured at the tailpipe no matter what fuel the vehicle is operating on, and upstream emissions are addressed at their upstream sources. Electricity should be treated no differently than gasoline, ethanol, natural gas, and every other fuel used in motor vehicles.

Nor does a compliance value of zero grams per mile negatively affect the emissions benefits of the GHG standards. The upstream emissions impacts of fuel production and transportation for all fuels projected to be used under the proposed standards are addressed in the benefit-cost analysis. If upstream emissions are assigned to vehicles, the benefit-cost analysis does not change. The only effect is to add additional technology and market pressures to manufacturers which would need to be considered by EPA in its analysis of what level of standard is appropriate.

We recommend that EPA remove all limitations (model year, production volume, or others) to the use of zero grams per mile for the tailpipe emissions of EVs operating on electricity and to move this

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[108] GHG NPRM (*supra* note 2) at 43761.

[109] *See* 40 C.F.R. § 86.1866-12(a).

compliance provision to a section more appropriate than that dealing with incentives for EVs (*e.g.*, 40 C.F.R. Part 600).

If EPA does not eliminate all model year and production limits for the use of zero grams per mile for the GHG emissions of a vehicle operating on electricity, it should issue a rule to clarify that 40 C.F.R. 86.1866-12(a) applies to model years 2012 through 2026.

In the current regulation, there is a potential conflict between 40 C.F.R. § 86.1866-12(a), which allows the use of zero grams per mile in MYs 2012-2025, and 40 C.F.R. § 86.1866-12(a)(2), which specifies that the provision is unrestricted in MYs 2017-2026. EPA clearly intended to extend the zero gram per mile provision through MY 2026 in prior rulemaking.[110] Notwithstanding our comment that upstream emissions should never be included for the purpose of compliance with EPA light-duty vehicle GHG regulations, we recommend that EPA correct the regulatory text at paragraph (a) to include an endpoint of MY 2026 for consistency with the subsequent subparagraph (a)(2).

GHG Reporting

Auto Innovators requests that EPA reduce pre-model year reporting requirements.

EPA requires that the pre-model year report include information applicable to the next model year and, to the extent possible, two model years into the future.[111] While we recognize that the extended report content required by EPA may be of interest to the agency, the requirement to report up to three future model years adds significant burden to prepare the information. We recommend that EPA modify the pre-model year report requirements to the next single model year.

EPA OBD Requirements

Auto Innovators supports the proposed change to allow EPA approval of on-board diagnostic ("OBD") systems that meet CARB OBD requirements newer than the 2013 version referenced in current EPA regulations.

EPA proposes to allow certification of OBD systems that meet CARB OBD requirements newer than 2013.[112] Auto Innovators supports this update to maintain alignment between CARB and EPA regulations in this highly technical area.

[110] SAFE Rule (*supra* note 67) at 24178.

[111] 40 C.F.R. § 600.514-12(b)(1).

[112] GHG NPRM (*supra* note 2) at 43754.

Comments on Fuels

Action on Liquid Fuels Will Help During the Transition to Vehicle Electrification

Given the timespan over which ICE technology will continue to be available to new vehicle purchasers, and the years that those vehicles will remain in the field, improved liquid fuels are a critically important technology pathway. The largely ignored improved liquid fuels pathway will facilitate increased fuel efficiency, and reduced GHG and non-GHG emissions while the EV market continues to grow.

EPA Should Undertake a Comprehensive Fuels Rulemaking

EPA should consider actions to:

- Transition to a higher minimum-octane gasoline (*i.e.*, minimum 95–98 research octane number) to facilitate higher engine efficiency;
- Implement a nationwide low carbon fuel standard to lower GHG emissions;
- Immediately eliminate sub-87 anti-knock index ("AKI") octane fuels from the market to increase fuel efficiency and reduce GHG emissions;
- Lower the sulfur cap of gasoline from 80 ppm to 20 ppm at the refinery gate to further reduce non-GHG emissions from ICE-equipped vehicles and engines to improve air quality;
- Cap summer vapor pressure of gasoline at 9.0 psi or less, regardless of ethanol content, to further reduce evaporative emissions as E10 fuel is ubiquitous in the market;
- Regulate the particulate forming tendency of market gasoline by eliminating the heavy aromatic fraction of gasoline, thereby reducing PM emissions from all ICE vehicles, equipment, and engines to improve air quality for all; and
- Limit air toxics, *e.g.*, olefins and aromatics, and their precursors from the fuel to improve air quality for all.

Legacy and New ICE-Equipped Vehicles Will Continue in the Fleet for a Significant Time

There are nearly 290 million light-duty cars and trucks in the United States,[113] and nearly 99 percent of those vehicles operate on gasoline or diesel fuel.[114] Looking forward, after meeting the Administration's goal of 50% EV new vehicle market share by 2030,[115] it is clear that substantial numbers of liquid-fueled vehicles will be produced well through this decade and into the next. In

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[113] *U.S. Vehicle Registration Statistics*, Hedges & Company, https://hedgescompany.com/automotive-market-research-statistics/auto-mailing-lists-and-marketing/ (accessed Sep. 24, 2021).

[114] Figures compiled by Alliance for Automotive Innovation with registered vehicle data provided by IHS Markit as of Jul. 1, 2021.

[115] *See* Executive Order 14037.

addition, the average age of a vehicle in the U.S. has grown to over 12 years.[116] The car parc will continue to rely on liquid fuels for years to come, and gasoline will continue to play a significant role in transportation. If EPA does not undertake a comprehensive fuels rulemaking, it is missing an opportunity to implement a low-cost approach to improving fuel economy and reducing GHG and criteria pollutant emissions.

EPA Should Adopt a High-Octane Fuel Standard for the ICE Vehicle Market

Automobile and engine manufacturers from around the world publish the Worldwide Fuel Charter ("WWFC"). The WWFC outlines the fuel properties needed for vehicles and engines to achieve a desired level of fuel efficiency and exhaust emissions. In 2019, the Sixth Edition of the WWFC outlined the use of a minimum 95 and higher Research Octane Number ("RON") for markets with advanced requirements for emission control and fuel efficiency.[117] Many developed markets including Europe already have mandatory 95 RON minimum.

Higher-octane gasoline enables opportunities for the use of key energy-efficient technologies, including higher compression-ratio engines, lighter and smaller engines, improved turbocharging, and optimized engine combustion phasing and timing. All of these technologies, when paired with higher-octane gasoline, permit smaller engines to meet the demands of the consumer while at the same time providing higher efficiencies and thus reducing GHG emissions during vehicle use. Furthermore, depending on its composition, high-octane fuel is safe to use in many existing vehicles.

The relative efficiency gain enabled by higher octane rated gasoline is well documented. A literature review published by Leone et al. shows that increasing fuel octane rating from 91 RON to 95 RON facilitates an increase in efficiency by three to five percent.[118] Figure 3 shows the correlation of efficiency gain enabled by higher octane rated fuels with higher compression ratio engines.

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[116] Mike Colias, "Americans Are Keeping Their Cars Longer, as Vehicle Age Hits 12 Years," The Wall Street Journal (updated Jun. 14, 2021).

[117] Worldwide Fuel Charter, 6th Edition (2019), https://www.autosinnovate.org/energy-environment/fuel-publications/Fuel%20Publications-WWFC-19_GASOLINE-15.10.2019-graphist-1.pdf (accessed Sep. 24, 2021).

[118] Thomas Leone *et al.*, "The Effect of Compression Ratio, Fuel Octane Rating, and Ethanol Content on Spark-Ignition Engine Efficiency." Environ. Sci. Technol. (2015) 49 (18), 10778-10789, https://pubs.acs.org/doi/10.1021/acs.est.5b01420 (accessed Sep. 24, 2021).

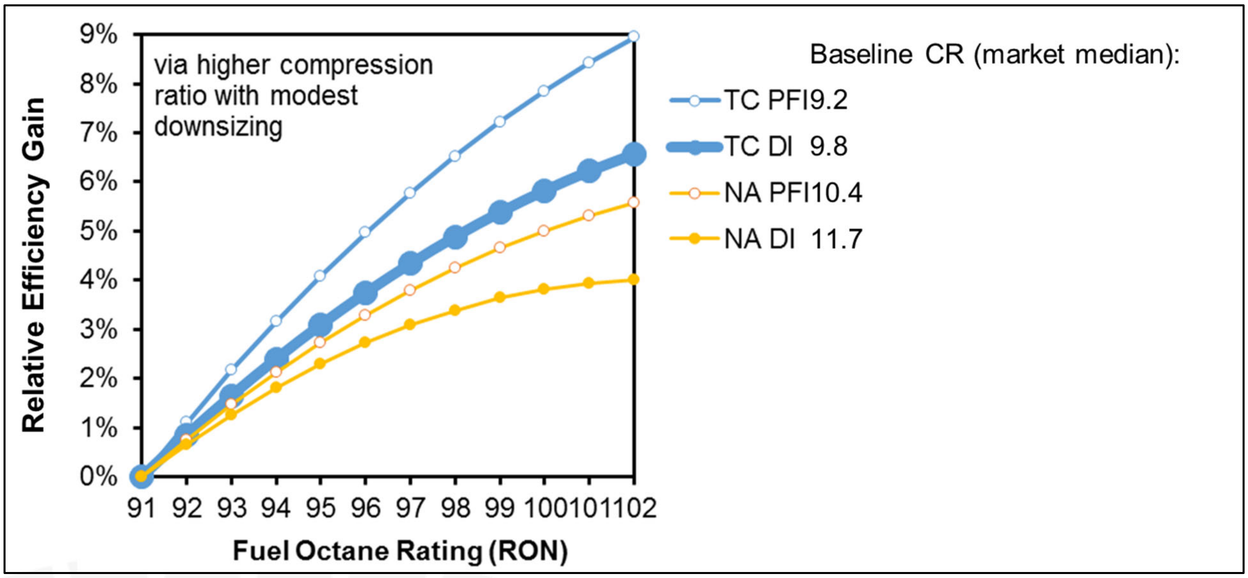

Figure 3: Relative efficiency gain with higher octane fuel rating. Raising octane enables engine compression ratio increases, resulting in improved engine efficiency. Source: Leone *et al.* (*supra* note 120).

