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COMMENTS OF THE MANUFACTURERS OF EMISSION CONTROLS ASSOCIATION ON THE SAFER AFFORDABLE FUEL-EFFICIENT VEHICLE RULE III (SAFE III) FOR MODEL YEARS 2022 TO 2031 PASSENGER CARS AND LIGHT TRUCKS

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The Manufacturers of Emission Controls Association (MECA) offers comments in response to the NHTSA “Safer Affordable Fuel-Efficient Vehicle Rule III (SAFE III) for Model Years 2022 to 2031 Passenger Cars and Light Trucks.

MECA is a non-profit industry association of the world’s leading manufacturers of technologies for clean mobility. Our members have represented clean mobility suppliers for over 50 years and have a proven track record in developing and manufacturing fuel efficient conventional and electrified powertrains, emission control, battery materials and system components 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 and vehicle efficiency success story associated with light-, medium- and heavy-duty vehicles in the United States, and has continually supported efforts to develop innovative, technology advancing policies to improve vehicle efficiency that yield fuel savings for 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 clean mobility industry has generated hundreds of billions of dollars in U.S. economic activity each year and continues to grow and add more jobs in response to reasonable and progressive fuel economy regulations. Automotive technology suppliers invest billions of dollars each year in research and development of technological innovation that gets exported around the world. In fact, these companies account for approximately 40% of the auto R&D conducted in the U.S. each year.

Summary

MECA supports technology-neutral, performance-based standards which can continue to cost effectively improve fuel economy and lower overall vehicle lifetime operating costs. Our members' technologies enable automakers to offer consumers a choice in the vehicles they drive through the use of a range of powertrains.

We urge NHTSA to set technology advancing targets at a stringency level that continues to improve fuel economy year-over-year to provide a stable environment for automotive supplier investments and employment in developing fuel efficiency vehicle technologies and scaling production to reduce costs. The current standards have resulted in significant investment and job creation, and as a result, the pace of efficiency technology introduction and breadth of available efficiency technology options has grown. These conventional and electrified powertrain technologies can be applied across the light-duty vehicle fleet to further increase fuel efficiency and save consumers money over the life of their vehicles. Our industry has responded to the need for more efficient vehicles catalyzed by feasible technology-advancing CAFE standards, resulting in technology innovation and commercialization. We are concerned that the significant weakening of these standards as proposed will erode the U.S. automotive industry's long-term global competitiveness.

MECA would like to provide comments on the following issues regarding the current NPRM. More details will be provided on each issue further in this document.

1. Economics: Suppliers who have invested in developing, commercializing and manufacturing technology are at risk of stranded investments as the demand for advanced fuel saving technologies is likely to decline under the current proposal. The NPRM analysis predicts lower penetration of many technologies which directly impacts revenue, jobs and investment by many automotive suppliers. Furthermore, as other nations in Europe and Asia continue to tighten fuel economy and/or CO_2 emissions targets, there is a likelihood of development, engineering and future manufacturing investment shifting from the U.S. to countries where those technologies are needed in response to government regulations.

   MECA supports a Corporate Average Fuel Economy program based on consistent progressive and aligned standards which address federal, state and commercial needs. This offers a successful, lasting program without the business uncertainty caused by extreme policy changes followed by protracted litigation.

2. Employment: NHTSA's own proposal projects employment losses will occur with implementation of its preferred alternative. Based upon input from our members, MECA believes that disproportionate employment and domestic industry skillset losses will occur amongst clean mobility technology suppliers if the preferred alternative is adopted and implemented.

3. Technology Leadership: The U.S. has been the world leader in vehicle efficiency technology in response to performance-based regulations to provide consumers fuel efficient vehicles. The current light-duty CAFE standards have led to fuel security in the U.S. due to the unprecedented introduction of innovative and advanced technologies such as advanced fuel injectors in downsized GDI engines, turbochargers, cooled-EGR systems, dynamic cylinder deactivation, hybrid powertrains, batteries, motors and electronic controls, and more. Other world regions will surpass the U.S. in technology leadership if the preferred alternative is finalized as proposed. This will effectively undermine U.S. automotive investments, resulting in a competitive disadvantage and potentially repeat the history of the 1970s when U.S. automakers were outcompeted by smaller, more efficient, foreign companies.

