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**COMMENTS OF THE MANUFACTURERS OF EMISSION CONTROLS ASSOCIATION ON THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY'S PROPOSED RECONSIDERATION OF 2009 ENDANGERMENT FINDING AND GREENHOUSE GAS VEHICLE STANDARDS**
**EPA-HQ-OAR-2025-0194**

The Manufacturers of Emission Controls Association (MECA) offers the following comments on the United States Environmental Protection Agency's (EPA) Proposed Reconsideration of the 2009 Endangerment Finding and Greenhouse Gas (GHG) Vehicle Standards. Our industry benefits from technologically feasible GHG standards that can be met through multiple pathways. MECA believes an important opportunity exists for performance-based standards to continue to cost effectively reduce NOx, PM, VOCs and GHGs in all segments of the light-, medium- and heavy-duty fleets through the application of a diversity of powertrain system technologies that offer consumers a choice in the cars they drive.

MECA is a non-profit industry association of the world's leading manufacturers of technologies for clean mobility. Our members have supported this industry for over 50 years and have a proven track record in developing and manufacturing emission control, engine efficiency, battery materials, components and charging as well as electric propulsion technology for a wide variety of on-road and off-road vehicles and equipment in all world markets. Our industry has played an important role in the emissions success story associated with light-, medium- and heavy-duty vehicles in the United States, and has continually supported efforts to develop innovative, technology advancing, emission reduction programs to improve ambient air quality while reducing greenhouse gases that yield fuel savings to consumers.

MECA members represent over 70,000 of the nearly 300,000 North American jobs building the clean mobility technologies that reduce emissions and improve the fuel economy of on-road and non-road vehicles. These jobs are located in nearly every state in the United States – the top 10 states being Michigan, Texas, Illinois, Virginia, New York, Indiana, North Carolina, Ohio, Pennsylvania, and South Carolina. The mobile source emission control industry has generated hundreds of billions of dollars in U.S. economic activity since 1975 and continues to grow and add more jobs in response to environmental regulations. Emission control, engine efficiency and electric technology manufacturers invest billions of dollars each year in developing the technologies that reduce emissions from mobile sources.

In order to simultaneously meet 2027 model year NMOG+NOx, PM and GHG emission standards, multiple pathways are available through a combination of advanced technologies. These include traditional and hybrid vehicles with internal combustion engines employing advanced combustion components such as turbochargers, EGR systems, cylinder deactivation, high pressure fuel injection, exhaust emission control catalysts, substrates and evaporative control system architectures. In addition, full electrification and hydrogen fueled vehicles contribute to emissions reductions. We support the current standards for criteria pollutants, including those that become effective in MY 2027 for both light- and heavy-duty vehicles, which will provide certainty to technology suppliers and their OEM customers who have already invested billions of dollars in commercializing and integrating the technologies on vehicles in preparation for deployment of compliant vehicles and in reliance on EPA's standards.

Recent changes in policies and market realities have led to slower than anticipated EV uptake. We agree with EPA that the rates of electrification estimated for compliance with EPA's final GHG rules for MY 2027 and later vehicles were ambitious. While electric vehicle technology is mature at this point, there is still considerable uncertainty in the timeline for market penetration. We remain concerned about the rate of charging infrastructure build-out as well as short and medium-term availability of sufficient critical minerals to support industry investments. In addition, unforeseen disruptions in electrical power availability have occurred as our nation's electrical grid is stressed by increased demand coupled with aging infrastructure.[1] Nevertheless, we still recommend retention of GHG standards for mobile sources. We suggest EPA consider application of GHG standards at a level that encourages continued progress in GHG reductions based on all available technologies, including efficiency improvements in current internal combustion engine vehicles and electrification technology that includes hybrids.

MECA appreciates the time and effort that EPA staff put into the regulatory process. We thank EPA staff for their dedication in receiving and incorporating feedback from a broad range of stakeholders. We look forward to continuing to discuss our suggestions with Agency staff as you work to finalize this regulation.

[1] https://www.utilitydive.com/news/energy-infrastructure-transmission-transformers-civil-engineers/743698/

**Summary**

MECA encourages EPA to consider alternatives to the proposed options in this rulemaking. EPA should revise the GHG standards to a level that continues to incentivize technology innovation and U.S. auto industry competitiveness in the global market. We are concerned that rescission of the Endangerment Finding to address motor vehicle GHG standards may increase policy risk and long-term regulatory instability which impairs our industry's ability to effectively make investments. Clean mobility suppliers invest in developing technology for a global automotive market many years in advance and depend on policy stability to avoid stranded investments.

As an alternative to eliminating GHG standards, we support revisions to enable a more holistic U.S. climate policy. One such improvement would be to account for well-to-wheels life-cycle carbon intensity of transportation and draw on a system-based strategy that includes fuels and allows both vehicles and the energy that powers them to be considered when meeting standards. The combination of downward adjusted GHG emission limits and life-cycle accounting of upstream emissions offers a robust and comprehensive approach to reconsidering the vehicle GHG emission standards. Such an approach treats all technologies equally and provides a stable and defensible regulatory framework for industry to base long term investments in the U.S. auto sector.

MECA would like to provide comments on the following issues that were requested in the current NPRM. More details will be provided on each issue later in this document.

1. EPA requested comment on "the nature and extent of any reliance interests that may have arisen from the Agency's assertion of regulatory authority over GHG emissions from new motor vehicles and engines and is committed to assessing any such interests, determining whether they are significant, and weighing such interests against competing rationales, as required by law (C-4)." Suppliers have made major investments in technology innovation, development and manufacturing of components to enable automakers and engine makers to achieve current and future GHG standards. Eliminating all GHG standards for mobile sources puts those investments at risk. MECA believes that finalizing this proposed regulation may result in significant loss of jobs from the automotive industry, based on the SAFE NPRM analysis.[2] Finally, because other nations in Europe and Asia continue to tighten fuel economy and $CO_2$ emission standards, there is a likelihood of engineering and future manufacturing investment shifting from the U.S. to other countries. This will effectively cede our leadership to foreign nations and put U.S. companies at a competitive disadvantage and potentially repeat the history of the 1970s when U.S. automakers were outcompeted by smaller, more efficient foreign companies.

[2] https://www.nhtsa.gov/document/final-regulatory-impact-analysis-fria-safer-affordable-fuel-efficient-safe-vehicles-rule

2. EPA has requested comment on the proper interpretation of "requisite technology." The U.S. has been the world leader in clean vehicle technology in response to performance-based and technology advancing regulations to protect air quality and provide consumers fuel efficient vehicles. Light-, medium- and heavy-duty GHG standards through MY 2026 have led to an introduction of innovative and advanced GHG technologies such as advanced fuel injectors in downsized GDI engines, turbochargers, cooled-EGR systems, 48-volt mild hybrid and full hybrid systems, cylinder deactivation, batteries, motors and electronic controls. These requisite technologies provide real GHG reductions when employed on engines and vehicles. The recent growth in hybrid vehicle penetration confirms consumer acceptance of the technologies that save them money at the pump.

3. EPA is seeking comment on "the analysis provided within section VIII related to the benefits and costs of the proposed action and whether benefit cost analysis is an appropriate and lawful basis for repealing the Endangerment Finding and/or resulting vehicle standards." The breadth of cost-benefit analyses conducted by EPA for its prior mobile source GHG regulations are far more detailed and extensive than that provided for the proposed rescission of the GHG standards. The Agency should review those prior analyses[3] and conduct a similarly detailed analysis of this proposal to compare current methodologies and results to those in previous regulatory impact analyses and technical support documents. EPA should describe the reasons for differences in previous modeled costs and benefits compared to those projected in this proposal. For example, when EPA proposed the SAFE Vehicle Rule, the Agency's Draft Environmental Impact Statement concluded that the preferred alternative would have resulted in a net loss of over $4 billion in climate benefits as well as increases in every conventional pollutant modeled when compared to the original baseline rule. The Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles finalized in 2024[4] (herein "Multipollutant Rule") estimated that fuel savings would far outweigh the costs of standards. Given that EPA is now proposing to eliminate all GHG standards, it would strengthen the proposal to document the differences between the current cost-benefit analysis and prior rulemaking analyses. EPA should provide the public an opportunity to comment on the analysis before finalizing the proposal.

4. The Agency has also requested comment on several proposed changes, "including on any additional regulatory provisions for engines and vehicles that should be removed as part of repealing the GHG standards or should be retained to effectuate unrelated standards that the Agency is not proposing to repeal or revise." We note that the EPA "is not proposing to reopen or substantively modify

[3] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1019VPM.pdf; https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013ORN.pdf

[4] https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model

at this time any regulations necessary for criteria pollutant and air toxic measurement and standards, CAFE testing, and associated fuel economy labeling requirements." However, the Agency has also stated that it remains open to reconsidering these at a later date. We support EPA's decision not to reconsider but rather retain standards for criteria pollutants in this proposal. The record supports that the criteria pollutant standards are achievable without relying on EVs and yield consumer savings and air quality benefits that are multiple times the nominal per vehicle costs. We urge EPA to continue to leave the 2027 criteria pollutant standards in place. In the event the Agency decides to reconsider the 2027 criteria pollutant standards and implementation timelines set forth in the Multipollutant Rule and Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards finalized in 2022[5] (herein "Heavy-Duty NOx Rule"), a notice-and-comment rulemaking is the most appropriate and legally defensible process.