Auto Innovators and its predecessor associations have long advocated that EPA should require a transition to a higher minimum-octane gasoline (minimum 95–98 RON). There are several ways to produce higher octane-grade gasoline. Increasing the ethanol content of gasoline is one approach. Hydrocarbon composition changes are another. Reducing the proportion of low octane naphtha or increasing the proportion of higher-octane streams such as alkylate or reformate will result in higher octane fuels. Ethanol blends higher than E10, with misfuelling mitigation measures in place, have been suggested by some to provide better value to consumers to achieve higher octane numbers and reduce carbon emissions. Auto Innovators does not promote any sole or particular pathway.

Producing higher octane fuel for the future ICE fleet will not impose any significant burdens on the refining and retail sectors. Hirshfeld et al. analyzed the refining economics of raising the average octane rating of the U.S. gasoline pool by increasing the octane rating of refinery produced blendstocks for oxygenated blending and/or the ethanol content of the finished gasoline.[119,120] These studies found a transition to higher-octane (95 RON, E10) gasoline was technically feasible and could be made without considerable increases in cost or CO_2 emissions for refineries.[121] The implementation of higher octane-rated gasoline in the marketplace would be a cost-effective means of improving fuel economy and

[119] David S. Hirshfeld *et al.*, "Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content," 48 ENVT'L SCI. & TECH. 11,064 (2014), https://pubs.acs.org/doi/10.1021/es5021668 (accessed Sep. 24, 2021).

[120] David S. Hirshfeld *et al.*, "Refining Economics of Higher Octane Sensitivity, Research Octane Number and Ethanol Content for U.S. Gasoline," Energy Fuels 2021, Publication Date: September 1, 2021, https://doi.org/10.1021/acs.energyfuels.1c00247 (accessed Sep. 24, 2021).

[121] *Id.*

therefore should be encouraged as soon as possible to maximize environmental benefits across the new car fleet.

EPA has the ability to enable the ICE to achieve increased fuel efficiency by requiring higher minimum octane rated gasoline in the marketplace. Research, data, and evidence confirms the ability to increase ICE efficiencies as the octane rating of gasoline increases. EPA, in the past, has recognized its authority to alter fuel quality to increase efficiencies. Specifically, as the criteria emission standards have increased in stringency, the allowable sulfur concentration decreased in recognition of sulfur's deleterious effects on emission control systems. Today, the GHG regulation has achieved such levels that the minimum market gasoline octane rating is limiting the ability to advance ICE technology. It is now necessary to adjust the gasoline octane rating (higher) commensurate with required decreases in GHG emissions. The new minimum octane rating needs to be set immediately to 95 RON and then increased to 98 RON as new GHG standards are implemented. The new gasoline octane levels are backwards compatible, and a subset of the vehicles in the legacy fleet have the ability to also increase efficiency in response to higher octane. Being able to leverage the legacy fleet in assisting in the reduction in transportation carbon emissions can significantly benefit the portfolio of technology solutions in achieving the collective goals associated with the climate.

The implementation of higher octane-rated gasoline in new vehicles would be a cost-effective means of improving fuel economy and reducing GHG emissions for the light-duty vehicle fleet.

<u>EPA Has the Authority to Regulate Fuels to Improve GHG Emissions</u>

The Clean Air Act provides statutory authority for the EPA to regulate GHG emissions, which can "cause, or contribute to, air pollution which may reasonably be anticipated to endanger the public health or welfare" (*Massachusetts v. EPA*, 549 U.S. 497 (2007)). Section 211 of the Clean Air Act provides EPA with the authority to regulate motor vehicle fuels in furtherance of the Act's goals. Specifically, Section 211(c) of the Act grants EPA the authority to set new national fuel standards, including octane rating, under the following circumstances:

- (1)(A) "if in the judgment of the Administrator, any fuel or fuel additive or any emission product of such fuel or fuel additive causes or contributes to air pollution or water pollution… that may reasonably be anticipated to endanger the public health or welfare," or
- (1)(B)"if emission products of such fuel or fuel additive will impair to a significant degree the performance of any emission control device or system which is in general use, or has been developed to a point where in a reasonable time it would be in general use were such regulations to be promulgated."

It is important to note that the addition of GHGs to the list of Clean Air Act "pollutants" is changing how one thinks of emissions control. For purposes of considering EPA's authority under 211(c)(1)(B), it is important to realize that the term "any emission control device or system" must be understood more broadly than it once was. With this realization, it is easy to see that engine efficiency improvements offer emission control benefits. However, low-octane fuel acts as a barrier to these efficiency benefits. EPA has the authority and must stand firmly on the side of removing these barriers and providing manufacturers with a full menu of options for striving to meet the future GHG standards.

In light of increasing GHG and CAFE requirements, it continues to be essential for vehicles and the fuels they operate on to be treated as a system and developed in tandem. Prospective fuels should enable greater vehicle efficiency and lower emissions, optimize the consumer experience, and fulfill societal values. Technology is in place to produce advanced engines. However, without a promulgated higher-octane fuel standard, the advanced engines cannot optimize their potential operational efficiency. It is now timely for EPA to undertake an accelerated process to implement and synchronize the market introduction of higher-octane gasoline that will enable the benefits of advanced technologies and support manufacturer investments. EPA has the authority to regulate national commercial gasoline octane specifications under the Clean Air Act. EPA should initiate a fast-track process to assure higher octane gasoline that meets the market and timing needs of new vehicle technologies for the U.S. commercial supply.

EPA Should Implement a Nationwide Low Carbon Fuel Standard ("LCFS")

EPA should take actions to support lower or net-zero carbon liquid fuels. Although automobile manufacturers are focused on electrification, actions on liquid fuels can provide benefits to legacy vehicles, would support even lower GHG emissions from PHEVs, and could provide much-needed GHG reduction pathways. EPA should leverage a new national LCFS and/or modified renewable fuel standard (RFS) to incentivize low carbon fuel use in legacy and future ICE vehicles and engines. A properly structured nationwide LCFS, while providing GHG reductions, can also create new revenue sources to incentivize market adoption of EVs.

EPA Should Take Further Action on Fuels to Reduce Emissions and Improve Air Quality

Use of improved liquid fuels supports ongoing efforts to improve air quality and can provide an important bridge in reducing emissions in low-income communities during the transition to expanded vehicle electrification. While today's vehicles emit near-zero levels of tailpipe and evaporative emissions, more can be done to support lower emissions and air toxics exposure, especially in disadvantaged communities.

EPA states:

> EPA recognizes that in addition to substantially reducing GHG emissions, a longer-term rulemaking could also address criteria pollutant and air toxics emissions from the new light-duty vehicle fleet—especially important considerations during the transition to zero-emission vehicles. EPA expects that a future longer-term rulemaking will take critical steps to continue the trajectory of transportation emission reductions needed to protect public health and welfare.[122]

Auto Innovators agrees that "… *a longer-term rulemaking could also address criteria pollutant and air toxics emissions from the new light-duty vehicle fleet*…" Auto Innovators would add that in many cases gasoline improvements would improve emissions from virtually all of the 290 million vehicles on the road today in addition to other liquid-fueled equipment. Given that these vehicles are on

[122] GHG NPRM (*supra* note 2) at 43730.

the road today and that benefits would accrue immediately upon introduction, we see no reason for EPA to delay in implementing a rulemaking. Auto Innovators has commented extensively in the past on the fuel improvements needed to address criteria pollutant and air toxics emissions.

Several improvements to market fuels can be made:

1. Reduce sulfur

When EPA finalized the Tier 3 rules governing gasoline, it lowered the maximum average sulfur level from 30 ppm to 10 ppm. This change was essential to facilitating the lower tailpipe emissions standards that are part of the Tier 3 standards because, as EPA points out, "any amount of gasoline sulfur will deteriorate catalyst efficiency."[123] However, EPA continues to allow 80 ppm sulfur at the refinery gate and has a 95 ppm downstream cap. Auto Innovators continues to stand behind previous industry comments on sulfur as detailed in the Auto Alliance Tier 3 comments.[124] Refiners and the distribution system have had many years to adjust to lower sulfur standards. We urge EPA to reduce the refinery gate and downstream caps to 20 and 25 ppm, respectively, perhaps with a phase-in period, and at the same time to develop a pathway toward a retail cap of 10 ppm per gallon. EPA can then provide *ad hoc* relief, with a notice and comment process, for refiners and downstream distributors that can show evidence of reasons they actually need it.

2. Cap vapor pressure

The EPA must cap summer gasoline vapor pressure at 9.0 psi or less regardless of ethanol level. From a vehicle operability perspective, there is no need for fuel vapor pressure to be even as high as 9.0 psi. California summer fuel is capped at 7 psi, and in Japan (JIS K 2202), the summer maximum is 6.4 psi. No operability issues with on-specification fuel are experienced in either place. Lower vapor pressure will reduce evaporative emissions across the fleet, particularly in older vehicles and off-road and handheld equipment. Since the beneficial effects of lower vapor pressure are enhanced by progressively lowering it and applying it to all gasoline fueled equipment from day one, there is no reason for EPA not to follow the California or Japanese examples for summer fuels and cap other seasons at ASTM D4814 maxima.

3. Eliminate sub-87 AKI market fuels

Vehicles sold in the U.S. require fuel octane of 87 AKI or higher. Tier 3 regular grade certification fuel has closely controlled octane and is specified at 87-88.4 AKI. In the majority of the U.S., the minimum market octane is 87 AKI by regulation or custom. However, in the Rocky Mountain

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[123] Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards, Proposed Rule, 78 Fed. Reg. 29816, 29821 (May 21, 2013).

[124] Supplemental Comments of the Alliance of Automobile Manufacturers on Market Gasoline Sulfur, Alliance of Automobile Manufacturers (Oct. 31, 2013), Docket ID EPA-HQ-OAR-2011-0135-4950.

states sub-octane fuel continues to be marketed. This was justified in the past by high altitude effects on engine knock. However, as ASTM D4814 section X1.6 points out:

> New vehicles have sensors to measure [sic] and engine management computers, which take into account such conditions as air charge temperature and barometric pressure. These vehicles are designed to have the same antiknock requirement at all altitudes and a reduced sensitivity to changes in ambient temperature. This more sophisticated control technology began to be used extensively in 1984. This technology, while constantly evolving and improving, is used on almost all new vehicles. This means that many vehicles in today's fleet require fuel having the same antiknock index regardless of changes in altitude or ambient temperatures.