4. Maximum Feasible Standards: NHTSA's preferred alternative consistently projects automaker overcompliance ("Achieved" Values) across all model years. This includes overcompliance with total light duty fleet requirements by 11.8 mpg in MY2027 and 6.8 mpg in MY2031. The proposal notes that automakers in MY2024 have achieved 35.4 mpg, which is better performance than the 34.5 mpg estimated requirement in MY2031 without taking other proposed program changes into account. This strongly supports that the proposed standards are not the "maximum feasible" as required by statute. MECA recommends that the projected "Achieved" values should become the "Required" targets to better represent a realistic level of fuel efficiency for consumers. This will provide greater market stability supporting reasonable progress, automotive supplier investments, and employment.

5. Vehicle Reclassifications in MY2028: MECA supports the proposed reclassification of vehicle types to "Passenger Vehicles" and "Non-Passenger Vehicles" based upon the identified design features and Light-Duty Work Factor.

6. Program Flexibility: MECA supports off-cycle credits that incentivize fuel economy improvements through all technologically feasible options. Such flexibilities drive innovation and achieve real world fuel economy benefits, while allowing vehicle manufacturers to meet the regulatory objectives by the most cost-effective means.

7. $0 Civil Penalty Rate: The $0 civil penalty rate raises serious concern that some manufacturers could choose non-compliance as a business strategy to gain a competitive advantage. This could draw other manufacturers into a "race to the bottom" cycle, undermining CAFE program objectives. We urge NHTSA to evaluate the impact of the $0 civil rate on compliance with CAFE standards. It is essential that fuel economy remains an equal goal amongst all manufacturers to ensure regulatory targets are met and that U.S. domestic manufacturers remain leaders in the global automotive industry.

Economic and Employment Impact to Supplier Industry

Companies that design and manufacture fuel efficiency technology products employ over 300,000 people at over 1200 facilities across in 48 states in the U.S.[1]. In 2022-2023, the Department of Energy's (DOE) Annual U.S. Energy and Employment Report (USEER) found that clean vehicle employment was increasing at an annual rate 11.4% - more than twice the rate of overall U.S. employment[2].

The clean mobility industry exists largely because of standards such as progressive Corporate Average Fuel Economy (CAFE) requirements which MECA supports. Indeed, the majority of MECA members advise that investments made in response to the current CAFE standards have resulted in above average U.S. employment growth in R&D, manufacturing and indirect industry labor.

The NPRM's preferred alternative destabilizes the future fuel efficiency technology market which will strand current investments. Furthermore, NHTSA's proposal would potentially jeopardize future investments in the U.S. which will likely be redirected to regions where standards will continue to be progressively tightened.

There may be justification to allow additional flexibilities or consideration of alternate rates of increasing stringency of fuel efficiency requirements. However, it is clear, that in the absence of progressive standards, there will be negative impacts to our industry's investments and employment in the U.S. Indeed, the Preliminary Regulatory Impact Assessment (PRIA) indicates an industry-wide loss of over seven thousand jobs[3] which MECA believes will most likely be in higher paid R&D and application engineering roles. Overall, the long-term impacts of stranded industry investment may risk future investments in the U.S. compared to other regions that offer regulatory stability.

Supporting Technology Leadership

The vast majority of engine and powertrain technologies that have been deployed across the light-duty fleet to meet tightening CAFE standards are not revolutionary but rather well-known technologies that deliver performance while reducing the operating cost of vehicles. These technologies offer a variety of ways to improve fuel economy in conventional internal combustion engines and hybrid powertrains without relying on full vehicle electrification.

The continuing introduction of innovative technologies is due in part to advances in computing power that are available on modern vehicles. Well-known technologies such as turbochargers, exhaust gas recirculation (EGR) systems, advanced fuel injectors, variable valve actuation technology, powertrain control modules, advanced exhaust

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[1] https://www.bluegreenalliance.org/wp-content/uploads/2017/05/Supplying-Ingenuity-vFINAL-low-res.pdf
[2] https://www.energy.gov/articles/doe-report-shows-clean-energy-jobs-grew-more-twice-rate-overall-us-employment
[3] Preliminary Regulatory Impact Analysis, Section 8.2.4 Sales and Employment Impacts, Table 8-2 Industry-Wide Labor Utilization Effects.

emission controls as well as a growing range of tailored hybrid vehicle powertrains are anticipated to be applied to both light- and medium-duty powertrains. Auto manufacturers are expected to take advantage of the synergies between advanced emission control technologies and advanced powertrains to optimize system performance and improve fuel economy.