**Suppliers Rely on Feasible GHG Standards to Provide Regulatory Stability**

MECA supports GHG standards that provide continued progress for technological innovation. We recognize the Agency's contention that MY 2027 and later GHG standards for both light- and heavy-duty vehicles would require ambitious levels of EV sales. We have previously commented that these would be challenging for engine and vehicle OEMs given the current level of consumer demand for EVs, which remains less than 10%[6] and under 1%[7] for light- and heavy-duty vehicles, respectively. The lack of demand for EVs can be attributed, in part, to higher EV purchase costs compared to ICE and hybrid vehicles of the same class and the lack of robust charging infrastructure. While there may be justification to allow additional flexibility or consideration of lower rates of increasing stringency of GHG emission standards, it is clear to technology solution suppliers that eliminating the standards will have an adverse impact on our industry.

Changing course at this late date, with less than one year until the start of implementation, is particularly challenging for our industry and increases the likelihood of stranded investments on the order of tens of millions of dollars for many of our member companies. In reliance on the standards, suppliers have been working with their customers to prepare for introduction of MY 2027 engines and vehicles for several years now. This includes substantial investments to conduct the engineering analyses that have resulted in the completion of design of MY 2027 and 2028 engines and vehicles. Furthermore, supply chains have been secured for the tooling needed in the manufacturing process.

Companies that design and manufacture emission control and efficiency technology products to meet GHG and criteria pollutant standards employ over 300,000

[5] https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-and-related-materials-control-air-pollution

[6] https://www.eia.gov/todayinenergy/detail.php?id=65384

[7] https://www.iea.org/reports/global-ev-outlook-2025/trends-in-heavy-duty-electric-vehicles

people at over 2000 facilities across the United States.[8] The clean mobility industry exists largely because of technologically feasible and cost-effective regulations of vehicles and fuels. The goal of these regulations, consistent with EPA's mission, is to reduce emissions in order to achieve improved air quality that results in a healthier American population; they save billions of dollars in medical expenses and attract investment in our economy. In addition to these health benefits, mobile source regulations have spurred an entire industry that generates hundreds of billions of dollars annually for the U.S. economy. Furthermore, suppliers invest billions of dollars each year in research and development of technological innovation that gets exported around the world. In fact, automotive technology suppliers account for approximately 40% of the auto R&D conducted in the U.S. each year.[9]

MECA supports technologically feasible GHG standards that can be cost-effectively achieved through application of a diversity of powertrains, including internal combustion engines, hybrids and fully electric vehicles. These standards, when designed appropriately, simultaneously promote technological progress and provide economic benefits to consumers of fuel-efficient vehicles, as well as improved health and welfare for all Americans. The rescission of all vehicle GHG standards would adversely affect the automotive clean technology supplier industry for several reasons. First, EPA's proposal will result in increased regulatory instability that leads to market uncertainty for our industry. This results in delays and cancellations of current programs already started by suppliers and OEMs. It also leads to delayed and cancelled investments toward future research and development as well as infrastructure projects that include manufacturing facilities. Second, the proposal will lead to stranded investments as GHG emission reduction technology sales will decline, leading to decreased revenue and less contribution to the U.S. economy. Finally, delayed, cancelled and stranded investments will result in lost U.S. jobs.

The additional uncertainty created by this NPRM may potentially jeopardize new investments in American manufacturing of advanced clean car technologies. Investments that would have been made in the U.S. may go to other countries where GHG standards will continue to be progressively tightened. Furthermore, elimination of the Endangerment Finding and GHG standards is almost certain to result in litigation that would take years to resolve. It also could lead to states exploring other approaches to require EVs or reduce vehicle GHG emissions in their jurisdictions, particularly if they believe that courts will not defer to the Agency's assertions in this proposal regarding preemption. This extended period of regulatory instability would only provide additional impetus for companies to look at other countries, where tighter GHG regulations are more stable, for making new manufacturing investments instead of the U.S. Due to the economics of long-term investments in manufacturing and supply chain management,

[8] https://www.bluegreenalliance.org/resources/bluegreen-alliance-unveils-latest-auto-industry-map-for-domestic-manufacturing-advocates/

[9] Motor & Equipment Manufacturers Association, Moving America Forward (2013), https://www.mema.org/resource/2013-economic-impact-study-moving-america-forward

there is a very low chance of jobs and investments returning to the U.S. once they are moved overseas because the overseas markets will be more mature, and it may be more cost effective to ship parts from abroad rather than building manufacturing capacity in the U.S.

Automotive suppliers represent the largest sector of manufacturing jobs in the nation and have made long-term investment decisions based on the GHG standards that were first set in 2012. In fact, automotive suppliers have seen an overall 23 percent increase in employment since 2012, which can partly be attributed to advanced technology development spurred by these standards. While supplier direct employment in the U.S. is highest in Michigan, Ohio, and Indiana, the highest growth in recent years has been seen in the Southeast region.[10] Elimination of the standards will cause adverse economic impacts, including the loss of jobs. Initial job losses will most likely be in application engineering. The long-term impacts of stranded investment may lead companies to question the risk of future investments in the U.S. when other regions offer regulatory stability.

When EPA and NHTSA proposed the SAFE Vehicles Regulation[11] not to eliminate but rather to keep the standards flat for light-duty vehicles from MY 2021-2026, the Agency forecasted declining demand for advanced GHG and fuel saving technologies. MECA conducted a survey to better understand the impacts of the SAFE Vehicles Regulation on our member companies. The vast majority of our members responded that investments had been made in response to the original GHG and CAFE standards, and over half of MECA member companies have experienced job growth in response to those standards.

EPA's own economic analysis predicted over 600,000 job losses in response to finalizing the SAFE Vehicles Regulation. Because EPA's current proposal seeks to go further by completely eliminating all GHG standards, it stands to reason that finalizing this regulation would result in significant job losses from the automotive industry as well as a diversion of future investments to overseas markets. The rationale for this is based on the SAFE NPRM analysis prediction of lower penetration of many technologies, which directly impacts revenue, jobs and investment by many suppliers. Other impacts of eliminating the GHG standards include an increase in consumer spending on gasoline[12] as well as increased ozone exceedances.[13] If this proposal is finalized, it will be vital to maintain policies that aim to reduce ambient ozone levels through emissions reductions of NOx and VOCs.

We recommend that EPA conduct a technology pathway analysis with the Agency's OMEGA model. The results from this analysis would help to inform EPA's regulatory impact analysis for the current proposal and will confirm the reliance interests described within

[10] https://www.mema.org/sites/default/files/resource/MEMA_ImpactBook.pdf

[11] https://www.epa.gov/regulations-emissions-vehicles-and-engines/safer-affordable-fuel-efficient-safe-vehicles-final-rule

[12] http://www.synapse-energy.com/sites/default/files/Giving-Back-Half-the-Gains-17-072.pdf

[13] https://repository.library.noaa.gov/view/noaa/19487

these comments. The Agency should provide the public with an opportunity to comment on the results from the OMEGA analysis as well as how EPA proposes to integrate those results into EPA's decision on the proposal to rescind the GHG standards.

It should be noted that prior to the most recent final rule, EPA and NHTSA had coordinated on joint rulemakings for GHG and fuel economy. MECA continues to advocate for a joint process since similar technologies are employed on vehicles to meet both sets of standards. The EPA analysis for this latest proposal does not consider current changes expected to the CAFE fuel economy standards. NHTSA has already issued an interpretive final rule[14] and signaled that light-, medium- and heavy-duty fuel economy standards will be revised in a future rulemaking.[15] Furthermore, Congress eliminated fuel economy penalties for CAFE in Section 40006 of the One Big Beautiful Bill Act.[16] The impact of these completed and future actions will be a backsliding on vehicle fuel economy, resulting in declining penetration of fuel efficiency technologies. We request that EPA consider the coincidental impacts, particularly on technology uptake, of all regulatory and policy changes to both EPA's GHG regulations as well as NHTSA's fuel economy regulations in this rulemaking analysis.

**Requisite GHG Reduction Technologies Exist**

Vehicle manufacturers rely on a variety of powertrain technologies and energy sources to meet tailpipe emission and fuel economy standards. This performance-based "systems approach" that pairs low-emitting engines and vehicles with clean fuels has been successful for decades. EPA has previously identified a large set of technology combinations available to reduce GHG emissions from passenger vehicles and light-duty trucks, including fuel-efficient advanced gasoline and diesel powertrains.[17] A review of heavy-duty GHG emission reduction technologies was provided by EPA during the Heavy-Duty Phase 2 rulemaking.[18] The majority of technologies that have been deployed in engines and vehicles have existed for decades and were initially designed into conventional internal combustion diesel and gasoline engines in response to GHG and CAFE requirements.

