MECA Clean Mobility
Comments on the Proposed Amendments to the Advanced Clean Trucks Regulation and the Zero-Emission Powertrain Certification Test Procedure

October 21, 2024

MECA Clean Mobility is pleased to provide supporting comments to the California Air Resources Board's Proposed Amendments to the Advanced Clean Trucks Regulation and the Zero-Emission Powertrain Certification Test Procedure.

MECA supports stringent GHG standards founded on technologically feasible and cost-effective solutions that allow the attainment of carbon reduction goals. We concur that the introduction, transition and widespread adoption of zero emission vehicles represents a vital advancement in the decarbonization of heavy-duty vehicles. Further, we believe an important opportunity exists to continue to reduce GHG emissions from heavy-duty vehicles through the alignment of California and U.S. EPA determinations of zero-carbon emissions status.

MECA is a non-profit association of the world's leading manufacturers of technologies for clean mobility. Our members have over 50 years of experience and a proven track record in developing and manufacturing emission control, engine efficiency, electric propulsion and hydrogen 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 mobile sources in the United States, including medium- and heavy-duty vehicles subject to this regulation. MECA continues to support efforts to develop innovative, technology advancing, emission reduction programs to deal with environmental problems in global world markets.

SUMMARY:

- MECA strongly supports the need to reduce criteria and CO_2 emissions from medium- and heavy-duty vehicles by setting technology neutral, performance-based standards that will achieve the earliest reduction of GHGs and pollution through deployment of advanced engine, powertrain and vehicle technologies including electric, hydrogen and renewable fuel powered vehicles into the U.S. fleet.
- CARB should recognize the need to include life cycle analysis in future rulemaking by assigning realistic "non-zero" emission values to EVs and FCEVs thereby providing a regulatory incentive

to continue to improve the electric efficiency of components and vehicle powertrain technologies that will further reduce vehicle related environmental impacts.

- CARB should pursue further harmonization and alignment of zero-carbon emission vehicle classification with those of the US EPA.
- CARB should consider a definition within the ACT and ACF for hydrogen engines as a special classification of powertrains such as an HD-PZEV or other designation that differentiates it from ZEVs and ultra-low NOx diesel engines because of its near zero-carbon emissions compared with diesel and support of accelerated deployment of hydrogen infrastructure that will be needed by fuel cell trucks. Manufacturers could offer the H_2ICE technology under the ACT at a discounted compliance credit and fleets may purchase to comply with the ACF if ZEVs are not available or practical for certain applications.

MECA Supports the Proposed Amendments

MECA supports the need to reduce emissions from medium- and heavy-duty vehicles by setting technology neutral, performance standards that continue to improve the efficiency of today's vehicles while accelerating the introduction of zero emission powertrains across applications where they yield significantly lower GHG emissions as well as meet the needs of end users.

We support the proposed amendments to the ACT regulation and Zero-Emission Powertrain Certification Test Procedure that will provide further clarifications and additional flexibilities for manufacturers. These include amendments clarifying compliance determinations and sales reporting requirements, credits, credit deficits, documentation as well as increased flexibilities that support implementation. In addition, MECA supports proposed amendments which better align the ACT regulation with the Advanced Clean Cars II regulations so that manufacturers may choose to get credit for class 2b-3 zero-emission vehicles under either regulation.

Hydrogen-Fueled Internal Combustion Engines

Another promising technology that is being commercialized globally to reduce the NOx and the carbon footprint of heavy-duty vehicles is the hydrogen internal combustion engine (H_2ICE). MECA participated in the Hydrogen Internal Combustion Engine (H_2ICE) Consortium at Southwest Research Institute[1]. Under the consortium, an H_2ICE heavy-duty engine coupled with advanced NOx aftertreatment fully aged according to the Diesel Aftertreatment Accelerated Aging (DAAAC) protocol demonstrated FTP composite NOx emissions of less than 25% (0.008 g/hp-hr) of the MY2027 limit (0.035 g/bhp-hr) as well as below 0.01 g/hp-hr over the Ramped Modal Cycle (RMC) and Low Load Cycle (LLC).