In fact, more stringent U.S. standards than those proposed provide domestic suppliers and vehicle manufacturers with a competitive advantage over foreign competition through the early development, adoption and optimization of technologies on vehicles.

Most importantly, as technology penetration increases, further cost reductions become available through the scaling of manufacturing, market competition and the increasing inclusion of such technologies as standard equipment in base vehicle models.

By essentially flatlining the 2021-2025 GHG standards out to 2031, the proposal jeopardizes supplier investments that are needed to develop and deploy technologies to maintain domestic technology leadership. In addition, the severe change from the previously finalized standards destabilizes the clean mobility technology market and increases uncertainty for future investments because of the expectation that the standards could be reconsidered within the next few years.

We urge NHTSA to set progressive performance-based policies that drive innovation and US leadership in all areas of vehicle fuel efficiency technologies.

Maximum Feasible Standards

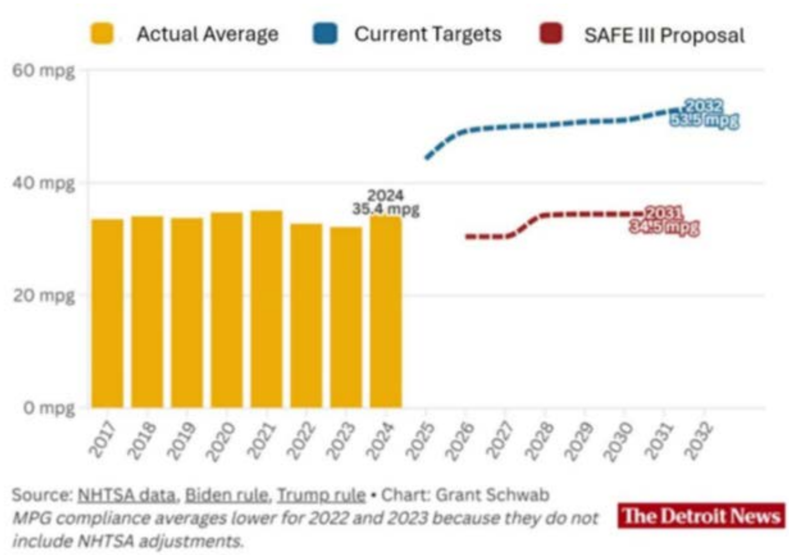

Figure 1. SAFE III Proposal vs. Current CAFE Targets

Figure 1 highlights that the current preferred alternative essentially flatlines CAFE standards to MY2031/2. In addition, NHTSA's preferred alternative consistently projects automaker overcompliance with significant margin ("Achieved" Values) across all model years. The proposal text also says automakers in MY2024 have achieved 35.4 mpg, which on its face is better performance than the 34.5 mpg estimated requirement in MY2031. This strongly supports that the proposed standards are not the "maximum feasible" as required by statute.

Section 8.2 of the PRIA examines the impact of the proposal on a range of eleven engine and powertrain fuel efficiency technologies, excluding battery electric vehicles, that manufacturers could deploy to improve the efficiency of their vehicles. Of these eleven technologies, only two technologies - high compression engines and strong hybrids - showed modest single digit increases in penetration under the preferred alternative while four technologies showed no significant change and five showed actual decreases in market penetration. The exclusion of battery electric vehicles in combination with the lack of powertrain and engine technologies with increasing market penetration further supports that the proposed standards are not the "maximum feasible" and will lead to lost revenue and jobs among technology suppliers. In addition, in a similar unconstrained CAFE analysis in the Draft Supplemental Environmental Impact Statement (SEIS) which includes battery electric vehicles at a penetration rate of 18%, the level of strong hybrids drops to 14%, a level very similar to the current overall industry penetration. This contrast between the PRIA and SEIS reinforces that the proposed standards are not the "maximum feasible".