There are numerous cost-effective ways to reduce GHG emissions and improve fuel economy without extensive reliance on electrification. MECA members are committed to providing the full spectrum of technologies that allow all of these fuel-efficient powertrains to meet the GHG requirements as well as the corresponding criteria pollutant standards. As the conventional technologies are deployed, suppliers will continue to innovate new technologies on engines and transmissions as well as electrification to

[14] https://www.nhtsa.gov/sites/nhtsa.gov/files/2025-06/cafe-interpretive-rule-2127-ZA26-web.pdf
[15] https://www.transportation.gov/sites/dot.gov/files/2025-01/Signed%20Secretarial%20Memo%20re%20Fixing%20the%20CAFE%20Program.pdf
[16] https://www.congress.gov/bill/119th-congress/house-bill/1
[17] https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockey=P100OXEO.pdf
[18] https://nepis.epa.gov/Exe/ZyPDF.cgi/P100P7NS.PDF?Dockey=P100P7NS.pdf

reduce vehicle GHG emissions to help their customers meet future standards. We urge EPA, consistent with past practice, to focus on setting performance-based policies that drive innovation in all areas of vehicle GHG reduction and fuel efficiency technologies.

The rapid introduction of innovative GHG technologies has occurred, in part, due to advances in computing power that are available on today's vehicles. Well known technologies such as turbochargers, exhaust gas recirculation (EGR) systems, advanced fuel injectors, variable valve actuation technology, 48-volt mild and full hybrid systems, advanced exhaust controls and powertrain control modules have been applied to light-, medium- and heavy-duty powertrains to meet current GHG standards. Engine and vehicle OEMs will take advantage of the synergies between advanced emission control technologies and advanced powertrains to optimize their performance with respect to both GHGs and criteria pollutant emissions. MECA members offer a large portfolio of technologies for reducing both GHGs and criteria pollutants from advanced engines.[19]

From 2012-2018, GHG standards led to the introduction of more innovative efficiency technology for internal combustion vehicles, and this has made buying new cars more appealing to consumers, resulting in record car sales. A 2017 analysis by ICCT, with input from MECA members and other suppliers, projected an 8-10% greater $CO_2$ reduction benefit at a 36% lower cost of technologies to meet the 2025 standards than originally estimated by EPA.[20]

The penetration of fuel-saving technologies into the heavy-duty fleet has been spurred by EPA's Heavy-Duty Phase 1 and Phase 2 Standards. At the same time, research undertaken by multiple teams as part of the Department of Energy's SuperTruck programs has demonstrated how these technologies can be combined to achieve a 16% boost in fuel economy and improved freight efficiency. Participants in the SuperTruck II program have demonstrated even greater gains in fuel and freight efficiency, with engines achieving 55% brake thermal efficiency using technologies like waste heat recovery. DOE has awarded five OEMs funding to develop electric and hydrogen fuel cell powertrains in SuperTruck III, which is scheduled to be completed in 2027.

Many fuel-saving GHG reduction technologies have been applied to vehicles, including advanced turbochargers, advanced fuel injection, cylinder deactivation, variable compression ratio, hybridization and electrification, and hydrogen internal combustion engines.

*Advanced Turbochargers*

Advances in turbochargers for internal combustion engines are enabling lower $CO_2$ emissions via a variety of available design options that improve thermal management capability through: i) state of the art aerodynamics, ii) electrically actuated wastegates that

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[19] http://www.meca.org/resources/LEV_III-Tier_3_white_paper_0215_rev.pdf
[20] http://www.theicct.org/US-2030-technology-cost-assessment

allow exhaust gases to bypass the turbocharger to increase the temperature in the aftertreatment, and iii) advanced ball bearings to improve transient boost response. More advanced turbochargers are designed with a variable nozzle that adjusts with exhaust flow to provide more control of intake pressure and optimization of the air-to-fuel ratio for improved performance (e.g., improved torque at lower speeds) and fuel economy. These variable geometry turbochargers (VGT), also known as variable nozzle turbines (VNT) and variable turbine geometry (VTG), enable lower $CO_2$ emissions through improved thermal management capability to enhance aftertreatment light-off. Finally, modern turbochargers have enabled engine and vehicle manufacturers the ability to downsize engines, resulting in fuel savings without sacrificing power and/or performance.

Heavy-duty vehicles can benefit from the latest high-efficiency turbochargers, which are one of the more effective tools demonstrated in the DOE SuperTruck program.[21] In addition to affecting the power density of the engine, turbochargers play a significant role in NOx and $CO_2$ regulations compliance. Continuous improvement in turbocharger technology is making it possible to run very lean combustion (high air/fuel ratios), which reduces $CO_2$, particulate and engine-out NOx.

In particular, electrically or mechanically driven turbochargers, can be used to control the speed of the turbomachinery independently of the engine's exhaust flow and vary the relative ratio between engine speed and turbo speed. Driven turbochargers may be utilized for several reasons, including performance, efficiency, and emissions. Considered an 'on-demand' air device, a driven turbocharger also receives transient power from its turbine. During transient operation, a driven turbocharger will behave like a supercharger and consume mechanical or electrical energy to accelerate the turbomachinery for improved engine response. At high-speed operation, the driven turbocharger will return mechanical or electrical power to the engine in the form of turbo-compounding, which recovers excess exhaust power to improve efficiency.[22] This cumulative effect lets a driven turbocharger perform all the functions of a supercharger, turbocharger, and turbo-compounder.

Electric boost is another new technology introduced by Mercedes in some MY 2018 vehicles.[23] Electric boost is used in combination with a main power turbo and often as part of a 48V mild hybrid system on a vehicle. Electric boost technology can quickly deliver boost as the power turbine comes up to full boost power in order to reduce turbo-lag and enable engine downsizing and down-speeding. Electric boost has been reported to yield as much as a 5% fuel savings over the test cycle.

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[21] Navistar, "Final Scientific/Technical Report for SuperTruck Project: Development and Demonstration of a Fuel-Efficient, Class 8 Tractor & Trailer Engine System," 2016.

[22] Suelter, B., Itou, T., Waldron, T., and Brin, J., "Optimizing Steady State Diesel Efficiency and Emissions Using a SuperTurbo™ on an Isuzu 7.8L Engine," SAE Technical Paper 2019-01-0318, 2019, https://doi.org/10.4271/2019-01-0318.

[23] https://www.jdpower.com/cars/shopping-guides/what-is-mercedes-benz-eq-boost-engine-technology

*Advanced Fuel Injection*

Fuel injection technology has been evolving along with combustion engines for nearly 100 years. Electronic fuel injection has led to numerous improvements since the 1990s. More recently, gasoline direct injection has been paired with advanced turbochargers to enable downsized engines to deliver emission reductions without sacrificing power. During everyday driving under light to moderate loads, the downsized engine enables reduced internal friction and pumping losses, which improves fuel economy and lowers emissions. When higher power is needed, the turbocharger compliments advanced fuel injection to allow fuel to be burned efficiently and generate greater output. This combination has led to weight reduction that adds to the safety and GHG benefits.

High-pressure fuel injectors provide significant GHG and PM emission benefits to gasoline engines by enabling finer atomization of fuel and more precise delivery directly into the combustion chamber. When fuel is injected at pressures up to 500 bar, droplet size can be minimized and more evenly distributed, which promotes rapid and more complete combustion.[24] This improves brake thermal efficiency, allowing engines to extract more energy per unit of fuel while reducing hydrocarbons and particulate from unburned fuel. In addition, precise control supports multiple injection strategies, which enhance efficiency during low-load operation.

*Cylinder Deactivation*

Cylinder deactivation (CDA) is an established technology on light-duty vehicles, with the primary objective of reducing fuel consumption and $CO_2$ emissions. This technology combines hardware and software computing power to, in effect, “shut down” some of an engine’s cylinders, based on the power demand, and keep the effective cylinder load in the more efficient portions of the engine map reducing fuel consumption. Based on decades of experience with CDA on passenger cars and trucks, CDA is now being adapted to heavy-duty diesel engines.