This text implies that the vehicles produced in the last 37 years require the same fuel as the rest of the country. More recently, automakers have produced increasing proportions of vehicles with turbocharged engines. These engines boost manifold pressure using turbochargers and are insensitive to altitude.

The result of misfuelling these vehicles, whether they have sensors and engine management computers dating from 1984 or more advanced technologies, is that the vehicle will knock on the sub-octane fuel resulting in spark retard and enrichment to protect the engine from damage. Spark retard will reduce fuel economy and increase GHG emissions, while fuel enrichment will increase CO and HC emissions. The solution to these issues is easy: EPA must mandate that all market fuels meet or exceed the octane of Tier 3 certification fuel.

4. Remove heavy aromatic compounds

Both EPA and CARB recognize the deleterious effects of vehicle particulate emissions. This is demonstrated by their regulations limiting tailpipe emissions of particulate matter ("PM"). The European Union ("EU") and China also regulate particulate emissions.[125,126] While establishing and tightening particulate emissions standards for prospective vehicles may lower emissions in future, there is a way to lower emissions today from all gasoline-powered equipment. Many studies have linked fuel properties, especially heavy aromatics, to tailpipe PM; some of particular importance were published by

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[125] Engeljehringer, K., *Emission Regulation Trends: Overcoming BS6 & RDE Challenges with 2020 getting Closer, in AVL India Seminar May 2018*, available at https://www.avl.com/documents/10138/8665616/02+AVL+India+Seminar+May+2018_Regulation+Trends_Engeljehringer.pdf (accessed Sep. 24, 2021).

[126] Ball, D., Meng, X., and Weiwei, G., *Vehicle Emission Solutions for China 6b and Euro 7*, SAE Technical Paper 2020-01-0654, 2020, available at https://doi.org/10.4271/2020-01-0654 (accessed Sep. 24, 2021).

Honda and include the development of a PM index for fuels.[127,128] While the Honda-developed PM index correlates well with tailpipe PM, other methods of measuring PM forming tendency beyond the detailed hydrocarbon analysis method used may be more effective.[129,130,131,132] The hard-to-identify heaviest fraction of the fuel harbors the molecules with the highest contribution to PM.[133]

There have been several Coordinating Research Council ("CRC") projects to investigate the impacts of ethanol, PM index and octane.[134,135] The data showed that there is a direct correlation between increased fuel PM index to increased tailpipe PM. Detailed hydrocarbon analysis of the fuels showed that the high molecular weight aromatics fractions of the fuel, C10+ hydrocarbons, are the main contributors to increased tailpipe PM. The more C10+ hydrocarbons there are, the greater the increase in PM formation.

Therefore, EPA should proceed with controlling the particulate forming tendency of market gasoline by requiring the removal of the heavy aromatic components to lower PM emissions throughout

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[127] Aikawa, K., Sakurai, T., and Jetter, J., *Development of a Predictive Model for Gasoline Vehicle Particulate Matter Emissions*, SAE Int. J. Fuels Lubr. **3**(2):610-622, 2010, available at https://doi.org/10.4271/2010-01-2115 (accessed Sep. 24, 2021).

[128] Aikawa, K. and J.J. Jetter, *Impact of gasoline composition on particulate matter emissions from a direct-injection gasoline engine: Applicability of the particulate matter index.* International Journal of Engine Research, 2014. **15**(3): p. 298-306. available at https://doi.org/10.1177/1468087413481216 (accessed Sep. 24, 2021).

[129] Chapman, E., Winston-Galant, M., Geng, P., and Konzack, A., *Global Market Gasoline Range Fuel Review using Fuel Particulate Emission Correlation Indices*, SAE Technical Paper 2016-01-2251, 2016, https://doi.org/10.4271/2016-01-2251 (accessed Sep. 24, 2021).

[130] Chapman, E., Winston-Galant, M., Geng, P., and Pryor, S., *Development of an Alternative Predictive Model for Gasoline Vehicle Particulate Matter and Particulate Number*, SAE Technical Paper 2019-01-1184, 2019, https://doi.org/10.4271/2019-01-1184 (accessed Sep. 24, 2021).

[131] Chapman, E., Geng, P., and Konzack, A., *Global Market Gasoline Quality Review: Five Year Trends in Particulate Emission Indices,* SAE Technical Paper 2021-01-0623, 2021, https://doi.org/10.4271/2021-01-0623 (accessed Sep. 24, 2021).

[132] Chapman, E., et al., *Comparison of the Particulate Matter Index and Particulate Evaluation Index Numbers Calculated by Detailed Hydrocarbon Analysis by Gas Chromatography (Enhanced ASTM D6730) and Vacuum Ultraviolet Paraffin, Isoparaffin, Olefin, Naphthene, and Aromatic Analysis (ASTM D8071),*. SAE Technical Paper 2021-01-5070, 2021, https://doi.org/10.4271/2021-01-5070 (accessed Sep. 24, 2021).

[133] Chapman, E., Geng, P., and Konzack, A., *Global Market Gasoline Quality Review: Five Year Trends in Particulate Emission Indices,* SAE Technical Paper 2021-01-0623, 2021, https://doi.org/10.4271/2021-01-0623 (accessed Sep. 24, 2021).

[134] Coordinating Research Council Report No. E-94-1. *Evaluation and Investigation of Gaseous and Particulate Emissions on SIDI In-Use Vehicles with Higher Ethanol Blend Fuels* (2014), http://crcsite.wpengine.com/wp-content/uploads/2019/05/03-17589_CRC-E94-1_Final-Report_6-2-2014_Lobato_Morgan.pdf (accessed Sep. 24, 2021).

[135] Coordinating Research Council Report No. E-94-2. *Evaluation and Investigation of Fuel Effects on Gaseous and Particulate Emissions on SIDI In-Use Vehicles* (2017), http://crcsite.wpengine.com/wp-content/uploads/2019/05/CRC_2017-3-21_03-20955_E94-2FinalReport-Rev1b.pdf (accessed Sep. 24, 2021).

the fleet and improve air quality for all, especially those who live and work in close proximity to major highways.

5. Limit air toxics

The emissions from an average light duty vehicle have been reduced by over 99% since the introduction of emissions control technology. The reduction has been such that, according to CARB, in the California south coast air basin, lawn and garden equipment is a greater contributor to poor air quality than light-duty vehicles.[136] Nonetheless, toxic emissions continue, especially from older vehicles and off-road equipment. The best approach to limiting toxic emissions is to remove toxics from the fuel prior to distribution. EPA recognized and applied this approach to limiting benzene emissions. Going forward, EPA must broaden its approach and limit air toxics, *e.g.*, olefins and aromatics, and their precursors from the fuel prior to distribution.

E10 Test Procedure Adjustment

In May 2020, EPA proposed an adjustment to laboratory-measured CO_2 when tested on Tier 3 certification fuel.[137] This proposed adjustment effectively revises the stringency of GHG standards and sets a policy precedent that is not supportive of the potential of future low carbon fuels to contribute to reductions in transportation carbon emissions. If an adjustment is necessary, we continue to encourage EPA to account for such adjustment in a full GHG standard-setting rulemaking under Section 202(a) of the Clean Air Act.[138]

As was stated in comments submitted on the E10 Test Procedure Adjustment NPRM, "the goal of Auto Innovators is to ensure that this rulemaking helps set a positive policy foundation that values the potential of low carbon fuels in contributing toward our shared climate goals. Auto Innovators proposes that making adjustments to laboratory results is not the optimal path forward and that the effect of E10, and other future low carbon fuels, is best handled within the context of future iterations of fleet average GHG standards."[139]

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[136] *SORE Fact Sheet*, California Air Resources Board, https://www.arb.ca.gov/msprog/offroad/sore/sm_en_fs.pdf?_ga=2.125314186.1460474514.1631206544-48095875.1631206544 (accessed Sep. 24, 2021).

[137] Vehicle Test Procedure Adjustments for Tier 3 Certification Test Fuel, Notice of Proposed Rulemaking, 85 Fed. Reg. 28564 (May 13, 2020).

[138] Alliance for Automotive Innovation comments on EPA's Vehicle Test Procedure Adjustments for Tier 3 Certification Test Fuel Notice of Proposed Rulemaking, EPA-HQ-OAR-2016-0604 (2020), Docket ID EPA-HQ-OAR_2016-0604-0087.

[139] *Id*.

Comments on Technology and Compliance Modeling

Auto Innovators provides the following comments on EPA's modeling of potential manufacturer compliance pathways, including technology benefits and costs, in the spirit of ensuring a robust assessment of the actions manufacturers may take for compliance, their associated costs, and other considerations. Given the limited time provided for comments, we have necessarily abbreviated our review. Auto Innovators may submit additional supplemental technical comments in response to EPA's analysis and to that of other stakeholder submissions.

In the GHG NPRM, EPA states that:

> In our design and analyses of the proposed program and our overall updated assessment of feasibility, EPA also took into account the decade-long light-duty vehicle GHG emission reduction program in which the auto industry has introduced a wide lineup of ever more fuel efficient, GHG-reducing technologies. The technological achievements already developed and applied to vehicles within the current new vehicle fleet will enable the industry to achieve the proposed standards even without the development of new technologies beyond those already widely available. Furthermore, in light of the design cycle timing for vehicles, EPA has basis to expect that the vehicles that automakers will be selling during the first years of the proposed MY 2023-26 program were already designed before the less stringent SAFE standards were recently adopted. Further support that the technologies needed to meet the proposed standards do not need to be developed, but are already widely available and in use on vehicles…[140]

Auto Innovators encourages EPA to rethink the assumption that the compliance modeling is reasonable in the context of policy analysis and projected response to major regulatory reform and considering significant events since 2017.[141]

While it is true that manufacturers and suppliers have invested hundreds of billions of dollars in research and development and in production facilities to bring fuel-saving technologies with impressive efficiencies to market over the last decade, scaling up the production of these technologies will take additional time and investment. Manufacturers and suppliers are working hard to grow automotive-grade battery production and other production capacities for fuel-saving technologies. Compliance with portions of this proposal require breaking new ground. Many elements of the supply chain are at capacity (consider the semiconductor shortage, for instance). Even if technologies are currently in production on some vehicles, future, unforeseen innovations are still required to meet the projected technology costs assumed in the EPA analyses (consider, for example, how quickly the Agencies assume battery costs are reduced through learning), and these cost-saving innovations are not guaranteed. The EPA analyses also include technologies that have not yet been produced (with

[140] GHG NPRM (*supra* note 2) at 43731.