We agree with NHTSA's interpretation of the CAFE statute that does not allow alternative fuel vehicles to be factored into design of fuel efficiency standards. However, the omission of an assessment of full vehicle electrification in the vehicle baseline causes market distortion because manufacturers will undoubtedly continue to sell electric vehicles and claim such vehicles in their compliance calculations. This further reduces the stringency of the proposed standards to such an extent that vehicle manufacturers could choose to de-content fuel efficiency technologies from their IC engine vehicles. These facts are further evidence that the proposal does not meet the "maximum feasible" threshold required by statute.

To address this deficiency, MECA recommends that the projected "Achieved" values should become the "Required" targets to better represent a realistic level of fuel efficiency improvement. This level of stringency is supported by technologies that can be applied to internal combustion engine vehicles and does not rely on electric vehicle sales. These changes will provide greater market stability supporting reasonable progress, automotive supplier investments, employment benefits and reduce market risk.

Vehicle Reclassifications

MECA supports the proposed reclassification of vehicle types to "Passenger Vehicles" and "Non-Passenger Vehicles" based upon the identified design features and Light-Duty Work Factor with one further consideration.

Our review leads us to believe that these reclassifications will better group vehicles based upon their fundamental design, normal daily use and preferred technology strategies to improve fuel economy. This should allow more tailored standards to be set for the two classes of vehicles.

Our assessment leads us to stress that the mere presence of an open cargo bed (i.e. pickup truck) vehicle design should not be considered by itself as sufficient grounds to be grouped as a "non-passenger vehicle". A growing number of small and mid-sized pick-ups being introduced into the market do not afford significant tow capacity ratings indicative of a "non-passenger vehicle" but are rather entirely comparable to a "passenger vehicle". These small and mid-sized pick-ups tend to share common "unitized construction" vehicle platforms with "passenger vehicles" and provide seating for four to five passengers which better characterizes their normal daily use as "passenger vehicles" that have the capability to occasionally carry oversized objects. The technology strategies to improve fuel economy for these small pick-ups are the same as for "passenger vehicles" that share the same vehicle platform.

As a further consideration, we suggest that the definition for "non-passenger vehicles" require vehicles with open beds to also meet the "Light-Duty Work Factor". This will reinforce the intended purpose of the re-classification of vehicles into the two distinct groups for fuel economy standards purposes.

Program Flexibility via Off-Cycle Credits

MECA continues to support the off-cycle credit program for recognizing the breadth of engineering ingenuity to reduce real-world fuel consumption through a verifiable credit process. Credit flexibilities such as AC efficiency, active grille shutters, passive cabin ventilation, engine warm-up systems, and high efficiency alternators drive innovation and achieve real world fuel economy benefits, while allowing vehicle manufacturers to meet the regulatory objectives by the most cost-effective means.

Given the phase out of advanced technology multiplier credits, we believe this could lead to increased interest and use of the current off-cycle credit provisions under the CAFE program especially for larger "non-passenger" vehicles. We support continuation of off-cycle menu credits through the currently defined pathways.

$0 Civil Penalty Rate

The $0 civil penalty rate raises serious concern that manufacturers could choose non-compliance as a business strategy. This could result in other manufacturers opting to do the same, undermining intended CAFE program objectives and equitable market competition and investments in fuel efficiency technologies.

An equitable civil penalty rate serves as legitimate incentive for manufacturers to comply with the objectives of the CAFE program and supports investments in fuel efficiency technologies to maintain the U.S. in a global leadership role in the light- and medium-duty vehicle markets.

If the $0 penalty rate is maintained, it will undermine the validity of the actual fuel economy standards.

We urge NHTSA to evaluate the impact of the $0 civil penalty rate on compliance with CAFE standards. This analysis should include the effect on U.S. investment and innovation across the automotive sector, from suppliers to vehicle manufacturers.

Fuel Efficiency technologies to Meet CAFE Standards.