Most importantly, the developed H_2ICE engine yielded near-zero tailpipe carbon emissions of less than 1.5 g/hp-hr – 99.7% lower than an equivalent MY2027 diesel fuel engine over all certification cycles[2]. On a concentration basis, the H_2ICE exhaust CO_2 is over 800 times lower as compared to diesel exhaust.

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[1] https://www.swri.org/industry/hydrogen-powered-vehicles/hydrogen-internal-combustion-engine-h2-ice-consortium.

[2] Briggs, Thomas, SwRI, "Demonstrating Near-Zero Emissions from a Hydrogen IC Engine – a Decarbonization Solution for the Post-2027 Landscape", 2024 ERC Symposium, Madison WI, June 12th and 13th, 2024. https://uwmadison.app.box.com/s/qcvdyb5bgsv2ivfw1x6ylivyjz3hacsd

Another climate compound that is emitted from combustion sources is nitrous oxide (N_2O). This is a regulated greenhouse gas because it has a Global Warming Potential (GWP that is nearly 300 times greater than CO_2. Based on measurements conducted on the consortium engine at SwRI, a properly designed hydrogen engine is about 60% lower than the best 2027 compliant diesel low NOx system and 90% below the current standard.

The developed H_2ICE engine was installed into a fully functional demonstration vehicle has been taken around the country to various trade shows and conferences (i.e. 2024 ACT Expo, California Hydrogen Leadership Summit and SAE 2024 COMVEC), to showcase the capabilities of H_2ICE vehicles and to educate potential fleet operators and policy makers on the findings of the H_2ICE consortium.

There is broad industry support for hydrogen-fueled internal combustion engines 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_2ICEs are attractive options for commercial trucking where challenges exist in applying current BEV or H_2-Fuel Cell technology and they can deliver early carbon reductions that return exponential climate benefits.

One of the main benefits of H_2ICE 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_2ICE 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_2ICE can borrow technology from currently available 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, are developing H_2ICE for commercial introduction in the MY 2027 timeframe.

Suppliers of on-vehicle hydrogen storage tanks are looking at H_2ICE as a transition technology to grow the manufacturing capacity for 350 bar, 700 bar high pressure hydrogen and liquid 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_2ICE trucks. Truck and engine manufacturers are targeting the introduction of H_2ICE trucks in the 2029 time-frame which has been estimated to be at least 10 years before fuel cell trucks become cost competitive with diesel trucks. The early introduction of H_2ICE trucks will help to accelerate the build-out of the hydrogen infrastructure and allow fleets to seamlessly transition from operating H_2ICE trucks to operating fuel cell trucks in their fleet. Furthermore, early carbon reductions have been shown to deliver multiplicative environmental benefits.

It is MECA's recommendation that CARB expand their analysis to include H_2ICE powered vehicles in harmonization with the US EPA's zero carbon emissions vehicle qualifications and determinations. The fact that H_2ICE has virtually no tailpipe CO_2 emissions should offer justification for special consideration of this technology as a distinct category of powertrains such as an HD-PZEV or other designation that differentiates it from ZEVs, NEVs and ultra-low NOx diesel engines that fleets may purchase to comply with the ACF if ZEVs are not available. Differentiation of this technology should be considered due to its early facilitation of hydrogen infrastructure deployment and hydrogen cost reduction that will accelerate fuel cell trucks into the fleets.

CONCUSION

MECA appreciates California's continued leadership and the dedication that CARB staff put into protecting the environment and public health. We support the proposed amendments and other provisions that facilitate flexibility toward manufacturer compliance. We ask that consideration be given for near-zero carbon technologies, such as hydrogen engines to comply with the ACT and ACF in applications where ZEV technologies are unavailable or impractical and for the synergistic support for hydrogen infrastructure that fuel cell trucks will ultimately need for market acceptance.

Our industry is prepared to do its part and deliver cost-effective and durable advanced emission, efficiency and electric technologies to the heavy-duty sector to meet the goals of the Advanced Clean Truck Regulation and the Zero-Emission Powertrain (ZEP) Certification Test Procedure.

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