[141] The effect of COVID on market conditions and supply chains for MYs 2020-2021, for instance.

projected effectiveness estimates that may not be technologically feasible), and these are assumed to be adopted quickly, and broadly in the EPA compliance pathways.[142]

The Need for Updated Tools and Modeling Inputs

EPA uses many outdated datasets, assumptions, and tools in its analysis supporting the GHG NPRM. Its choices significantly lower the projected challenges of meeting the proposed standards and inflate the projected benefits. These older inputs are used despite new data, based on credible information, like recently submitted greenhouse gas compliance data. This is readily available within the U.S. Federal Government, as demonstrated by NHTSA's CAFE NPRM, which was signed on the same day as the GHG NPRM.

The GHG NPRM states that:

> [I]t is notable that, although each analysis is based on projections from the then-available fleet data forward to model years 2025 or 2026, the results of each of these earlier analyses, as well as the updated analysis we have performed for our proposed standards, have all produced very similar results in several key metrics. For example, the estimated projected cost to manufacturers to implement similar standards in 2025–2026 has remained fairly consistent since 2012.[143]

Auto Innovators does not agree that updated analysis produced similar results. Key metrics, such as the portion of the fleet that must be electrified to comply with standards, have changed with reasonably updated assumptions.

EPA should make use of the most recent version of CCEMS.

EPA uses the version of CCEMS developed for use in the SAFE final rule with some modifications to its inputs.[144] The Department of Transportation has developed a more recent version of CCEMS, which it used for the CAFE NPRM.[145] It is unclear why the Agencies did not coordinate and

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142 "EFR", or Engine Friction Reduction, for instance. Or EPA's characterization of potential efficiency gains from "HCR2" in combination with "EFR" and "IACC", which is highly speculative, and *not* recommended for use. Inclusion of "HCR2", or "HCR2 + EFR + IACC" incorrectly characterizes efficiencies by overestimating improvements assumed to be possible with internal combustion engines, with this configuration of engine equipment. Including HCR2, and HCR2 in combination with EFR and IACC in the analysis, artificially deflates the extent to which electrification is needed to comply with rapidly increasing standards. DOT's characterization of HCR0, HCR1, HCR1D, and IACC, and exclusion of HCR2 is preferred, and better reflects technologies in the market today.

143 GHG NPRM (*supra* note 2) at 43734.

144 GHG RIA (*supra* note 17) at 4-1 *et seq*.

145 *CAFE Compliance and Effects Modeling System*, National Highway Traffic Safety Administration, https://www.nhtsa.gov/corporate-average-fuel-economy/cafe-compliance-and-effects-modeling-system (accessed Sep. 24, 2021).

use the same version of CCEMS. By using an older model, and older data, EPA ignores many recommendations highlighted in the peer review of modeling tools for GHG policy analysis.[146]

The baseline fleet should be updated from MY 2017 to MY 2020.

The EPA analysis begins with a MY 2017 fleet,[147] even though a reasonable representation of manufacturer compliance positions and vehicles is available with the MY 2020 fleet.[148] While some updates to the characterization of tire rolling resistance, aerodynamic drag, and other fuel saving technologies may yet need additional characterization to more accurately reflect the technologies used in MY 2020, the MY 2020 fleet is preferred over the MY 2017 fleet as a baseline for compliance modeling. Using the MY 2020 fleet will account for important shifts in consumer preferences related to fuel prices, and adoption of fuel-saving technologies (like advanced engines, and electric vehicles), as well as significant changes to the mix of vehicles sold at an industry level. These changes substantively affect the benefit-cost analysis, and the projection of actions manufacturers may take to comply with a rapid increase in stringency of GHG and CAFE standards. Analysis using a MY 2020 baseline fleet will also highlight the importance of electrification in meeting standards and lay bare the risks for the industry as adoption of electrified technology moves beyond the "innovator" stage, to "early adopters" and "early majority" consumers. Use of electrified vehicle technology is a key metric for policy analysis, as highlighted in President Biden's Executive Order targeting 50% electric vehicle sales share in 2030.[149,150]

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[146] *CAFE Model Peer Review*, U.S. Department of Transportation, National Highway Traffic Safety Administration, DOT HS 812 590 (Jul. 2018), https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/812590-cafe-peer-review.pdf (accessed Sep. 17, 2021).

[147] GHG RIA (*supra* note 17) at 4-2.

[148] CAFE NPRM (*supra* note 4) at 49633.

[149] *Fact Sheet: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks, The White House* (Aug. 5, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/ (accessed Sep. 17, 2021).

[150] *Executive Order on Strengthening American Leadership in Clean Cars and Trucks, The White House* (Aug. 5, 2021), https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/ (accessed Sep. 17, 2021).

Off-cycle credit assumptions should be reconsidered.

Technologies that earn off-cycle credits are an important pathway for manufacturers to comply with GHG and CAFE standards. The EPA analysis assumes that manufacturers earned 10 g/mi, or even 15 g/mi by MY 2020,[151,152] but compliance data shows that this was not the case.[153]

Furthermore, the costs for off-cycle technologies used in today's study are based off an average technology cost from an older EPA compliance pathway study, conducted around the time of the Draft Technology Assessment Report. An analysis with compliance pathways that rely significantly on a rapid adoption of off-cycle technologies, at a cost pegged to the output average technology cost of older studies, would be expected to skew the results of the current analysis towards those of the older analysis. Also, it is important to recognize that many off-cycle technologies on the credit menu are specific to vehicles with ICEs, and these may not be applicable for battery electric vehicles, or plug-in hybrid vehicles. As manufacturers introduce significant numbers of battery electric vehicles in their production plans to meet GHG/CAFE standards, especially towards the MYs 2026-2030 timeframe, EPA does not describe what off-cycle technologies might be recognized to earn 15 g/mi at a fleet level, with a raised cap and greater EV penetration.

Auto Innovators encourages EPA to update how off-cycle technologies are modeled to better address these topics above. Auto Innovators encourages EPA to update the number of off-cycle credits assumed in the analysis so that it more closely aligns with what manufacturers have actually earned in MYs 2018-2020 and are likely to earn (particularly with the proposed revised definitions) in MYs 2021-2026. This update to inputs is more realistic (though imperfect) and will likely highlight the significant amount of electrification needed to comply with rapidly rising GHG and CAFE standards, including in the near-term.

Modeling of HCR2 engines should be reconsidered.

For this NPRM, EPA has resurrected highly optimistic effectiveness estimates for future Atkinson cycle engines based on a speculative engine map, and has used the results as "HCR2" technology. This usage diminishes the integrity of the analysis and distorts discussions of technological feasibility and economic practicability of future standards. While some commenting organizations have purported that EPA's 2016 characterization of HCR2 is a reasonable characterization of engines in the market today, like Toyota's 2.5L on the Camry and RAV4,[154] or Mazda's 2.5L on the CX-5,[155] history has shown that the HCR2 assumptions used in the analysis significantly and unreasonably overestimate the real-world fuel saving capability of state-of-the-art Atkinson engine technology in these applications.

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[151] *GHG RIA* (*supra* note 17) at 4-8.

[152] EPA Compliance and Effect Modeling System Market input files.

[153] *Baseline Study* (*supra* note 34) at 71.

[154] Characterized as HCR1 + IACC in the DOT baseline analysis.

[155] Characterized as HCR1D in the DOT baseline analysis.

The EPA HCR2 engine map assumes engine accessory drive improvements ("IACC") and engine friction reduction ("EFR") have already been used to the maximum extent possible, so reapplying these technologies again in the modeling (as the EPA analysis does) incorrectly double-counts the potential effectiveness of these technologies. EPA incorrectly states that HCR2 technology, as modeled, exists in the fleet and is widely available for adoption. Tables 3, 4, and 5 below compare existing vehicles with advanced high-compression ratio engines to the modeled results for such vehicles, demonstrating the optimistic and speculative nature of the HCR2 technology modeling.

Table 3: Comparison of modeled Toyota Camry technologies and fuel economy to actual Toyota Camry technologies and fuel economy.

Observation Year	Vehicle (Code)	Technologies	Fuel Economy (MPG)
2017 (EPA Baseline, compliance data)	Toyota Camry Se/SXe/Xle (2303000)	VVT; VVL; AT6; EPS; ROLL0; AERO5; MR0	36.8
2020 (DOT Baseline, compliance data)	Toyota Camry SE (2303010)	HCR1; AT8; IACC; ROLL0; AERO5; MR2; LDB	43.4
2024 (EPA NPRM, FE Projection)	Toyota Camry Se/SXe/Xle (2303000)	EFR; HCR2; AT8; IACC; ROLL20; AERO5; MR1	51.7

Table 4: Comparison of modeled Toyota RAV4 technologies and fuel economy to actual Toyota RAV4 technologies and fuel economy.

Observation Year	Vehicle (Code)	Technologies	Fuel Economy (MPG)
2017 (EPA Baseline, compliance data)	Toyota RAV4 Le/Xle FWD (2317004)	VVT; VVL; AT6; EPS; ROLL0; AERO0; MR0	34.9
2020 (DOT Baseline, compliance data)	Toyota RAV4 XLE (2317004)	HCR1; AT8; IACC; ROLL20; AERO10; MR2; 12VSS; LDB	43.4
2024 (EPA NPRM, FE Projection)	Toyota RAV4 Le/Xle FWD (2317004)	EFR; HCR2; AT8; IACC; ROLL20; AERO15; MR1	48.0

Table 5: Comparison of modeled Mazda CX-5 technologies and fuel economy to actual Mazda CX-5 technologies and fuel economy.