Cylinder Deactivation and Variable Valve Actuation

Cylinder deactivation (CDA) is an established technology on light-duty gasoline vehicles, with the primary objective of reducing fuel consumption. This technology combines hardware and software computing power to seamlessly, in effect, “shut down” some of an engine’s cylinders, based on the power demand, and keep the effective cylinder load in an efficient portion of the engine map without burning more fuel. Based on decades of experience with CDA on gasoline passenger cars and trucks, CDA is now being adapted for diesel engines. On a diesel engine, CDA is programmed 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, CDA has resulted in exhaust temperatures increasing by 50°C to 100°C when it is most needed to maintain peak engine efficiency and effective diesel engine exhaust emissions control. In some demonstrations, CDA has been combined with a 48-V mild hybrid motor with launch and sailing capability to extend the range of CDA operation over the engine, and this may deliver multiplicative fuel savings from these synergistic technologies[4].

[4] https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf

Modern Turbochargers

Modern turbochargers enable engines to be downsized, resulting in fuel savings without sacrificing power and/or performance. Today's turbochargers have a variety of available design options enabling improved fuel economy by improving thermal management capability, such as: i) state of the art aerodynamics, ii) electrically-actuated wastegates that allow exhaust gases to by-pass 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), also enable fuel efficiency through improved thermal management capability to enhance aftertreatment light-off. Continuous improvement in turbocharger technology is making it possible to run leaner combustion (high air/fuel ratios), which increases efficiency. This improvement allows for very low particulate generation and even lower engine-out NOx.

Driven Turbochargers

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, fuel 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. This cumulative effect lets a driven turbocharger perform all the functions of a supercharger, turbocharger, and turbo-compounder.

Turbo-compounding

Turbo-compounding is a variant of turbocharger technology that allows for the energy from the exhaust gas to be extracted, converted to mechanical or electrical energy and either mechanically added to the engine crankshaft through a transmission or stored electrically for opportunistic use in other driving conditions. Mechanical turbo-compounding has been employed on some commercial diesel engines, and NHTSA along with EPA estimated penetration to reach 10% in the U.S. by 2027[5]. Turbo-compound designs may also incorporate bypass systems during cold start and low load operation to improve efficiency and emissions control. In addition, electrically driven turbo-

[5] U.S. EPA, "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles -- Phase 2," Federal Register, pp. 73478-74274, 25 October 2016.

compounding systems can also be placed after the exhaust components of an aftertreatment system.

Mild Hybridization (MHEVs) and 48 Volt System Technologies

48-volt systems can be found on many light-duty vehicle models (primarily from Europe) from Mercedes, Audi, VW, Renault and PSA. In the U.S., Stellantis is offering a 48-volt system on the RAM 1500 pick-up and the Jeep Wrangler under the eTorque trademark. 48-volt mild hybrid electrical systems and components are making their way onto an increasing number of vehicles including commercial diesel vehicles as they reduce starter size and wire gauge requirements, offering cost and weight savings which increase with increasing vehicle size.

Similar to the passenger car fleet, OEMs are considering replacing traditionally mechanically-driven components with electric versions to gain efficiency on an increasing range of light- and medium-duty vehicles. Running accessories off 48-volt electricity rather than 12-volts is more efficient due to reduced electrical losses and because components that draw more power, such as pumps and fans, have increased efficiency when operating at higher voltages. 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.

Mild hybridization covers a range of configurations, but a promising one includes an electric motor/generator, regenerative braking, electric boost and advanced batteries. In this way, 48-volt mild hybridization is complementary technology to cylinder deactivation and start-stop capability, allowing the combination of multiple technologies on a vehicle to yield synergistic benefits.

In lighter medium-duty applications, advanced start-stop systems have been developed that use an induction motor in a 48-volt belt-driven starter-generator (BSG). When the engine is running it acts as a generator charging a separate battery. When the engine needs to be started, the motor then applies its torque via the accessory belt and cranks the engine instead of using the starter motor. The separate battery can also be recharged via a regenerative braking system. In addition to the start-stop function, a BSG system can enhance fuel economy even during highway driving by cutting off the fuel supply when cruising or decelerating. Such systems can also be designed to deliver a short power boost to the drivetrain. This boost is typically 10 to 20 kW and is limited by the capacity of the 48-V battery and accessory belt linking the motor to the crankshaft. New designs are linking the BSG directly to the crankshaft and allowing additional power boost of up to 30 kW to be delivered, giving greater benefits to light and medium commercial vehicles.[6]

[6] https://www.meca.org/wp-content/uploads/resources/MECA_2027_Low_NOx_White_Paper_FINAL.pdf

Full / Strong Hybridization (HEVs)

A full hybrid can enable electrification of many of the components described above for mild hybrid vehicles, but the higher voltages allow for more parts to be electrified and to a higher degree of efficiency. Full hybrids which implement larger electric motors and batteries also support greater acceleration capability, regenerative braking power recovery and fully electric operation over short distances. Full hybrid vehicles offer the greatest benefit over urban driving conditions where they can take advantage of efficiency gains due to variable lower vehicle speeds and regenerative braking[7].