On a diesel engine, CDA is calibrated to operate differently than on gasoline engines, with the goal of the diesel engine running hotter in low load situations by having the pistons that are firing do more work. This programming is particularly important for vehicles that spend a lot of time in creep and idle operation modes. During low load operation, the use of CDA results in exhaust temperatures increasing by 50°C to 100°C to maintain effective conversion of NOx in the SCR.[25] In some demonstrations, CDA has been combined with a 48-volt mild hybrid motor with launch and sailing capability to extend the range of CDA operation over the engine, and this may deliver multiplicative $CO_2$ reductions

[24] https://journals.sagepub.com/doi/abs/10.1243/14680874JER608

[25] Morris, A. and McCarthy, J., "The Effect of Heavy-Duty Diesel Cylinder Deactivation on Exhaust Temperature, Fuel Consumption, and Turbocharger Performance up to 3 bar BMEP," SAE Technical Paper 2020-01-1407, 2020, https://doi.org/10.4271/2020-01-1407.

from these synergistic technologies.[26] In another study, CDA combined with an electric heater or fuel burner has been shown to reduce NOx as well as $CO_2$ to levels below the capabilities of each technology individually.[27] CDA has also been synergistically combined with high efficiency turbochargers, and an electrically driven EGR pump to yield an additional 1.7 to 3.6% reduction in $CO_2$.[28]

Dynamic cylinder deactivation utilizes high speed computing to electronically control the deactivation and firing fraction of any cylinder independently of the others depending on the load at each engine rotation as a way to further optimize efficiency. This technology has the potential to improve fuel economy by 10-17% and up to 20% when combined with 48V mild hybrid technology. Dynamic cylinder deactivation was introduced on two MY 2019 U.S. vehicles[29] and continues to be deployed today, saving fuel costs for drivers.

*Mild Hybridization*

Mild hybrid, or 48-volt systems, can be found on many light-duty vehicle models from Mercedes, Audi, VW, Renault and PSA. In the U.S., FCA is offering a 48-volt system on the RAM 1500 pick-up and the Jeep Wrangler under the eTorque trademark. In the near future, 48-volt mild hybrid electrical systems and components are expected to make their way onto medium and heavy-duty vehicles. Because the safe voltage threshold is 60 volts, which is especially important when technicians perform maintenance on the electrical system, 48-volt systems are advantageous from an implementation standpoint. From a cost perspective, 48-volt systems include smaller starter and wire gauge requirements, offering cost savings from a high voltage architecture of a full hybrid.

Once a vehicle employs 48-volt hybridization, traditional mechanically driven components can be replaced with equivalent or improved electric versions to gain efficiency. Converting electrical accessories from 12-volts to 48-volts reduces electrical losses and this is particularly advantageous for components that draw more power, such as pumps and fans as well as heated and ventilated seats for comfort. The types of components that may be electrified include electric turbos, electronic EGR pumps, AC compressors, electrically heated catalysts, electric cooling fans, oil pumps and coolant pumps, among others. Another technology that 48-volt systems could enable is electric power take-offs rather than using an engine powered auxiliary power unit or idling the main engine during hoteling while drivers rest.

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[26] Dhanraj, F., Dahodwala, M., Joshi, S., Koehler, E. et al., "Evaluation of 48V Technologies to Meet Future $CO_2$ and Low NOx Emission Regulations for Medium Heavy-Duty Diesel Engines," SAE Technical Paper 2022-01-0555, 2022, https://doi.org/10.4271/2022-01-0555.

[27] McCarthy, Jr., J., Zavala, B., and Matheaus, A., "Technology Levers for Meeting 2027 NOx and $CO_2$ Regulations," SAE Technical Paper 2023-01-0354, 2023, https://doi.org/10.4271/2023-01-0354.

[28] Bitsis, D.C., Matheaus, A., Hopkins, J. and McCarthy, J. Jr., "Improving Brake Thermal Efficiency Using High Efficiency Turbo and EGR Pump While Meeting 2027 Emissions," SAE 2021-01-1154, https://doi.org/10.4271/2021-01-1154.

[29] https://www.caranddriver.com/news/2019-chevy-gmc-trucks-get-smarter-fuel-saving-cylinder-deactivation

*Full hybridization and electric vehicles*

Full hybrid configurations are currently found on a growing number of models of light-duty passenger cars and light trucks in the U.S. and a limited number of medium-duty trucks and urban buses. These include models that can also be plugged-in (PHEVs) to enable electric operation for a limited “all- electric” range (AER). There are over 50 distinct models of hybrids offered for sale in the U.S.,[30] and in 2025 to date, full hybrids (HEV) and PHEVs make up approximately 15% of new U.S. car sales.[31] In fact, at least one OEM has announced offering some models in hybrid-only configurations.[32]

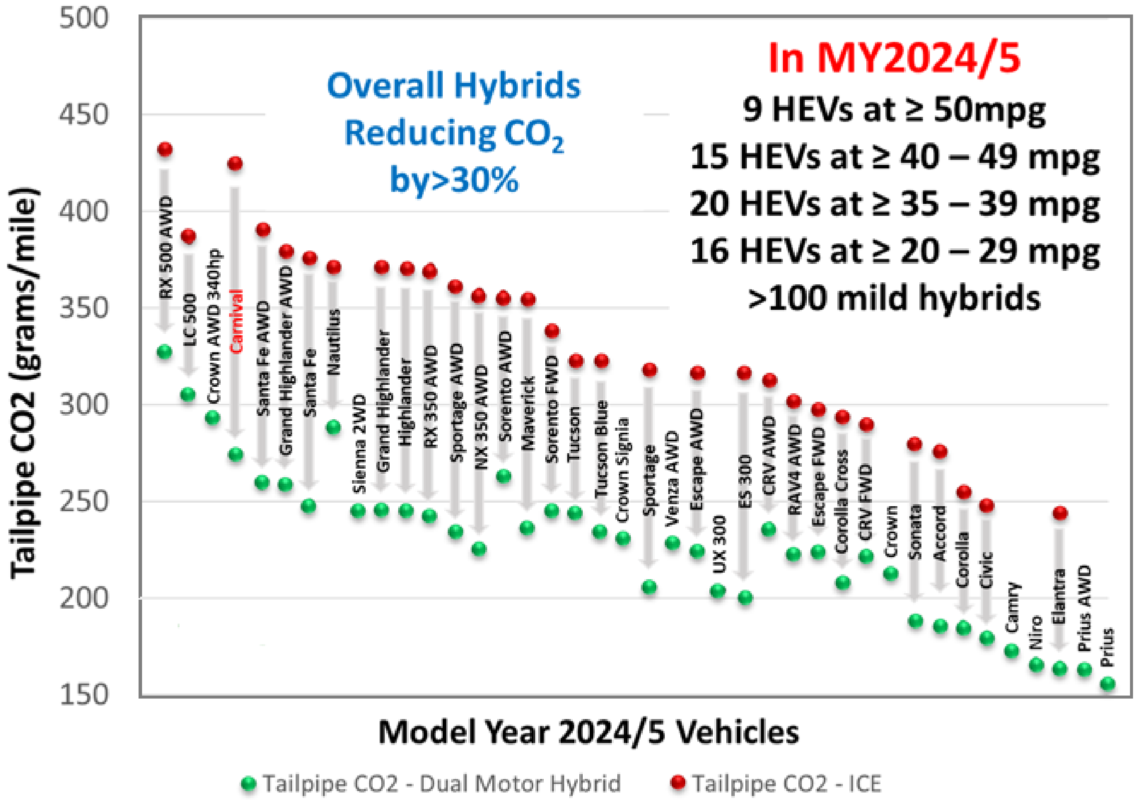


**Figure 1. Certified CO2 emissions data from MY 2024-2025 hybrid vehicles.**

A full hybrid (HEV) can enable enhanced electrification of many of the components described above for mild hybrid vehicles because the higher voltages allow for more parts to be electrified and to a larger degree. Full hybrids also employ larger electric motors and batteries, which support greater acceleration capability and regenerative braking power. As shown in Figure 1, both HEVs and PHEVs are able to achieve significant GHG benefits compared to their conventional vehicle counterparts, with HEV $CO_2$ levels as much as 57%

[30] https://fueleconomy.gov/

[31] https://www.eia.gov/todayinenergy/detail.php?id=65384

[32] https://www.caranddriver.com/news/a64704544/2026-toyota-rav4-revealed/

lower[33] and PHEV $CO_2$ levels as much as 77% lower.[34] The resulting fuel savings provide payback on the order of three to five years after vehicle purchase.

Another benefit of hybrids is that they employ relatively low-capacity batteries compared to full electric vehicles. Based on stated battery capacities for selected vehicles, we calculated the amount of battery material needed to manufacture each full battery electric vehicle could be deployed to manufacture five PHEVs or roughly 60 HEVs. We have provided this analysis as well as avoided $CO_2$ emissions per mass unit of battery materials in previous comments to the Agency.[35]

Full hybrid and plug-in hybrid vehicles have made the highest penetration into medium- and heavy-duty vocational applications such as parcel delivery, beverage delivery and food distribution vehicles because they can take advantage of regenerative braking in urban driving and operate from a central location.[36] Integrated electric drivetrain systems, consisting of a fully qualified transmission, motor and power electronics controller, are now commercially available. With power levels of over 160kW and the ability to meet high torque requirements, these systems enable electrification of medium-duty commercial vehicles. There is also an increasing number of electric drivetrain solutions up to 300kW that are suitable for medium and heavy-duty vehicles that can be used with either battery or fuel cell power sources.[37] Model predictions of heavy-duty HEV 600-800V technology recently verified at Oak Ridge National Laboratory have shown GHG emissions reductions of 9% on tractor certification cycles and 13%-19% on the vocational cycles, while enabling both anti-idle and hoteling function.[38]

With respect to full electric and hydrogen fuel cell vehicles, clean mobility suppliers are commercializing components necessary for their operation. This includes battery materials for the manufacture of both cathode and anodes utilizing unique macrostructure and composite formulations to improve efficiency and energy density. Electric component manufacturers are using state of the art transistor materials in their motors and power electronics that operate at higher voltages and require simpler cooling strategies to again reduce switching losses and improve electric efficiency of the system architecture in electric powertrains. To facilitate integration, component suppliers are integrating the motor, inverter and transmission into electric drive units to simplify the thermal management of the electric components and ease design into vehicles.