Observation Year	Vehicle (Code)	Technologies	Fuel Economy (MPG)
2017 (EPA Baseline, compliance data)	Mazda CX-5 Sport 2wd (2404001)	HCR0; AT6; EPS; ROLL0; AERO5; MR1	36.6
2020 (DOT Baseline, compliance data)	Mazda CX-5 Sport FWD (2404001)	HCR1D; AT6; EPS; ROLL0; AERO5; MR0; LDB	37.1
2023 (EPA NPRM, FE Projection)	Mazda CX-5 Sport 2wd (2404001)	HCR2; AT8; IACC; ROLL20; AERO15; MR1	45.3

EPA projects that manufacturers will broadly apply HCR2 technology to improve fuel economy, and this is no surprise given the unrealistically high projected effectiveness estimates, and relatively low cost in comparison with other technologies. Moreover, EPA projects that many manufacturers *should have already applied* very advanced configurations of HCR technology between MYs 2017 and 2022 to a greater extent than is observed in the fleet as actually produced.

Table 6 shows the technology penetration rates of HCR2 in the EPA analysis, by manufacturer, in the "Safe-to-Proposal" alternative published in EPA's NPRM, and the DOT 2020 baseline. Note, projected HCR0 penetration rates, also significant in the EPA analysis for many manufacturers, are not included in this table for brevity.

Table 6: EPA projections for HCR2 technology adoption and observed market share in the MY 2020 fleet.

	Year	BMW	Daimler	FCA	Ford	General Motors	Honda	Hyundai Kia-H	Hyundai Kia-K	JLR	Mazda	Mitsubishi	Nissan	Subaru	Toyota	Volvo	VWA
HCR2 Penetration Rates (EPA Projections)	2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2018	-	-	0.11	-	-	-	-	0.10	-	-	-	-	-	-	-	0.02
	2019	-	-	0.11	0.03	-	-	-	0.10	-	-	-	-	-	-	-	0.02
	2020	-	-	0.41	0.03	-	-	-	0.12	-	-	-	-	-	-	-	0.03
	2021	-	-	0.44	0.02	-	-	-	0.12	-	-	-	-	-	-	-	0.03
	2022	-	-	0.44	0.02	0.01	0.01	-	0.12	-	-	-	-	-	-	-	0.03
	2023	-	-	0.44	0.02	0.06	0.01	-	0.12	-	0.39	-	0.02	-	-	-	0.03
	2024	-	-	0.44	0.02	0.09	0.01	0.05	0.12	-	0.39	-	0.02	-	0.28	-	0.03
	2025	-	-	0.44	0.02	0.25	0.01	0.05	0.12	-	0.39	-	0.03	-	0.28	-	0.03
	2026	-	-	0.54	0.19	0.28	0.11	0.20	0.12	-	0.85	-	0.03	-	0.41	-	0.03
	2027	-	-	0.54	0.23	0.30	0.26	0.20	0.12	-	0.85	0.01	0.03	-	0.43	-	0.03
	2028	-	-	0.54	0.26	0.30	0.32	0.20	0.12	-	0.91	0.01	0.02	-	0.55	-	0.03
	2029	-	-	0.54	0.26	0.30	0.34	0.29	0.12	-	0.95	0.01	0.02	-	0.55	-	0.03
	2030	-	-	0.54	0.26	0.30	0.34	0.29	0.07	-	0.95	0.01	0.02	-	0.65	-	0.03
HCR1 Penetration Rates (EPA Projections)	2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2018	-	-	0.01	-	0.18	0.18	-	-	-	0.56	-	-	-	-	-	-
	2019	-	-	0.04	-	0.18	0.18	0.06	-	-	0.56	-	0.08	-	0.00	-	-
	2020	-	-	0.07	0.13	0.19	0.22	0.07	-	-	0.85	-	0.10	-	0.07	-	-
	2021	-	-	0.07	0.15	0.20	0.22	0.32	0.36	-	0.85	0.31	0.14	-	0.14	-	-
	2022	-	-	0.07	0.17	0.21	0.22	0.33	0.36	-	0.91	0.43	0.15	-	0.19	-	-
	2023	-	-	0.09	0.18	0.21	0.22	0.43	0.46	-	0.52	0.43	0.22	-	0.19	-	-
	2024	-	-	0.09	0.18	0.21	0.22	0.48	0.57	-	0.56	0.43	0.36	-	0.19	-	-
	2025	-	-	0.09	0.19	0.10	0.22	0.47	0.57	-	0.56	0.43	0.49	-	0.33	-	-
	2026	-	-	0.18	0.06	0.05	0.22	0.33	0.57	-	0.10	0.43	0.49	0.37	0.36	-	-
	2027	-	-	0.19	0.02	0.01	0.21	0.61	0.57	-	0.10	0.30	0.70	0.64	0.36	-	-
	2028	-	-	0.20	-	0.01	0.21	0.61	0.57	-	0.04	0.30	0.76	0.64	0.23	-	-
	2029	-	-	0.20	-	0.01	0.21	0.52	0.57	-	0.00	0.30	0.77	0.64	0.23	-	-
	2030	-	-	0.20	-	0.01	0.21	0.52	0.57	-	0.00	0.30	0.77	0.64	0.13	-	-
HCR1 and HCR2 penetration rates (EPA Projections)	2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2018	-	-	0.12	-	0.18	0.18	-	0.10	-	0.56	-	-	-	-	-	0.02
	2019	-	-	0.15	0.03	0.18	0.18	0.06	0.10	-	0.56	-	0.08	-	0.00	-	0.02
	2020	**-**	**-**	**0.48**	**0.15**	**0.19**	**0.22**	**0.07**	**0.12**	**-**	**0.85**	**-**	**0.10**	**-**	**0.07**	**-**	**0.03**
	2021	-	-	0.51	0.18	0.20	0.22	0.32	0.48	-	0.85	0.31	0.14	-	0.14	-	0.03
	2022	-	-	0.51	0.19	0.23	0.23	0.33	0.48	-	0.91	0.43	0.15	-	0.19	-	0.03
	2023	-	-	0.53	0.20	0.28	0.23	0.43	0.58	-	0.91	0.43	0.23	-	0.19	-	0.03
	2024	-	-	0.53	0.21	0.31	0.23	0.53	0.69	-	0.95	0.43	0.38	-	0.48	-	0.03
	2025	-	-	0.53	0.21	0.35	0.23	0.53	0.69	-	0.95	0.43	0.52	-	0.61	-	0.03
	2026	-	-	0.73	0.25	0.33	0.32	0.53	0.69	-	0.95	0.43	0.52	0.37	0.76	-	0.03
	2027	-	-	0.74	0.25	0.31	0.47	0.81	0.69	-	0.95	0.31	0.73	0.64	0.78	-	0.03
	2028	-	-	0.74	0.26	0.31	0.53	0.81	0.69	-	0.95	0.31	0.78	0.64	0.78	-	0.03
	2029	-	-	0.74	0.26	0.31	0.55	0.81	0.69	-	0.95	0.31	0.79	0.64	0.78	-	0.03
	2030	-	-	0.74	0.26	0.31	0.55	0.81	0.64	-	0.95	0.31	0.79	0.64	0.78	-	0.03
Observed 2020 fleet	HCR0	-	-	-	-	-	-	0.30	0.31	-	-	-	-	-	0.00	-	-
	HCR1	-	-	-	-	-	-	0.16	0.15	-	0.23	-	-	-	0.30	-	-
	HCR1D	-	-	-	-	-	-	-	-	-	0.49	-	-	-	-	-	-
	Total HCR	-	-	-	-	-	-	**0.46**	**0.46**	-	**0.72**	-	-	-	**0.30**	-	-

Design Cycles

EPA's statement that, "…in light of the design cycle timing for vehicles, EPA has basis to expect that the vehicles that automakers will be selling during the first years of the proposed MY 2023-26 program were already designed before the less stringent SAFE standards were recently adopted,"[156] completely misconstrues the importance and significance of design cycles on real world response to changes proposed in today's policy. DOT and EPA jointly proposed the SAFE Vehicles Rule on August 24, 2018,[157] signaling some probability of changes in federal regulations on GHG and CAFE. It is reasonable to expect that some manufacturers updated production plans for new vehicles accordingly, and consistent with the corporate strategies, for some of the affected model years in the SAFE proposal (MYs 2021-2024, for instance). The most reasonable way to characterize how each manufacturer responded to recent policies and market conditions is with an up-to-date fleet, and not conjecture about what manufacturers could have, or should have done in retrospect.[158] A small portion of the fleet is redesigned every year, and often the burden of higher stringency weighs significantly on redesigned vehicles.[159] In response to a rapid increase in standards like those in the proposed standards, manufacturers may use banked credits, produce many hybrid and electric vehicles, which the market will hopefully adopt, and continue to integrate fuel saving technologies, like tire rolling resistance technology, aerodynamic drag reducing technology, and mass reduction technology.

Tables 7 and 8, below, show the portion of the fleet with at least one redesign after MYs 2023 and 2024, respectively. As can be observed, only a small portion of any manufacturer's fleet is likely to be redesigned in any particular model year. For most manufacturers, their entire fleet will not be redesigned until after MY 2026.

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[156] GHG NPRM (*supra* note 2) at 43731.

[157] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks; Notice of proposed rulemaking, 83 Fed. Reg. 42986 (Aug. 25, 2018).

[158] The EPA analysis diverges in compliance pathways in 2018-2021 model years, both between alternatives considered today, and with what manufacturers achieved. Vehicles produced in these years are already produced and sold. MY 2022 vehicles are in production now. Manufacturers cannot go back in time and change past decisions about engines or transmissions offered in products, and it's not instructive at all for how changes in policy considered today may affect societal costs and benefits, or future stakeholder actions. The DOT analysis uses the SAFE rule stringency as the baseline, and ensures compliance pathways chosen by manufacturers are the same for 2021, and 2022, regardless of alternative, and this is a recommended approach. However, the DOT analysis also bakes a ZEV program into the baseline, and as a result, the technology costs associated with ZEV compliance do not appear to affect incremental technology cost, or future sales, and this is incorrect (a very large ZEV mandate could increase technology costs significantly, and consumers may be less likely to purchase as many vehicles at higher prices, but the current form of the DOT analysis would not consider this, and this is an error, and a failure to properly account for the technology cost of other vehicle standards affecting fuel economy and economic practicability).

