

Air Products and Chemicals, Inc.
7201 Hamilton Boulevard, Allentown, PA 18195-1501
(Additional line if needed)
T 610-481-4911 F 610-481-5900
www.airproducts.com



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(document submitted electronically)

Clerk of the Board
California Air Resources Board
1001 I Street
Sacramento, CA 95418

RE: Comments regarding Low Carbon Fuel Standard – Potential Regulation Amendments Workshop on October 14, 2020.

Air Products appreciates the opportunity to provide comments on potential regulation amendments to the Low Carbon Fuel Standard (LCFS) regulation impacting hydrogen infrastructure investment and fueling station build out.

As a leading global supplier of outsourced hydrogen, Air Products is uniquely positioned to ensure hydrogen supply and fueling infrastructure considers the best mix of environmental, economic, operational performance needed for implementation of zero emission hydrogen mobility in California. We have been involved in over 250 hydrogen fueling projects in more than 20 countries around the world and completed greater than 10 million safe fuelings of cars, buses, trucks, forklifts, planes, and trains, among other vehicles.

In review of the LCFS amendments being considered by CARB staff impacting hydrogen supply and infrastructure to support market commercialization of zero emission fuel cell vehicles we suggest that regulatory changes in the following areas be considered:

1- Fuel Pathway Certification under CA-GREET 3.0

The LCFS program uses a California specific version of Argonne National Labs GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model to calculate the life-cycle carbon intensity of all transportation fuels. CARB's modification of the Argonne's GREET model involved thorough review, modifications, of the base Argonne GREET1_2016 model.

The California version of GREET was last updated in 2018 and serves as the basis of the current CA-GREET3.0 model today. All future fuel pathway certifications in LCFS will be required under CA-GREET3.0.

Argonne National Labs has conducted major updates to GREET1_2016 and recently issued GREET 2020 in October 2020. Changes include updated energy efficiency and emission factors for hydrogen production supply chains, reduced methane emissions, the production of green ammonia, reduction of methane leakage in natural gas supply, and other GREET model refinements.

Air Products recommends CARB staff incorporate the latest Argonne 2020 GREET model changes into an updated California version of CA-GREET model supporting future fuel pathway certification.

2. Expand §95488.5(d) of LCFS to all hydrogen transportation fuels.

The California versions of the Argonne GREET models reflects the carbon intensity of the California electric grid mix. Section 95488.5(d) of 2019 LCFS further supports annual update to the carbon intensity of electric power for electrolysis hydrogen production and battery electric vehicle charging lookup table pathways.

Updates supporting §95488.5(d) in 2019 and 2020 provide California electric grid carbon intensity values significantly lower than the CA-grid mix supporting all other hydrogen supply pathways contained in current CA-GREET3.0 model. Electric power supporting high efficiency liquid hydrogen production is assigned higher carbon intensity power supply than electrolysis hydrogen production including electrolysis balance of plant operations. All power consumption associated with electrolysis water purification, process pumps, heated dryers associated with hydrogen purification, and other equipment are assigned lower carbon intensity power supply. The assignment of different power carbon intensity is unfairly penalizing the liquid hydrogen fuel pathway relative to the water electrolysis fuel pathway.

To harmonize the carbon intensity for electricity supplied to all hydrogen production pathways Air Products recommends the annual California grid updates for electricity used for transportation fuels be extended to all hydrogen production methods including process energy used in hydrogen liquefaction.

3. Tier 2 EER Applications

In 2020, CARB staff issued LCFS Guidance 20-04 [Requesting EER-Adjusted Carbon Intensity Using a Tier 2 Pathway Application.](#)

Table 5 in Appendix A of LCFS guidance document 20-04 omits Energy Economy Ratio (EER) values for fuel cell electric vehicles and should be updated to remain consistent with section §95486.1(a).

In addition, the EER's representing vehicle performance are independent of carbon intensity of fuel supplied to the vehicle. Fuel cell performance using low carbon intensity hydrogen produced to SAE J2719 specification is no different than higher carbon intensity hydrogen produced to the same SAE specification.

Air Products recommends that new EER's established for next generation hydrogen vehicles under

Tier 2 applications should be allowed to apply the appropriate hydrogen fuel pathway and associated carbon intensity represented in look-up table and user specific Tier 2 fuel pathways. The process results in establishing adjusted CI values based any new EER's established under Tier 2 EER application.

4. Hydrogen Refueling Infrastructure Credits

Air Products is pleased that CARB staff continues to develop and implement innovative incentives under the LCFS to accelerate the development and build out of hydrogen refueling stations in California. The Hydrogen Refueling Infrastructure (HRI) Crediting program adopted in 2019 LCFS §95486.2 to generate LCFS credits based on hydrogen fueling capacity for light duty vehicles has supported a step-change in planned hydrogen fueling stations to support light-duty vehicle commercialization.

The LCFS HRI crediting program in combination with other support mechanism has shown to attract a higher level of private investment in hydrogen infrastructure. This innovative LCFS crediting program is turning out to be one of strongest market support mechanisms for California to meet the State's goal of 200 light-duty fueling stations. Lessons learned in the light-duty vehicle market segment needs to be expanded to heavy duty and mass transit infrastructure build-out at market onset.

Air Products recommends CARB staff consider extending a HRI type or similar crediting to hydrogen heavy duty and mass transit vehicles. The crediting program to support heavy-duty and mass transit fuel cell fleet adoption should support higher levels of private investment in heavy duty and mass transit hydrogen fueling infrastructure. Having hydrogen infrastructure installed and in place to support heavy duty will be critical to heavy duty and mass transit fuel cell vehicle market acceptance and adoption. Public investment for conversion to hydrogen fuel cell mass transit vehicles will follow normal fleet replacement schedules that can span 10-15 years. A HRI-like incentive for private investment in the fueling infrastructure sufficient to meet full fleet fueling demand will facilitate the long-term conversion to zero emission mass transit.

Air Products would like to commend the California Air Resources Board once again to taking the initiative to further refine and evolve the Low Carbon Fuel Standard innovate programs to further support the development of hydrogen infrastructure. We appreciate this opportunity to submit comments concerning the Low Carbon Fuel Standard regulation, and we welcome the opportunity to discuss our comments and viewpoint further with CARB staff at your convenience.

Please feel free to contact me at (610)481-5222 if you have any questions or would like to discuss further.

Sincerely,

Brian B. Bonner
Manager, Government Policy and Contracting

Hydrogen for Mobility