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[33] Based on 2025 Kia Carnival on www.fueleconomy.gov.
[34] Based on 2025 Ford Escape on www.fueleconomy.gov.
[35] https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0829-0564
[36] CARB, "Draft Technology Assessment: Heavy-Duty Hybrid Vehicles," 2015.
[37] Navistar, "Final Scientific/Technical Report for SuperTruck Project: Development and Demonstration of a Fuel-Efficient, Class 8 Tractor & Trailer Engine System," 2016.
[38] Patil C., Thanom W., Dykes E., Kreucher J., Genise T., "Model-based Assessment of Fuel Economy and Performance of a Switchable P2/P3 Hybrid Powertrain for Heavy Truck", In Proceedings of the Ground Vehicle Systems Engineering and Technology Symposium (GVSETS), NDIA, Novi, MI, Aug. 10-12, 2021.

*Hydrogen-Fueled Internal Combustion Engines*

Hydrogen internal combustion engines ($H_2$ICE) are being commercialized to both reduce the NOx and carbon footprint of heavy-duty vehicles. These engines, when coupled with NOx aftertreatment, have the potential to meet the MY 2027 NOx limits while emitting zero tailpipe carbon emissions when operated on hydrogen fuel and zero lifecycle carbon emissions when operated on renewable green hydrogen. There is broad industry support for internal combustion engines fueled with clean hydrogen and most engine manufacturers and component suppliers are conducting significant development work and testing with ongoing on-road demonstrations in Europe and North America. $H_2$ICEs are attractive options for commercial trucking where challenges exist in applying current BEV or $H_2$ fuel cell technology.

One of the main benefits of $H_2$ICE is their lower upfront capital costs due to the leveraging of existing investments in manufacturing capacity in engines, emission controls and powertrain as well as vehicle servicing. $H_2$ICE vehicles share many components with today's diesel and natural gas-powered vehicle fleet, including the base engine, installation parts, powertrain components and aftertreatment system architectures. Furthermore, $H_2$ICE can borrow technology from currently available natural gas engines, such as cylinder heads, ignition systems, fuel injection, turbochargers, cooled exhaust gas recirculation (EGR), and engine control unit/software, among others. Nearly all on-road and off-road engine OEMs, along with their suppliers, had signaled their intent to develop $H_2$ICE for commercial introduction in the MY 2026-2027 timeframe. However, recent uncertainty about regulatory and policy stability for hydrogen has led to announced delays.[39]

Suppliers of on-vehicle hydrogen storage tanks are looking at this $H_2$ICE transition technology to grow the manufacturing capacity for 350 bar and 700 bar high pressure hydrogen tanks and bring down their costs. This will accelerate the introduction of fuel cell trucks that will rely on the same high pressure fuel tanks and hydrogen infrastructure that they will share with $H_2$ICE trucks. Truck and engine manufacturers are targeting the introduction of $H_2$ICE trucks at least 10 years before fuel cell trucks are expected to become cost competitive. The early introduction of $H_2$ICE trucks will help to accelerate the build-out of necessary hydrogen infrastructure and allow fleets to seamlessly transition from operating $H_2$ICE trucks to operating fuel cell trucks in their fleet.

*Technologies that Reduce Off-Cycle Emissions*

MECA continues to recognize the benefit to emission reductions via the off-cycle credit program as a policy to expand the available technologies that vehicle manufacturers can deploy. MECA represents both on-cycle and off-cycle technology suppliers, and therefore we are committed to credit policies that ensure measurable and verifiable $CO_2$ emission reductions in the real-world. Technologies that reduce emissions that are not fully captured by EPA certification test cycles include (but are not limited to) advanced

[39] https://www.freightwaves.com/news/are-hydrogen-combustion-engines-delayed-or-doa

alternators, stop-start systems and various thermal management systems like waste heat recovery.

*Lighter Weight Components*

Manufacturers have been using high-strength steel and aluminum and other lightweight materials to significantly reduce the weight of the biggest vehicles on the road. Studies have shown that this results in safety improvements of the heaviest vehicles, including SUVs and crossovers, which are currently among the most popular models of vehicles purchased today.[40] Automotive suppliers have responded to OEM requests to use weight reduction to achieve GHG and CAFE goals by providing light-weight on-engine and exhaust components that significantly reduce the weight of vehicles with absolutely no impact on safety.

MECA members have developed exhaust components such as dual wall exhaust manifolds to replace cast iron components and insulated dual wall exhaust pipes and catalyst housing that reduce the weight of the upstream portion of the catalyst system. The weight of the downstream portion can be reduced by replacing the muffler with acoustic noise canceling technology to quiet the exhaust and reduce backpressure at highway speeds. In addition, on-engine components such as dual wall and water-cooled turbocharger housings are used to reduce weight of traditional turbocharger housings. These methods to reduce weight of a vehicle in no way impact safety while contributing to lower GHGs and higher fuel economy. Separately, performance-based standards for safety are used to ensure vehicles pass all federal requirements and allow innovation to bring appropriate solutions.

**Level Playing Field for All Technology Pathways**

*Life Cycle Accounting in Certification*

MECA supports regulations that treat all powertrain technologies on a level playing field, which enables innovation across internal combustion, hybrid and electric platforms. Today, nearly every OEM offers all these powertrains, which provides consumers with the choice that best meets their needs. However, these vehicles are still not treated equitably by GHG emission regulations due to EPA's tailpipe-only certification requirements. MECA suggests that EPA include upstream accounting of the emissions generated from the energy used for propulsion of all vehicles.

For a technology to be a sustainable and durable solution, it must demonstrate the ability to compete on a level playing field with other technologies to allow consumers the choice that meets their needs. MECA believes this is best accomplished through well-to-wheels life cycle accounting incorporated into performance-based standards. Currently,

[40] The 2024 EPA Automotive Trends Report. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P101CUU6.pdf.

this is well established for ICE vehicles since the total emissions from fuel combustion are measured at the tailpipe. However, there are two gaps in the current certification methodology.

First, it does not include a means for certification of emissions benefits of clean fuels. For example, engines that operate on diesel are certified based on the assumption that all diesel fuel is petroleum-based. However, 7.3% of U.S. diesel fuel consumption was renewable diesel or biodiesel in 2023,[41] with California displacing over 70% of its petroleum diesel with renewable and biodiesel in 2024.[42] This trend is projected to increase as clean fuel production rises and displaces a larger fraction of petroleum fuels in the future. By not crediting ICE with the benefits of real-world GHG emissions savings in the fuel production process, combustion engine technologies are disadvantaged in regulatory compliance.

The second gap in current certification requirements is allowing electric vehicles to certify to zero emissions despite electricity used to power them having a non-zero emission footprint everywhere in the U.S. When EPA began regulating GHG emissions from light-duty vehicles starting with MY 2012, the Agency decided to allow electric vehicles and fuel cell vehicles to claim 0 g/mile GHG in order to encourage the initial commercialization of these promising technologies.[43] However, the Agency also finalized requirements for upstream emissions to be factored into electric and fuel cell vehicle certification levels as penetration of these vehicles increased. The justification given by EPA was that "upstream GHG emission values associated with electric vehicles are generally higher than the upstream GHG emission values associated with gasoline vehicles, and that there is currently no national program in place to reduce GHG emissions from electric powerplants."

In 2023, EPA made the 0 g/mile GHG treatment of battery and fuel cell vehicles permanent. The Agency's rationale was that "the program has now been in place for a decade, with no upstream accounting and has encouraged the continued development and introduction of electric vehicle technology." EPA further reasoned that "these emission reduction technologies are now coming into the mainstream and can serve as the primary technologies upon which EPA can base more stringent standards" and that "power sector emissions are declining and the trend is projected to continue." Finally, EPA concluded that the "approach of looking only at tailpipe emissions and letting stationary source GHG emissions be addressed by separate stationary source programs is consistent with how every other light-duty vehicle calculates its compliance value."