[159] Auto Innovators appreciates that EPA now uses redesign cycles, specific to individual nameplates, as part of the analysis, which is a major improvement from EPA's prior analysis assumptions that all vehicles could be (and would be) redesigned by 2021, and again by 2025. However, many manufacturers will be hard-pressed to apply fuel saving technologies in response to updated standards in MYs 2023 and 2024, and can respond to increases in stringency more thoughtfully with longer lead-time.

Table 7: Fraction of each manufacturer's fleet with at least one redesign in MY 2023 or after based on DOT CCEMS input files.

	Portion of the manufacturer fleet with at least one redesign 2023 or after, according to DOT input files							
	2023	2024	2025	2026	2027	2028	2029	2030
BMW	0.13	0.20	0.34	0.38	0.78	0.97	1.00	1.00
Daimler	0.22	0.39	0.46	0.70	0.77	0.90	0.91	0.91
FCA	0.07	0.07	0.07	0.30	0.43	0.59	0.61	0.86
Ford	0.12	0.21	0.23	0.64	0.91	1.00	1.00	1.00
GM	0.03	0.33	0.57	0.77	0.93	1.00	1.00	1.00
Honda	0.22	0.29	0.33	0.35	0.69	0.99	0.99	0.99
Hyundai Kia-H	0.06	0.38	0.49	0.84	1.00	1.00	1.00	1.00
Hyundai Kia-K	0.00	0.60	0.72	0.77	0.81	1.00	1.00	1.00
JLR	0.30	0.65	0.80	0.87	0.87	0.87	1.00	1.00
Mazda	0.13	0.20	0.83	0.97	0.97	0.97	1.00	1.00
Mitsubishi	-	-	1.00	1.00	1.00	1.00	1.00	1.00
Nissan	0.10	0.31	0.41	0.42	0.64	0.78	0.91	0.93
Subaru	0.16	0.52	0.79	0.89	0.99	0.99	0.99	0.99
Toyota	0.08	0.60	0.61	0.78	0.82	0.93	0.93	0.98
Volvo	0.32	0.32	0.34	0.35	1.00	1.00	1.00	1.00
VWA	0.02	0.33	0.71	0.81	0.83	0.91	0.94	1.00

Table 8: Fraction of each manufacturer's fleet with at least one redesign in MY 2024 or after based on DOT CCEMS input files.

	Portion of the manufacturer fleet with at least one redesign 2024 or after, according to DOT input files						
	2024	2025	2026	2027	2028	2029	2030
BMW	0.07	0.21	0.25	0.65	0.85	0.93	1.00
Daimler	0.17	0.24	0.48	0.55	0.68	0.69	0.90
FCA	0.00	0.00	0.23	0.35	0.51	0.53	0.81
Ford	0.09	0.11	0.51	0.78	0.88	0.96	0.96
GM	0.30	0.54	0.74	0.90	0.97	0.99	0.99
Honda	0.07	0.11	0.13	0.47	0.99	0.99	0.99
Hyundai Kia-H	0.32	0.43	0.78	0.97	0.97	1.00	1.00
Hyundai Kia-K	0.60	0.72	0.77	0.81	1.00	1.00	1.00
JLR	0.35	0.50	0.57	0.57	0.57	0.83	1.00
Mazda	0.07	0.70	0.84	0.84	0.84	1.00	1.00
Mitsubishi	-	1.00	1.00	1.00	1.00	1.00	1.00
Nissan	0.22	0.31	0.32	0.54	0.75	0.88	0.90
Subaru	0.36	0.63	0.72	0.83	0.99	0.99	0.99
Toyota	0.52	0.54	0.70	0.76	0.87	0.88	0.92
Volvo	-	0.01	0.03	0.68	0.68	0.68	1.00
VWA	0.31	0.69	0.79	0.83	0.91	0.94	1.00

Batteries and Electric Vehicles

Batteries

Automotive-grade batteries will play a prominent role in many important fuel-saving technologies, and Auto Innovators encourages the Agencies to regularly review assumptions about batteries and high-voltage automotive systems.

Auto Innovators appreciates DOT's and DOE's continued collaborative effort to refine the BatPac model assumptions, considering battery chemistries, battery cell sizes, and battery pack architectures. Auto Innovators encourages continued benchmarking, teardown, and technical review of production systems, and the use of information to inform technical specifications of packs and estimates of current direct manufacturing costs that likely reflect the commercial state-of-the art as demonstrated by production vehicles. Given high levels of investment in research and development, and production processes, and the considerable uncertainty of what approaches will succeed or fail, it is possible that NHTSA's estimates of battery pack direct manufacturing costs (after learning factor) will be meaningfully low, or high in the MY 2027 timeframe and beyond.

EPA appears to use previous generation assumptions and battery costs from the SAFE Final Rule record, despite updated battery pack assumptions, and direct manufacturing cost assumptions being available for use in the DOT analysis.

To the extent that some manufacturers begin to vertically integrate and technically differentiate on battery systems, Auto Innovators encourages the Agencies to consider costs and specifications that are reasonable for the industry as a whole to inform policy analysis, and not to assume that intellectual property and proprietary production processes that have been the result of billions of dollars of research and development paid by one manufacturer will be readily available to all manufacturers. In the BatPac model, production volume can affect direct manufacturing cost estimates, and Auto Innovators points out that many battery cells vary (size, shape, chemistry) to suit the application. Even battery packs that share cells may require different housings and assembly processes, requiring separate production lines, resulting in economies of scale lower than would be projected if all these parts were the same. Total industry volumes of battery electric vehicles are not an appropriate volume assumption for BatPac. Auto Innovators recommends that EPA update their approach to that used in the DOT analysis to estimate battery costs for strong hybrids, plug-in hybrids, and battery electric vehicles, considering vehicle type and synergies with other fuel saving technologies. That analysis could be improved by using the BatPac results for BEV400's and BEV500's, instead of scaling up BEV300 costs.

Battery electric vehicles should be carefully considered in the GHG analysis

More battery electric vehicles have been stated as a policy objective by some state governments, and by executive order. The market is emerging, and there is considerable uncertainty around the types of battery electric vehicles consumers may adopt, their costs to build, their costs to charge and operate, and how they will be used. Policymakers should carefully consider what complementary programs may be needed to unlock to the projected benefits of this technology.

The EPA proposal considers battery electric vehicles with limited range (BEV200, BEV300), and in response to rapid increases in stringency, the analysis assumes a very large portion of the market may adopt vehicles with less range than comparable internal combustion engine vehicles. The DOT analysis considers that longer range battery electric vehicles (BEV400, BEV500, in addition to BEV200, BEV300) will be required to attract "early adopters" and "early majority" to these alternative fuel vehicles. BEV400 vehicles are already on the market and are necessary to meet the demands of some of the earliest battery electric vehicle adopters. Auto Innovators encourages EPA to include BEV400 and BEV500 in their analysis tool, and to adopt DOT phase-in caps from the CAFE NPRM in place of the phase-in caps used in the EPA proposal, as the EPA proposal likely overestimates the number of consumers who would accept BEV200's, especially given today's charging infrastructure. Even if there are more charging stations, rapidly adding energy to a small pack is difficult, and pack size may limit charge rate.[160] Longer range means battery packs with more storage capacity, and more capacity generally means additional cost of equipment. Battery electric vehicles with larger packs are even more expensive relative to their internal combustion engine counterparts than their lower range siblings, taking longer to pay back the upfront investment based on fuel savings alone, which policymakers should carefully consider when designing consumer incentive programs and analyzing regulatory policies. Auto Innovators encourages the Agencies to regularly review assumed phase-in caps, and the market acceptance of vehicles with limited electric range for some segments (*i.e.*, trucks and SUV's) as the market for battery electric vehicles and charging infrastructure mature.

Both the EPA and DOT proposals assume that EVs will be driven like their ICE counterparts, but early data suggest this is not the case. In each agency's analysis, benefits like fuel savings accumulate as miles are driven. The benefits of EVs could be overestimated (perhaps significantly so) if multi-vehicle households shift their mileage towards ICE vehicles and drive the EVs less than projected. The Agencies should review the data used to create vehicle miles traveled (VMT) assumptions, and study how EVs are accumulating miles over time relative to comparable ICE vehicles, and how these differences trend as the market for EVs matures. Coordinated policies and programs (like charging infrastructure) will be important to realize the benefits as projected with the current VMT schedules in the modeling tools, and to entice drivers to choose EVs for all kinds of trips, in all kinds of driving conditions.

<u>Approach to Fuel Cost Savings</u>

Energy savings associated with EVs.