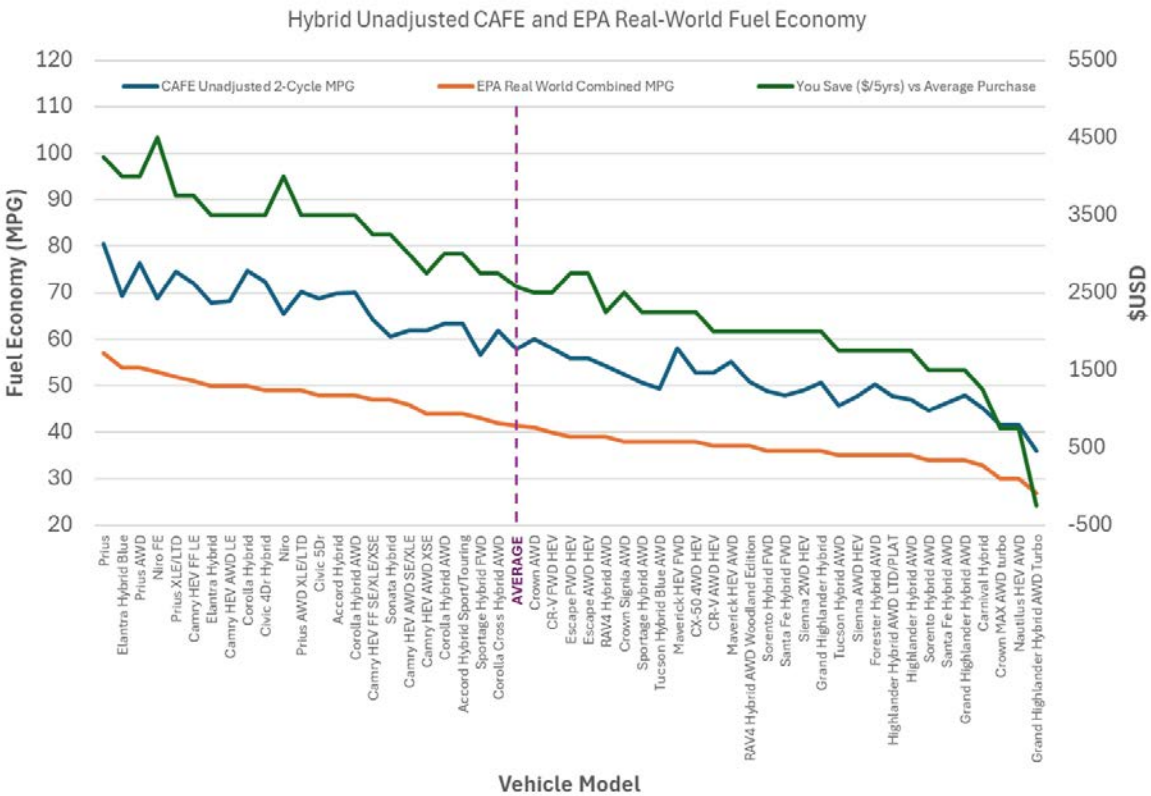

Figure 2. Comparison of Full Hybrid Passenger Vehicle CAFE Unadjusted and EPA Real World Fuel Economy Values and ii) EPA Reported Fuel Savings over 5 Years vs. the Average New Vehicle Purchase[8]

The Honda Insight and Toyota Prius were the first full hybrid vehicles offered for sale in the U.S. in MY1999 and MY2000 respectively. After 25 years, full hybrids are now a common product offering on small and larger light-duty cars, crossovers, SUVs and pick-ups from manufacturers such as Toyota, Honda, Ford, Hyundai, Kia, Mazda and Subaru. In 2025, full hybrid vehicle sales industry wide represented 16% of all new U.S. vehicle sales with Toyota sales approaching 50%. With respect to pick-ups, the hybrid versions of the

[7] CARB, "Draft Technology Assessment: Heavy-Duty Hybrid Vehicles," 2015.