Regarding the first two points, while the program has indeed been in place for a decade, the sales volumes of electric and fuel cell vehicles remain in the minority of new vehicle sales (<10% for light-duty and <1% for heavy-duty). As sales increase, there is a

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[41] https://blog.ucs.org/jeremy-martin/all-about-biodiesel-and-renewable-diesel/

[42] https://cleanfuels.org/2024-saw-rapid-growth-for-biodiesel-renewable-diesel/

[43] https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-model-year-2012-2016-light-duty-vehicle;

potential for erosion of benefits if the pace of grid decarbonization and charging infrastructure build-out do not meet projections. Regarding EPA's final point, the agency previously recognized the inconsistency in treatment of upstream emissions of the power sector versus the oil and gas sectors. The Agency's justification then, and still valid today, is that upstream emissions related to power production to propel battery electric vehicles is higher than the upstream GHG emissions associated with gasoline vehicles, and there remains no final federal regulation to reduce GHG emissions from electric power plants.

Since we know the mix of sources for each region of the U.S. electricity grid,[44] the emissions attributed to electricity used to power an electric vehicle could be reasonably estimated, projected into the future, and reported during certification. It should be noted that at this time we are not suggesting a full life cycle accounting method, such as the inclusion of emissions due to the manufacture of vehicles and production of fuels (both for generating electricity and direct consumption in the vehicle), due to the complexity of such an approach. The Agency may utilize the procedures previously described in 40 CFR § 600.113-12, prior to their elimination in the Multipollutant Rule.

The continuation of a zero gram per mile certification value for EVs does not reflect the real world and presents an unfair bias against clean ICE solutions. The EPA transportation office's regulatory-based emissions standards and voluntary programs have always been both fuel- and technology-neutral since the first standards were set in the 1970s. MECA believes that EPA should continue to set performance-based standards that assess technology pathways based on delivering the intended emission reductions over the full well-to-wheels vehicle life cycle in the real world.

*Electric Vehicle Durability and Warranty Requirements*

EPA should not reconsider the EV battery durability monitoring and performance requirements and warranty requirements that begin with MY 2027. These requirements help to effect a level playing field amongst vehicles with different powertrains and sustain U.S. technology leadership and competitiveness. The world is already harmonized around the UNECE GTR No. 22 for light-duty vehicles and 22b (when finalized) for medium- and heavy-duty vehicles for battery durability, and discussions are underway for consideration of phase-in to match vehicle useful life in later years. UNECE GTR No. 22 and No. 22b include state of health (SOH) monitors and usable battery energy (UBE) measurement requirements, as well as vehicle range and virtual miles traveled for medium-duty vehicles with power take-off (PTO) or vehicle-to-X capability of light-duty vehicles. This information will serve to generate durability data to support industry and consumer needs. While the EVE IWG chose not to set a minimum performance requirement (MPR) for Category 2 (MDV) plug-in electric vehicles at this time, MECA supports EPA aligning with a future MPR for MDVs when the UNECE finalizes an applicable GTR.

[44] https://www.epa.gov/egrid

MECA supports EPA's MY 2027 and later warranty requirements for light-duty BEV and PHEV batteries and associated electric powertrain components, such as electric machines, power electronics, and similar key electric powertrain components. We agree with the concept of building upon existing high value component warranty provisions, such as emission controls. We support designating the high-voltage battery and associated electric powertrain components for light-duty electric vehicles as specified high value components subject to a warranty period of 8 years or 80,000 miles. In addition, we support the same warranty periods for components in medium- and heavy-duty BEVs and PHEVs.

As experience with battery durability and warranty develops, MECA requests the requirements be revisited and extended to better represent the useful life of light-, medium- and heavy-duty vehicles. Most consumers expect the battery to last the life of the vehicle, and alignment of the durability period with the vehicle useful life will facilitate consumer acceptance and drive innovation in battery technology. Aligning EV durability and warranty requirements with those for ICE will also provide a level playing field for all vehicles whether EV or ICE and give consumers confidence in the reliability of any powertrain they choose.

**Criteria Pollutant Standards**

We note that the EPA "is not proposing to reopen or substantively modify at this time any regulations necessary for criteria pollutant and air toxic measurement and standards, CAFE testing, and associated fuel economy labeling requirements." However, the Agency has also stated that it remains open to reconsidering these at a later date. We support EPA's decision not to reconsider but rather retain standards for criteria pollutants in this proposal. We urge EPA to continue to leave these standards in place. The record[45] supports that the criteria pollutant standards are achievable without relying on EVs and yield consumer savings and air quality benefits that are multiple times the nominal per vehicle costs.

The Multipollutant Rule finalized in 2024 has an implementation schedule that phases in from MY 2027 to MY 2032. The PM standard is only required to be met by 20% of vehicles in 2027, 40% in 2028, 60% in 2029 and all vehicles by 2030. Similarly, the final NMOG+NOx fleet average standard does not need to be met until 2032, with interim targets of 25, 23, 21, 19 and 17 mg/mile each year from 2027 to 2031, respectively. This gradual implementation schedule provides ample flexibility for compliance with the criteria pollutant standards and obviates the needs for any delays to these requirements. The mild phase-in schedule, together with the flexible bin structure, allows OEMs to comply in the early years without any significant technology change.

[45] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1019VPM.pdf; https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0829-0564

*PM Standards are Feasible with Current Technology*

EPA should not reconsider the Light- and Medium-Duty PM standard of 0.5 mg/mile, including all updated certification test procedures in the rule, because the existing record demonstrates that the standard can be met by internal combustion engine vehicles with gasoline particulate filter technology (GPF) technology and advanced fuel injection already commonly used in most other automotive regions of the world. EPA designed the standard to be met on an individual vehicle basis, therefore being independent of electric vehicle sales.

EPA based the 0.5 mg/mile PM standard on a number of research studies as well as actual testing by the Agency during the rulemaking development. This testing not only proved the feasibility of a vehicle achieving the standard during all operating conditions, but it also demonstrated the feasibility to collect and measure PM at the necessary detection limits for certification. This measurement feasibility was conducted via a round-robin measurement program that included three independent laboratories using existing CFR test methods that would require no additional test burden on manufacturers. Moreover, car and truck OEMs have been conducting exhaust PM research for decades and are well versed in the appropriate PM collection methodology that reduces sampling errors to enable ultralow limits of detection.

As of today, two years ahead of the start of EPA's MY 2027 PM limit implementation phase-in, two-thirds of the major automotive producing regions of the world, including Europe, China and India, are meeting even tighter PM emission standards than the U.S. 2027 requirements. To meet tightening particulate standards in other global regions, fuel injection and gasoline particulate filter (GPF) suppliers have continued to improve their commercially available technologies. In fact, nearly every European GDI engine car is currently certified with a GPF. China has gone as far as requiring all diesel and gasoline cars to be equipped with the best available control technology, based on wall flow GPF and DPF filters, that diesels have used in the US since 2007.

Based on evolution of control technologies, future Euro 7 standards will expand the operating window to include lower temperature operation, higher altitude and towing. In anticipation of these tighter limits over extended duty operation, suppliers have improved fuel injection[46] as well as diesel and gasoline particulate filters.[47] U.S. and international OEMs are exceeding requirements in other global markets equivalent to or more stringent than the 0.5 mg/mile standard beginning in the U.S. for 2027.[48]

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[46] Yamaguchi, A., Dillner, J., Helmantel, A., Koopmans, L. et al., SAE 2023-01-0239;

[47] Obata, S., Furuta, Y., Ohashi, T., and Aoki, T., SAE 2023-01-0394.

[48] https://circabc.europa.eu/sd/a/fdd70a2d-b50a-4d0b-a92a-e64d41d0e947/CLOVE%20test%20limits%20AGVES%202020-10-27%20final%20vs2.pdf

MECA's industry assessment, which is corroborated by others,[49] concluded that a GPF will cost approximately $50-$300 per vehicle, depending on engine displacement. Our members are already working with their OEM customers to integrate this technology onto vehicles ahead of the 2027 implementation date of the Multipollutant Rule finalized in 2024. The 2025 model year already includes five vehicle models equipped with GPFs, with about 50 additional models expected by 2027 and another 18 in 2028. Based on these projections, we believe EPA's current phase-in schedule provides the flexibility the OEMs need to gradually integrate this known technology across their fleets. Changing this provision in the rule at this late date would create a hardship for technology suppliers, resulting in stranded investments, lost jobs and idle manufacturing capacity.

MECA conducted a study that showed this PM standard alone will result in annual decreases in PM pollution, reaching over 110,000 tons reduced in the year 2050 and delivering hundreds of millions of dollars in health benefits to Americans.[50] Notably, those benefits can be achieved independent of the number of electric vehicles sold. Figure 2 illustrates this for the Energy Information Agency (EIA) Annual Energy Outlook 2022 (AEO2022) electrification forecast of 17% new EV sales in 2050.