In both EPA and DOT analysis, a large portion of the projected benefits are attributed to fuel savings, either from using less energy to travel the same number of miles, from switching to a lower cost fuel (electricity), or from a combination of both. At this time, there is a tremendous amount of uncertainty related to the future of the electricity grid, and electricity rates (both residential rates including transmission costs, and whatever rates that may be offered to consumers at public vehicle

[160] It is useful to compare to the capacity of the battery pack (kWh) to the rate (kW) energy may be safely stored in or removed from the battery. "C rate" for charge and discharge is an important specification, and high C rates may only be achieved in ideal conditions. The small size of the battery and limited ability to add energy quickly to small batteries, often deter customers from adopting (or even considering) BEV150's and BEV200's. Also, it is important to note that synergy with road load reducing technologies (ROLL, AERO, MR) often means the same range is projected with smaller battery capacity, but the theoretical range equivalency may not translate well to the real world if the air-conditioning, heat, or defog/defrost is activated.

charging infrastructure). Researchers and scientists from National Renewable Energy Laboratory ("NREL") have highlighted challenges with integrating variable renewable energy generation into the electric grid beyond 30% generating capacity, with challenges including higher transmission costs, and costly overhead associated with storage and standby generation.[161] Notably, states with higher portions of renewable electricity generation like Hawaii, California and Massachusetts also have some of the highest electricity rates in the country.[162,163] Studies from the NREL have outlined how renewable power sources, such as solar, could be integrated into the electric grid to meet the nation's ambitious emissions goals, and these studies acknowledge that costs increase when the timing of electricity generation and electricity demand are not synchronized.[164] Without public charging infrastructure, many EVs will be charged at night, at residences, when solar arrays are not generating electricity. EPA inputs estimate the cost of delivered electricity ($/kWh) as $0.122 in 2021, and $0.133 in 2040. DOT inputs estimate the cost of delivered electricity ($/kWh) as $0.121, and $0.120 in 2040. States with a larger percentage of renewable electricity generation typically have end-use rates 1.5 to 2.5 times higher than those assumed by the Agencies, with delivered costs ($/kWh) increasing as more renewable generating capacities are added. (Increases in transmission costs and increases in standby generating costs partially offset or exceed cost reductions of solar and wind generation). As the U.S. electricity generating industry transforms towards renewables, Auto Innovators urges policymakers to consider the possibility that electricity rates may be considerably more expensive relative to gasoline than projected in the GHG NPRM and CAFE NPRM analyses (as indicated by higher electricity rates in states that are already working toward renewable electricity generation), and this could significantly erode projected fuel savings and consumer demand for EVs. As the penetration rate of EVs increases, the projected electricity rates will become an important modeling input for assessing costs, benefits, and consumer adoption of EVs. Auto Innovators encourages policymakers to consider the possibility that electricity rates may double from 2021 to 2040 (in 2018$ terms) when considering policies for light-duty vehicle GHG and CAFE, and to use real-world data to inform an electricity price forecast.

Fuels and Benefit-Cost Analysis

Both EPA and DOT recognize fuel savings as significant in the benefit-cost analysis. These fuel savings accumulate to consumers based on assumed prices of fuel, fuel efficiency for combinations of

[161] Benjamin Kroposki, "Integrated High Levels of Variable Renewable Energy into Electric Power Systems," National Renewable Energy Laboratory (revised Dec. 2018), available at https://www.nrel.gov/docs/fy17osti/68349.pdf (accessed Sep. 24, 2021) at 11.

[162] *State Electricity Profiles*, U.S. Energy Information Administration, https://www.eia.gov/electricity/state/ (accessed Sep. 24, 2021).

[163] *Electric Power Monthly: Table 5.6.A Average Price of Electricity to Ultimate Customers by End-Use Sector*, U.S. Energy Information Administration, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a (accessed Sep. 24, 2021).

[164] *Solar Futures Study*, U.S. Department of Energy Office of Energy Efficiency & Renewable Energy (Sep. 2021), available at https://www.energy.gov/sites/default/files/2021-09/Solar%20Futures%20Study.pdf (accessed Sep. 24, 2021).

technologies, and travel over the lifetime of the vehicle. Each analysis recognizes that independent of regulations, consumers will adopt fuel saving technologies that pay back quickly.[165]

Fuel prices vary significantly across the U.S. California has some of the highest gasoline prices in the country, often 50% higher than in other states with large automotive markets.[166] Many manufacturers' sales vary significantly by region. Some manufacturers have higher sales concentrations in California and Section 177 states than other manufacturers, and this may affect corporate strategy and the incorporation of fuel-saving technologies on vehicles. Auto Innovators encourages policymakers to consider the importance of regional factors carefully before exporting California policy as a baseline for federal standards.

Both the EPA and DOT analysis use—and have used—forecasts from the U.S. Energy Information Administration for fuel prices in their central analyses. Over the last decade (as shown in Figure 4 below), these fuel price forecasts have significantly overestimated the national average price of gasoline, which has in turn overstated the projected benefits of increases in stringency and improving fuel economy for consumers in the near term. Over the last decade, the long-term price outlook for gasoline has steadily declined as well, both in the EIA forecasts, and in private sector forecasts.

Interestingly, DOT included a sensitivity case for gasoline prices, as forecast by Global Insight. This is a credible source, alongside the EIA forecast. Both forecasts have a similar trajectory and values from 2022-2029, but they depart significantly in 2030 and beyond. Gasoline prices are volatile, and difficult to predict. Both EPA and DOT show U.S. consumption of gasoline decreasing significantly in the long term, as fuel efficiency of light duty vehicles improves in response to stringent alternatives, and as the fleet transitions towards electrification. Auto Innovators encourages policymakers to review the assumptions underlying the EIA gasoline price forecast, including assumed domestic consumption of fuel, and the extent to which plug-in vehicles are assumed to be adopted, and review the extent to which those assumptions are consistent with the policy objectives for light-duty vehicle electrification as stated in recent executive orders. If the EIA Central Case gasoline forecast assumes fewer than 50% plug-in vehicles by 2030, Auto Innovators encourages use of the Global Insight gasoline price forecast in the Central Case for both EPA and DOT analysis.

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165 Within 30 months, for instance.

166 *Weekly Retail Gasoline and Diesel Prices*, U.S. Energy Information Administration, https://www.eia.gov/dnav/pet/pet_pri_gnd_a_epmr_pte_dpgal_w.htm (accessed Sep. 24, 2021).

To the extent that gasoline prices may remain low in the long-term (perhaps reflecting depressed demand for gasoline, as shown in both of the Agencies' analysis), consumers may require additional incentives to transition towards plug-in vehicles.

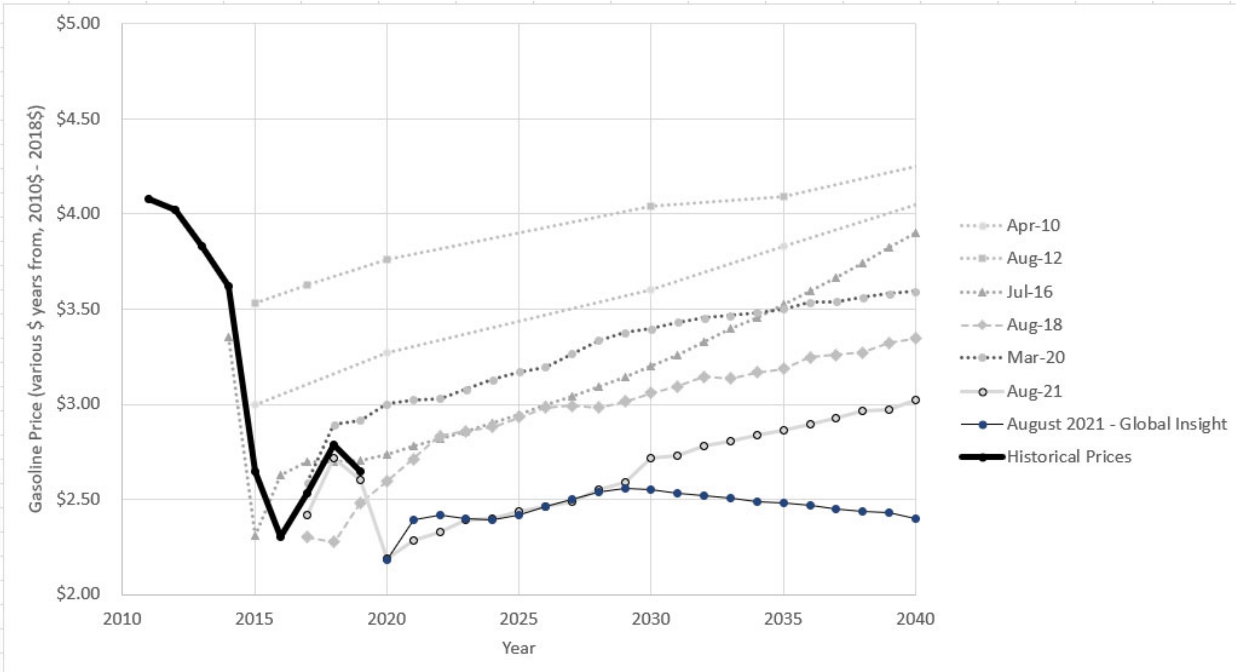

Figure 4: Comparison of EIA and Global Insight projected gasoline prices.

Many of the projected benefits of the proposal are backloaded, taking years for consumers, and society, to realize payback on fuel-saving technologies. If gasoline prices do not increase significantly in the 2030 and beyond timeframe, this would have significant bearing on the benefit-cost analysis, and the projected benefits of the proposed rule. Policymakers should carefully consider this possibility given the trends of fuel price forecasts over the last decade, and consumption projections.

Tools and Inputs for Compliance Modeling

Compliance modeling tools should simultaneously consider all federal and state regulations that significantly affect light-duty vehicle GHG emissions, fuel economy, and related technology mandates.

Auto Innovators supports the use of a compliance modeling tool that is capable of simultaneously modeling individual manufacturer compliance at the fleet (manufacturer, domestic car, import car, and light truck) level with the multitude of GHG and fuel economy regulatory requirements in the U.S. (including EPA GHG regulations, NHTSA CAFE regulations, CARB GHG regulations, CARB zero-emission vehicle regulations, and the California Framework Agreement). This is the challenge that manufacturers face in developing compliance plans—numerous similar, but not fully coordinated and harmonized regulations, all of which product plans must account for. While no presently available vehicle regulatory compliance modeling tool fully considers all of these requirements, the CAFE Compliance and Effects Modeling System ("CCEMS") comes closest for the time being. Therefore, we support use of CCEMS by EPA for modeling compliance, and urge the Agencies to jointly develop a tool that is more fully capable of considering all requirements.

The consumer-facing costs of the EVs should be included and shown as part of the anticipated increased costs of future vehicles.

Fully accounting for the costs of EVs in assessing the technology costs of GHG and CAFE regulations is becoming increasingly important. Simply assuming that other regulations such as the California ZEV mandate will create specific outcomes in isolation from EPA's own regulatory efforts—e.g., including them in a baseline or reference case—is a flawed approach. As noted above, manufacturers must plan simultaneous compliance with all regulations, and the technology decisions made for compliance with one also affect compliance with the others. Conducting the analysis in a way that assumes the costs of meeting other related regulations are incurred separately from compliance with the proposed GHG regulations will lead to under-reporting of expected vehicle cost increases associated with meeting the multitude of related standards simultaneously. We recommend that cost increases associated with the technology required to meet all of the related GHG, fuel economy, and technology-forcing regulations at minimum be shown as part of the consumer-facing costs (expected per-vehicle cost increases) over the regulatory period.