[8] Chart assembled with data from www.fueleconomy.gov

Toyota Tacoma, Tundra, Ford F150 and Maverick represented 11.1%, 20.7%, 10.8% and 52% of sales respectively[9, 10].

As shown in Figure 2 above, MY2025 full hybrids which under NHTSA's proposal would be categorized as "passenger vehicles" offered an average CAFE unadjusted 2-cycle Fuel Economy of 57.9 MPG which readily surpasses the proposed MY2031 target of 34.5 MPG by 68%.[11]

These MY2025 passenger vehicle full hybrids offer a corresponding average EPA Real-World Fuel Economy value of 41.5 MPG with an overall average EPA reported fuel savings of $2577 USD over 5 years and $2299 USD compared to the equivalent conventional ICE power variants of the same vehicle models. These 5-year savings increase over the lifetime of the vehicle and are vastly greater than the average new vehicle price reduction of <$1000 USD projected by NHTSA for the current proposal.

Despite the proven fuel economy performance of full hybrid technology in passenger vehicles, the NPRM anticipates only single digit increases in full hybrid technology penetration which underscores that the current proposed standards are far from the maximum feasible.

With respect to larger "non-passenger vehicles", the renewed interest in hybrid technologies is anticipated to lead to the reintroduction of serial hybrids better known today as extended range electric vehicles (EREVs). Of special note, EREV technologies are anticipated to be utilized on larger passenger and non-passenger vehicles given their greater towing capacities.

Integrated hybrid electric drivetrain systems, consisting of a fully qualified transmission, motor and power electronics controller, are now also commercially available for medium-duty vehicles[12]. With the ability to meet high torque requirements, these systems will enable hybridization of a broad range of medium duty vehicles.

Plug-in Hybrids (PHEVs)

Plug-in hybrids (PHEVs) can be practical for light and medium- duty vehicles that do not travel long distances or operate for long periods of time without returning to the owner's home or to a central fleet location for overnight recharging. PHEVs can also provide a usable daily driving range for many owners charging from conventional 110V wall outlets when the vehicles are not in use.

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[9] https://www.fromtheroad.ford.com/us/en/articles/2026/ford-2025-full-year-us-sales-results

[10] https://s3.amazonaws.com/toyota-cms-media/toyota-pdfs/US%20December%202025%20FINAL.pdf

[11] Data downloaded from www.fueleconomy.gov

[12] https://www.nationalacademies.org/read/25542/chapter/9#209

An increasing number of PHEVs now offer all-electric ranges in excess of 40 miles including the BMW X5, Mercedes GLC350e, GLE450e, S580e, and AMG E53, Toyota Prius and RAV4, and Volvo S60 and T60.

It is worth highlighting that both HEVs and PHEVs deliver significant fuel economy benefits compared to their conventional vehicle counterparts by employing relatively low-capacity batteries.

Extended Range Electric Vehicles (EREVs)

Extended Range Electric Vehicles (EREVs) employ an engine operating only as a generator to charge the high voltage traction battery to drive an all-electric powertrain. EREVs are highly effective in extending the operating range of larger electrically-driven vehicles, such as pick-ups that need to tow significant distances and offer operational flexibility for other commercial vehicles without the need for extensive charging infrastructure. Both Stellantis and Ford have indicated they plan to launch pick-up trucks with EREV powertrains in the near future.

Critical Mineral Security

Table 1. Comparison of Battery Capacities of Conventional, Full Hybrid, Plug-in Hybrid and Battery Electric Vehicles

	2023 Toyota RAV4 AWD 2.5L, 4cyl. 	2023 Toyota RAV4 AWD Hybrid 2.5L, 4cyl. 	2022 Toyota RAV4 Prime AWD PHEV 2.5L, 4cyl. 	2023 Tesla Model Y Long Range AWD BEV 
Fuel Economy (mpge)	28	40	Elec + Gas: 94 Gas only: 38	Electric 122
Tailpipe + Upstream GHG (grams/mile)	383	268	190 *assumes 69.3% electric only operation	110 **based on U.S. average grid intensity
Fuel Economy Benefit (mpge)	-na-	12	66	94
Vehicle Battery Capacity (kWh)	-na-	1.6	18.1	100
Vehicles Produced from 100 kWh Battery Capacity	-na-	62	5.5	1
Fuel Economy Benefit per kWh Battery Capacity (mpge)	-na-	7.5	3.7	0.94

Table 1 above displays www.fueleconomy.gov data with stated battery capacities for comparable MY2023 conventional, full hybrid, plug-in hybrid and battery electric vehicles.