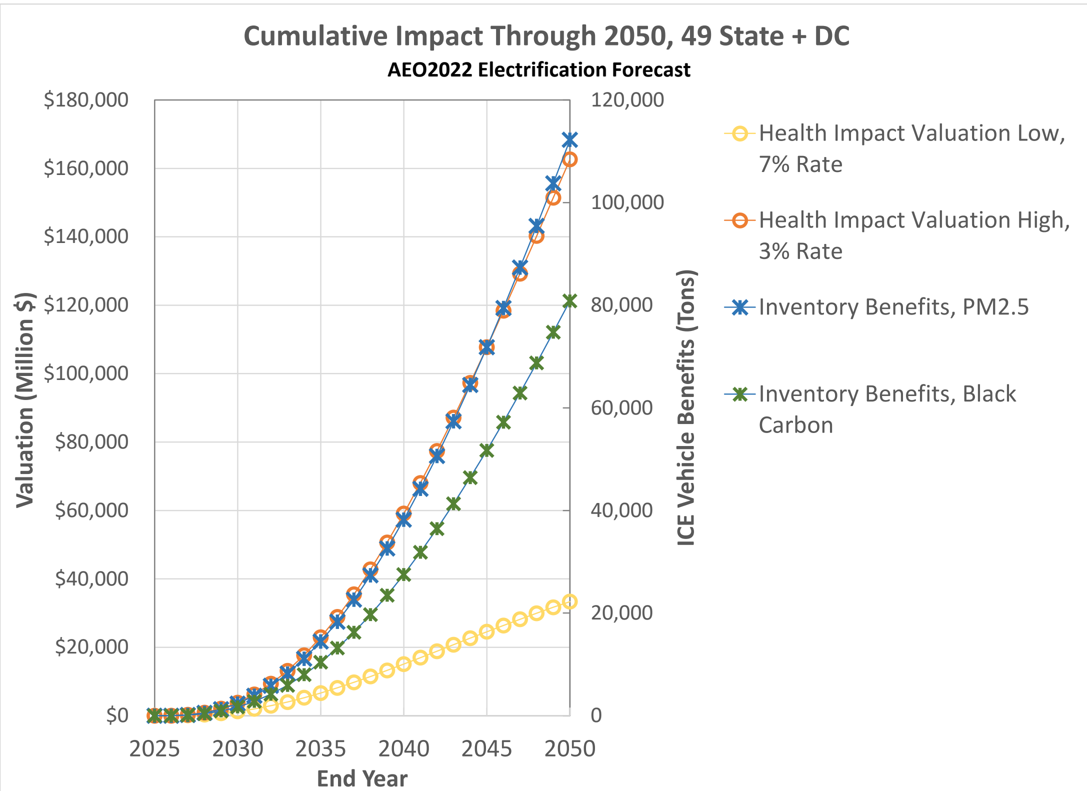


**Figure 2. Cumulative Benefits of 0.5 mg/mile PM Standard Assuming Low EV Sales.**

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[49] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1019VPM.pdf; https://theicct.org/wp-content/uploads/2023/11/ID-48-%E2%80%93-U.S.-GPF-fact-sheet-letter-70112-v3.pdf
[50] https://www.meca.org/wp-content/uploads/2023/06/LDV_PM_Standard_Final_Report_06272023.pdf

*NMOG+NOx Fleet Averages are Feasible with Current Technology*

EPA should not reconsider the technology neutral light-duty NMOG+NOx fleet average standard of 15 mg/mile that phases in by 2032. EPA ran several compliance scenarios in the Multipollutant Rule finalized in 2024, including ambitious and mild projections of electric vehicle penetration. When EPA finalized the NMOG+NOx standards, it found that they were "feasible for ICE-based vehicles without taking into consideration the possibility of averaging with zero-emitting vehicles."[51] ICE cars and pick-up trucks can achieve these standards by employing targeted calibration of currently available engine and aftertreatment technologies, complemented by increasing adoption of hybrids already underway in the market.

Our analysis of currently available certification data[52] supports that vehicle manufacturers have made substantial progress on the path to the Bin 30 fleet average level. In fact, we estimate that, under the revised bin structure adopted in the Multipollutant Rule, OEMs are poised to comply with the MY 2027 NMOG+NOx fleet average of 25 mg/mile with today's sales mix that includes modest uptake of HEVs, PHEVs and BEVs. It has now been over twenty years since the first vehicle was certified to the Bin 30 standard and seven years since the first Bin 20. As of June 2025, over 400 vehicle models met the Bin 30 standard while 30 are certified to the Bin 20 standard.

Advances in catalyst technology and honeycomb substrates have evolved to achieve NMOG+NOx emission levels well below 20 mg/mile. In fact, there are already 212 different vehicle models available for sale that emit under 15 mg/mile based on certification test data. That is more than triple the number just two years ago and speaks to the tremendous progress that suppliers and their OEM customers have made to continuously improve emissions from ICE vehicles. Today, even pick-up trucks, larger SUVs and mini-vans with conventional and hybrid powertrains are emitting at levels low enough to be certified down to Bin 15.[53]

A selection of Bin 20 and Bin 30 certified vehicles is shown in Figure 3. The horizontal arrows at the top of the figure represent the certification Bins. A sampling of compact cars, mid-size sedans, SUVs and pick-up trucks are listed along the x-axis. The blue vertical bars show the actual levels emitted by these vehicles over the FTP cycle, which are reported to EPA per certification requirements. It is evident that many vehicles sold today have significant margins below today's fleet average emissions limit. This sample set represents the vehicles employing advanced emission control technology and includes pure ICE, hybrid and plug-in hybrid powertrains all incorporating a combustion engine. The agency provided a generous phase-in of the fleet average from 2027 to 2032 to provide OEMs time to deploy technologies discussed below, across additional models and achieve the final fleet average standards by 2032.

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[51] https://nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=P1019WE6.pdf, page 1057.

[52] https://www.epa.gov/compliance-and-fuel-economy-data/annual-certification-data-vehicles-engines-and-equipment#Ct

[53] MY 2026 Volvo XC90 B5 AWD per EPA certification data referenced in footnote 50.

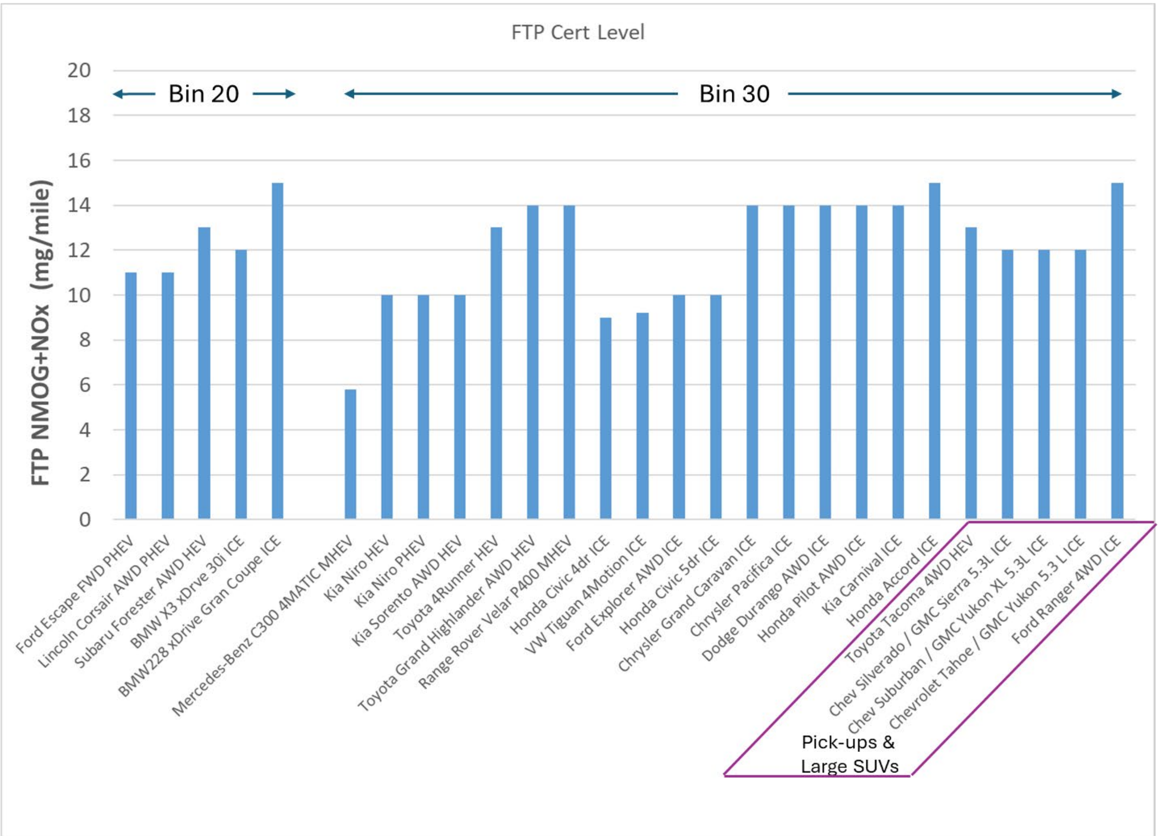


**Figure 3. Model Year 2024-2025 NMOG+NOx Certification Data for Selected Vehicles.**

The use of existing engine, hybrid powertrains and exhaust emission control architectures have also facilitated achieving the lowest Bin 20 and Bin 30 NMOG+NOx emission levels cost-effectively. Further technology improvements coupled with thorough engine mapping and improved calibration continue to be incorporated into new production vehicles to enable compliance with the declining NMOG+NOx fleet average independent of electric vehicle sales. MECA members are commercializing these engine, aftertreatment and electrified technologies that will enable a fleet average of 15 mg/mile NMOG+NOx by 2032.