Coordination Between the Agencies' Analysis

While DOT and EPA use similar tools to conduct analysis, EPA is using an old version of inputs, with a few meaningful tweaks, to conduct the analysis. The differences are notable (Table 9).

Table 9: Differences between EPA and NHTSA compliance modeling for the GHG NPRM and CAFE NPRM.

Topic	EPA Tool	DOT Tool
Fleet Vintage for Baseline	• 2017 Model Year.	• 2020 Model Year.
Other policies in baseline.	• California Framework Agreements.	• California Framework Agreements. • ZEV compliance (via forced BEVs) by 2025 Model Year.
First year's response to newly proposed standards	• 2018 Model Year.	• 2023 Model Year.
Treatment of Atkinson engines (HCR)	• HCR widely applied in compliance pathways. • HCR0, HCR1, HCR2 included. • HCR2 projects unbelievable effectiveness estimates. • HCR engines applied in 2018, 2019, 2020, and 2021 in excess of what was observed in the market.	• HCR0, HCR1, HCR1D included. • Effectiveness estimates in-line with observed applications, in combination with IACC. • Some additional improvements possible with EFR. • Model often jumps ahead to electrification in response to proposed standards.
Treatment of BEV's	• BEV200 / BEV300. • Most BEVs through 2027 are BEV200.	• BEV200 / BEV300 / BEV400 / BEV500 • Rapid ramp of BEVs requires mix of longer ranges (BEV300s, etc.) for consumer acceptance.
Treatment of Off-Cycle credits	• Manufacturers ramp to 10 g/mi, or 15 g/mi in 2020.	• Many manufacturers ramp to 10 g/mi or 15 g/mi by 2026. • Some manufacturers stop ramping up around 7 – 10 g/mi.
Central Case Gasoline Prices	• EIA forecast. No difference with DOT.	• EIA forecast. No difference with EPA.
Battery Prices	• Uses direct manufacturing costs from the SAFE Final Rule.	• Uses direct manufacturing with most recent release of BatPac assumptions at the time of analysis. • Updates better account for high voltage isolation costs, and battery cell specifications.
Mass reduction treatment	• Uses SAFE Final Rule mass reduction costs.	• Updates to mass reduction costs for MR5/MR6, based on carbon fiber composite prices. • Model will not apply MR5/MR6 to high volume programs.

Comments on Potential Future Technology Additions

Aside from the previous discussion of HCR2, which is a prominent issue in EPA's analysis with respect to technological feasibility, Auto Innovators provides the following comment and guidance for current and near-future analysis.

The Agencies should maintain a performance-neutral approach when estimating technology benefits.

Vehicle design parameters are never static. With each new generation of a vehicle, manufacturers seek to improve vehicle utility, performance, and other characteristics based on research of customer expectations and desires, and to add innovative features that improve the customer experience. The Agencies have historically sought to maintain the performance characteristics of vehicles modeled with fuel economy-improving technologies. Auto Innovators encourages the Agencies to maintain a performance-neutral approach to the analysis, to the extent possible. Auto Innovators appreciates that the Agencies continue to consider high-speed acceleration, gradeability, towing, range, traction, and interior room (including headroom) in the analysis when sizing powertrains and evaluating pathways for road-load reductions. All of these parameters should be considered separately, not just in combination. (For example, we do not support an approach where various acceleration times are added together to create a single "performance" statistic. Manufacturers must provide all types of performance, not just one or two to the detriment of others.)

Tire rolling resistance improvements

Auto Innovators discourages the addition of 30% tire rolling resistance reductions ("ROLL30") to the analysis at this time. Performance neutrality for cold weather traction, hot weather performance, wet weather traction, load handing (for addition weight of batteries, for instance), wear and durability, and noise, vibration, and harshness can be challenging to achieve for 20% tire rolling resistance reduction, and the technology pathway to ROLL30 for many vehicles remains unclear.

Aerodynamic improvements

A 20% aerodynamic improvement relative to 2015 baseline vehicles remains challenging to achieve for many body styles, given form drags, and other regulations, like side view mirror requirements. Auto Innovators does not recommend considering additional aerodynamic improvements (such as 25 percent aerodynamic improvements, etc.). Some additional reductions in aerodynamic forces may be possible if side view mirrors were no longer required by NHTSA and Federal Motor Vehicle Safety Standards.

Comments on Legal and Administrative Issues

<u>Comment Period and Supplemental Comments</u>

The comment period on the GHG NPRM is abnormally short.

Executive Order 12866 states in part, "…each agency should afford the public a meaningful opportunity to comment on any proposed regulation, which in most cases should include a comment period of not less than 60 days."[167]

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[167] Executive Order 12866, section 6, paragraph (a).

As a "significant regulatory action" as defined in EO 12866, Auto Innovators anticipated at least a 60-day comment period. In contrast, EPA only provided a 53-day comment period based on the public release of the proposed rule (August 5, 2021), and only 48 days based on the proposed rule's publication in the *Federal Register* (August 10, 2021), the official means of publishing such notices.

Historically, EPA has provided more than 60 days for public comment on proposed light-duty vehicle GHG rules. For the SAFE Vehicles proposal, 86 days were provided from its public release and 63 days from its publication in the Federal Register.[168,169] For the 2012 Rule, 74 days were provided from the proposed rule's publication in the *Federal Register*. [170,171] EPA provided 60 days for public comment on its first proposed light-duty vehicle GHG rulemaking from its publication in the *Federal Register*, plus the additional time between its public release and formal publication.[172]

The shorter comment period is particularly constraining when one considers that past EPA and NHTSA rulemakings were done as a single set of coordinated documents with joint hearings, and a single comment deadline. In the case of the present EPA rulemaking, the regulated stakeholders (and other interested parties) must respond to two related regulatory proposals from EPA and NHTSA with separate, uncoordinated technical inputs and analysis, non-harmonized standards, and separate hearings, all on significantly overlapping, but separate timelines. In addition, a third related rulemaking to revise CAFE civil penalties was also on a concurrent timeline, further consuming the same engineering and human resources to evaluate and respond to GHG and CAFE proposals.

Although we recognize that EPA is on an accelerated rulemaking timeline to finalize MY 2023 standards prior to its start on January 2, 2022, it is more important to get the standards done right than it is to get them done fast.

EPA should consider supplemental comments to the extent possible for this rulemaking, and in the context of future rulemaking actions for later model years.

Auto Innovators anticipates submitting additional comments following the official closure of the comment period on the GHG NPRM. To the extent possible, such comments should be considered as

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[168] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks; Notice of Proposed Rulemaking, 83 Fed. Reg. 42986 (Aug. 24, 2018). Signed Aug. 1, 2018.

[169] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks; Extension of Comment Period, 83 Fed. Reg. 48578 (Sep. 26, 2018). Comments due Oct. 26, 2018.

[170] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Proposed Rule, 76 Fed. Reg. 74854 (Dec. 1, 2011).

[171] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Notice of Proposed Rulemaking; Extension of Comment Period, 77 Fed. Reg. 2028 (Jan. 13, 2012). Comments due Feb. 13, 2012.

[172] Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 74 Fed. Reg. 49454 (Sep. 28, 2009). Comments due Nov. 27, 2009.

informative to the present rulemaking. EPA should also consider such supplemental comments as it prepares to undertake a post-model year 2026 rulemaking.

List of Abbreviations

2012 Rule	2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule, 77 Fed. Reg. 62624 (Oct. 15, 2012)
ABT	(Credit) averaging, banking, and trading
A/C	Air conditioning
ACC2	California Advanced Clean Cars 2 rulemaking activities
(The) Agencies	Collectively, the U.S. Environmental Protection Agency and National Highway Traffic Safety Administration
AIM Act	American Innovation and Manufacturing Act
AKI	Anti-knock index
Auto Innovators	Alliance for Automotive Innovation
Baseline Study	Model Years 2012 to 2020 Baseline Study, IHS Markit (Sep. 1, 2021).
CAFE	Corporate Average Fuel Economy
CAFE NPRM	Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks, 86 Fed. Reg. 49602 (Sep. 3, 2021)
CARB	California Air Resources Board
CCEMS	CAFE Compliance and Effects Modeling System
CRC	Coordinating Research Council
EFR	Engine friction reduction
EPA	U.S. Environmental Protection Agency
EU	European Union
EV(s)	Electric vehicles including battery electric, plug-in hybrid electric, and fuel cell electric vehicles
EV Multipliers	Advanced technology vehicle production multiplier incentives for electric vehicles
GHG	Greenhouse gas
GHG NPRM	Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43726 (Aug. 10, 2021)
GREEN-MAC-LCCP	Global Refrigerants Energy and Environmental-Mobile Air Conditioning-Life Cycle Climate Performance (model)

HCR2	A futured Atkinson cycle engine used in EPA's compliance modeling
HFC(s)	Hydrofluorocarbon(s)
IACC	Improved engine accessory drive components
ICE	Internal combustion engine
IMAC	Improved Mobile Air Conditioner (study)
IMAC-GHG-LCCP	Improved Mobile Air Conditioner-Greenhouse Gas-Life Cycle Climate Performance (model)
JAMA	Japanese Automobile Manufacturers Association
LCCP	Life-Cycle Climate Performance (model) (SAE J2766)
LCFS	Low carbon fuel standard
MAC	Mobile air conditioning
MY(s)	Model year(s)
NASEM Report	*Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2025-2035*, National Academies of Sciences, Engineering, and Medicine, Washington, DC: The National Academies Press, 2021
NHTSA	National Highway Traffic Safety Administration
NREL	National Renewable Energy Laboratory
OBD	On-board diagnostic (systems)
PM	Particulate matter
RFS	Renewable fuel standard
RON	Research octane number
SAFE Rule	The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks, 85 Fed. Reg. 24174 (Apr. 30, 2020).
TEWI	Total equivalent warming impact
WWFC	Worldwide Fuel Charter