One can calculate the amount of fuel consumption reduced each year as a function of battery capacity (kWh) and miles driven. On an individual vehicle basis, the fuel economy of the battery electric vehicle (Tesla Model Y Long Range AWD) is 122 mpge compared to

94 mpge (electric and gas operation) for the plug-in hybrid (Toyota RAV4 Prime) if only 69.3% of its operation is all-electric. However, on an equivalent battery capacity basis, the last row of Table 3 shows that PHEVs and HEVs use the available battery materials more efficiently than BEVs, providing greater fuel economy benefits per kWh of battery capacity and contributing to U.S. critical mineral security. This improved efficiency of hybrids is due to the higher rate of cycling of their smaller hybrid battery capacities. As a result, a far greater cumulative fuel economy benefit can be realized by deploying the 5 PHEVs at 94 mpge than by the operation of the one BEV at 122 mpge. Full hybrids offer the highest cumulative fuel economy benefit allowing 62 vehicles employing the same cumulative battery capacity as one battery electric vehicle without any need for charging infrastructure or sales incentives.

To fully electrify a medium-duty vehicle, a minimum of a 100kWh battery would be needed. The same analysis could be run as for light-duty vehicles above to compare example medium-duty vehicles with varying degrees of electrification. The result would be similar with the conclusion that fuel economy improvements per kWh of battery are maximized for hybrid powertrains.

These analyses illustrate that strategically deploying HEV and PHEV powertrains can yield significantly greater fuel economy benefits on a battery capacity and critical minerals utilization basis thus reducing battery critical mineral supply chain pressures and providing manufacturers greater flexibility in achieving CAFE and fuel efficiency goals. In summary, we highlight that greater early market penetration of hybrids and PHEVs will moderate near term critical minerals usage, yielding greater mpge/kWh but also per unit of critical minerals (e.g., Li, Ni, Co, Mn). This will be an essential benefit while domestic sources of these materials are developed.

Conclusion

MECA believes that the projected manufacturer “Achieved” levels of fuel economy are readily achievable, reasonable and defendable as the minimum “Required” CAFE targets since they more realistically represent a “maximum feasible” level of fuel efficiency improvement. This will provide cost effective vehicle fuel economy improvements that would benefit millions of Americans with lower lifetime vehicle costs, provide greater job security for American workers while supporting technology supplier investments and maintaining U.S. automotive market technology leadership.

MECA supports NHTSA’s proposed MY2028 vehicle reclassifications to “Passenger Vehicles” and “Non-Passenger Vehicles” based upon the identified design features and reinforced by the proposed Light-Duty Work Factor. This change will allow future targets to be more specifically tailored to these defined vehicle groups, which will ensure that manufacturers will respond with focused fuel economy improvements in a greater number of vehicles in each vehicle group.

MECA continues to support flexibilities such as off-cycle credits that incentivize fuel economy improvements through all technologically feasible options. Such flexibilities drive innovation and achieve real world fuel economy benefits, while allowing vehicle manufacturers to meet the regulatory objectives by the most cost-effective means. These credits will be particularly important for “Non-Passenger Vehicles” due to their greater size and weight.

We also urge NHTSA to evaluate the impact of the $0 civil rate on compliance with CAFE standards. It is essential that fuel economy remains an equal goal amongst all manufacturers to continue to improve fuel economy for their customers but also ensure the continued leadership in the global automotive industry. We believe the $0 civil rate on fuel economy compliance is a serious risk to the attainment of the standards.

Finally, we reiterate our industry’s commitment to do its part to deliver cost-effective and durable advanced fuel efficiency technologies to the light-duty “passenger vehicle” and “non-passenger” and medium-duty vehicle sectors.

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