In order to comply with lower NMOG+NOX and PM emissions standards over all certification cycles, manufacturers will employ improved engine maps and calibration strategies of existing engines and emission control related systems. Other design changes to system architecture can be deployed to manage engine-out emissions and exhaust flows, reduce catalyst light-off times, increase exhaust temperatures during periods of low-load or idle and reduce excessive warmed-up and hot running emissions to protect engine and emission control components which are susceptible to deterioration from extended exposure to severe exhaust temperatures.

Several choices can be made to improve and optimize emission control performance. For gasoline engines, the technology base of advanced three-way catalysts deposited on high cell density (as high as 1200 cells/in$^2$), thin-walled substrates (approaching 0.05mm) have evolved dramatically for light- and medium-duty chassis certified vehicles to comply with Tier 3 standards. Recent advances have yielded high porosity, low thermal mass substrates with narrow pore size distributions, which enable high emission reduction efficiency with less precious metal loading.[54] Catalyst coating technology based on layered or zoned architectures combined with targeted precious metal placement has been successful in controlling costs in light of rising raw material prices. Thus, we estimate the cost to bring a Bin 30 vehicle down to Bin 15 to be less than $100 per vehicle. In addition, the introduction of the additional certification bins will provide greater certification flexibilities to manufacturers. Our industry is on course to deliver the technologies that will allow our OEM customers to meet the final 15 mg/mile fleet average by 2032 without a requirement to sell more electric vehicles. In addition, the standards allow OEMs to comply by selling EVs, and numerous analyses project a modest increase in EV sales driven by consumer interest over the coming decade.

In summary, our review of the industry data submitted to EPA over the last two years, since the Multipollutant Rule was proposed and finalized, has further strengthened the argument made in the 2023 analysis that led the agency to conclude that the 15 mg/mile NMOG+NOx fleet average can be met without a reliance on EV sales. The automotive industry, including MECA members, has continued to integrate better technology on vehicles, resulting in a tripling of the number of models emitting below the 15 mg/mile limit in the 2025 model year. Over the next seven years, the technologies can be expanded across a greater number of vehicles to bring the fleet average down to this level. This compelling evidence confirms that the final 2032 fleet average is not a defacto EV mandate, as some stakeholders have claimed, but rather a feasible and achievable performance-based limit that allows all technologies to participate and will stimulate innovation and create U.S. jobs across the automotive supplier sector while delivering real health benefits and supporting American jobs.

*Heavy-Duty Engine NOx Standards*

The record shows that commercially available technologies have been extensively demonstrated in several programs conducted at Southwest Research Institute (SwRI) over the past 10 years to meet the heavy-duty low NOx limits finalized in 2022 for implementation in 2027.[55] During cold-start and low-load operation, which are challenging conditions for emission control, engine technologies can be combined with calibration and thermal management to reduce engine-out NOx emissions and achieve real-world NOx

[54] T. Asako, D. Saito, T. Hirao and E. Popp, SAE 2022-01-0543; J. Warkins, T. Tao, M. Shen and S. Lyu, SAE 2020-01-0652.

[55] https://www.arb.ca.gov/lists/com-attach/1-hdomnibus2020-VDdXMFIhU2IAWQIw.pdf?_ga=2.189721900.646680494.1757191788-1933188432.1743011479; https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/13-312.pdf; https://www.arb.ca.gov/lists/com-attach/79-hdomnibus2020-Uj4AaQB2Aj8FbAhw.pdf?_ga=2.29302075.646680494.1757191788-1933188432.1743011479; https://www.arb.ca.gov/lists/com-attach/79-hdomnibus2020-Uj4AaQB2Aj8FbAhw.pdf?_ga=2.29302075.646680494.1757191788-1933188432.1743011479; https://www.regulations.gov/document/EPA-HQ-OAR-2019-0055-2964

reductions. Several engines and potential aftertreatment layouts were demonstrated in the SwRI test programs, which aided suppliers and their OEM customers in designing vehicle configurations that will both meet the standards and be accepted by consumers. This is evidenced by the announcements by all major heavy-duty engine and vehicle OEMs that they will release commercial products that will meet the MY 2027 standards.[56]

With less than one year before implementation, our members have made hundreds of millions of dollars in investments and are working with their OEM customers to integrate technologies that will meet upcoming emission requirements. We estimate the cost of the hardware to meet these standards along with higher durability requirements (without added warranty requirements) for a Class 8 truck to be $1,500 to $2,050, which is in close agreement to EPA's estimate of $2,316 in the rulemaking.[57] These numbers have been corroborated by an independent cost analysis by the ICCT.[58] Based on the average purchase price of a class 8 sleeper tractor of $160,000 (calculated from $145,000 in 2021 and 2.5% annual increase)[59], the incremental cost is only 1.5% of the purchase price of a new truck. A change to these standards, at this late point in the technology integration phase, would significantly impact jobs and investments made by our industry and diminish the health benefits that the NOx reductions will deliver to Americans.

As noted above, the hardware costs were estimated without inclusion of new warranty requirements, also finalized by EPA for MY 2027 and later trucks. There is greater disagreement on the costs associated with meeting the extended warranty provision of the Heavy-Duty NOx Rule, with some estimates for longer warranty being equal to multiple times the cost of hardware.[60] The difficulty in estimating warranty costs is due to considerable uncertainty about the state of vehicles during the time of operation beyond today's 100,000-mile warranty. Much of the data on warranty claims and repairs as well as vehicle use characteristics originate from the time when the first owner operates a vehicle while data from repairs made by second and third owners is very limited. Without warranty claim information beyond 100,000 miles, it is difficult for suppliers to estimate the cost impact of a warranty period out to 450,000 miles.

We believe revising the warranty requirements to the level required of today's trucks (100,000 miles)—while retaining the 2027 emission limits—can significantly address the cost concerns of fleets that operate these trucks for their business. Any fleets wanting longer warranties can purchase extended warranties already offered by OEMs for their customers. MECA's cost analysis, which was provided to EPA and corroborated by several

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[56] https://www.ttnews.com/articles/diesel-oems-2027-standards; https://www.cummins.com/engines/on-highway/heavy-duty-truck/2027-x15
[57] https://www.govinfo.gov/content/pkg/FR-2023-01-24/pdf/2022-27957.pdf
[58] https://theicct.org/publication/estimated-cost-of-diesel-emissions-control-technology-to-meet-the-future-california-low-nox-standards-in-2024-and-2027/
[59] https://theicct.org/wp-content/uploads/2022/01/Final-Report-eTruck-Virtual-Teardown-Public-Version.pdf
[60] https://www.truckandenginemanufacturers.org/file.asp?F=Exhibit+B+Ricardo%2Epdf&N=Exhibit+B+Ricardo%2Epdf&C=documents

other studies, demonstrates the impact of reconsidering only the warranty requirements (i.e., keeping today's warranty) while retaining the model year 2027 and later criteria pollutant limits. We estimate this will result in 50-65% lower per-vehicle costs than originally projected, while achieving public health goals through the previously finalized cost effective and achievable emission standards in the Heavy-Duty NOx Rule.

**Conclusion**

In conclusion, MECA supports GHG standards set to a level that aligns with consumer and market trends while continuing to incentivize technology innovation and U.S. auto industry competitiveness in a global market. Suppliers have made major investments in technology innovation, development and manufacturing of components to enable automakers and engine makers to achieve current and future feasible GHG standards. Eliminating all GHG standards for mobile sources puts those investments and a significant number of jobs at risk. Existing requisite technologies deliver real fuel savings to consumers when employed on engines and vehicles. MECA supports regulations that treat all powertrain technologies on a level playing field, such as consideration of life cycle emissions in certification, which would enable innovation across internal combustion, hybrid, and electric platforms. EPA should provide the public an opportunity to comment on the results from additional cost-benefit analysis and the OMEGA analysis, including how EPA proposes to integrate those results into Agency's decision on the proposal to rescind the GHG standards.

We commend the EPA for not reconsidering criteria pollutant standards in this rulemaking and urge the Agency to retain these standards on their current implementation timelines. EPA set the PM standard on an individual vehicle basis, and therefore it is independent of electric vehicle sales. The PM standard can be met with existing technology already used in most other automotive regions of the world. The rulemaking record for the Multipollutant Rule establishes that the NMOG and NOx standard can be achieved without factoring in EVs but rather by increased application of currently available technology that is already being introduced on many light-duty vehicles. Our industry is prepared to do its part and deliver cost-effective and durable advanced emission control and efficiency technologies to light-, medium- and heavy-duty vehicles. Retaining the criteria pollutant standards at the finalized levels will bring a win for EPA by delivering on the Administrator's first pillar to ensure clean air for every American.

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