



July 3, 2018

Sam Wade  
Chief, Transportation Fuels Branch  
California Air Resources Board  
1001 "I" Street  
Sacramento, CA 95812  
Delivered via website

Dear Mr. Wade:

We support the **Hydrogen Refueling Infrastructure** (HRI) Pathway as proposed by the California Air Resources Board (ARB) in the 15-day Notice of Public Availability of Modified Text and Availability of Additional Documents and Information for Proposed Amendments to the Low Carbon Fuel Standard (LCFS) Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels (ADF) (henceforth "15-day Notice"). In the second part of this letter, we also propose amendments to strengthen the proposed regulation.

**We believe the HRI can provide an effective incentive for expanding zero-emission vehicle infrastructure while remaining consistent with the LCFS policy's intent**, by accomplishing the following during the early years of Fuel Cell Electric Vehicle (FCEV) deployment:

- partially offset the initial lower utilization of hydrogen refueling stations, thereby supporting refueling network development to increase the availability of hydrogen fuel;
- enable efficient development of hydrogen refueling stations at a sustained pace and scale to achieve significant cost reduction, promoting the efficient use of public and private funds and reducing the cost of low-carbon fuels for Californians;
- enable the incentive structure already in place in the LCFS to reduce the carbon intensity of hydrogen through increasing renewable content;
- become self-balancing and sun-setting, with credit generation through the HRI decreasing over time as hydrogen sales and station utilization increase;
- ensure best-in-class carbon intensity and infrastructure quality through eligibility conditions;
- ensure no material or unintended impacts to the overall LCFS policy and stakeholders through fixed limits on duration, infrastructure capacity, and credit generation.

**We believe the HRI as proposed by the ARB in the 15-day Notice has benefited from public input.** The proposal for an HRI was originally introduced at the ARB LCFS public workshop on program amendments held 6 November 2017, and submitted in writing to the ARB docket with specific regulatory language on 28 November 2017. The proposal was then revised to better align with the objectives and direction in Executive Order B-48-18 and to build upon the original proposal to ensure it would be effective for increasing the supply of hydrogen refueling stations and decreasing the carbon intensity of this Zero Emission Vehicle (ZEV) fuel without having a material or unintended impact on the overall LCFS policy and stakeholders. The revised proposal was submitted in writing to the ARB docket on 20 April 2018, and was supported by comments from industry during the public hearing to consider proposed amendments to the LCFS regulation on 27 April 2018. The HRI as proposed by the ARB in the 15-day Notice was introduced at the ARB LCFS public workshop on proposed amendments to the LCFS on 11 June 2018, and public availability of modified text and additional documents including the HRI was announced on 20 June 2018. This 15-day notice, following the public hearing on 27 April and with a deadline for public comment on 5 July 2018, is the result of nearly eight months of public process relating to the proposal.

**We believe the HRI as proposed by the ARB is consistent with Executive Order B-48-18 and the LCFS policy intent.** The LCFS was established by Executive Order S-01-07, pursuant to AB32, to reduce the carbon intensity of California's transportation fuels. With Executive Order B-48-18, California announced a target of 5 million ZEVs by 2030 and an eight-year \$2.5 billion investment initiative to continue the state's clean vehicle rebates and spur more infrastructure investments. The Executive Order also specifically calls for State entities to collaborate with stakeholders to implement this order, including "expand zero-emission vehicle infrastructure through the Low Carbon Fuel Standard Program."

Reaching California's goals for greenhouse gas and criteria pollutant emission reductions necessitates the acceleration and scaling up of very low-emission options in the transportation sector. This will require consumer choice across all vehicle segments and refueling/recharging modes of use, and will require growth in California's energy infrastructure to accommodate demand from the transportation sector as well as increasing supply from renewable sources. To be successful, a portfolio of ZEV including FCEV, Battery Electric Vehicles (BEV) and Plug-in Hybrid Electric Vehicles (PHEV) will be needed. Of these, FCEVs have the benefit of long range, fast refuel time and scalability, and are a very good ZEV option for those without the ability to charge at home. The refueling model for FCEVs is like that of conventional internal combustion engine vehicles in that it is done at a refueling station. As such, hydrogen refueling station capacity, coverage, and cost are prerequisites for a successful FCEV market. The initial low utilization of new refueling infrastructure during early stages of the market limits the pace of development and availability of this fuel, and increases the cost relative to traditional transportation fuels, all of which inhibit customer adoption. However, with modest scale in sustained development of hydrogen refueling infrastructure, it has been shown that the cost of hydrogen refueling stations can be reduced by 50% or more. A significant portion of cost reduction in hydrogen refueling stations serving light-duty vehicles can transfer to stations serving heavy-duty vehicles.

**We believe the HRI as proposed by the ARB in the 15-day Notice is appropriately constrained to Hydrogen** and the unique aspects thereof, and constrained in size, duration, and eligibility to protect

against unintended consequences while supporting the low-carbon, clean-air, and ZEV goals of the State of California.

**However, we also believe the HRI can be made even more effective without undue impact to the overall LCFS policy with the following changes.**

- **Application Period for Eligibility:** we encourage the ARB staff to complete the planned “evaluation to determine whether HRI application eligibility should be extended beyond 2025” well in advance of the stated objective for “prior to 2026” in order to provide certainty and stability to the market.
- **Design Nameplate Capacity:** we encourage the use of a **24-hour period, according to an established fueling profile**, to determine the Design Nameplate Capacity as this will better align the incentive for station design created by the HRI to serving customer demand. For comparison, only approximately 78% of demand is served in a 12-hour period from 0600 to 1800 hours.
- **OEM station approval:** we recommend modifying the requirement that “[a]t least three OEMs have confirmed that the station meets protocol expectations, and their customer can fuel at the station” (Sec. 95486.2(a)(4)(D)) to require that the station fueling interface shall conform to SAE International J2601: 2016, Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles ([www.sae.org](http://www.sae.org)), or the most recent version of the standard published and promulgated by the SAE. The fueling interface shall be tested per CSA HGV 4.3: 2012, Test Methods for Hydrogen Fueling Parameter Evaluation and related devices, or the most recent published version of the standard, and confirmed by either (1) a 3rd party Nationally Recognized Test Lab (NRTL) as approved by CARB, or (2) the U.S. Department of Energy Hydrogen Station Equipment Performance (HyStEP) device as practicable, for fueling interface confirmation.
- **Requirements to Generate Credits:** the hydrogen community previously recommended a requirement for company-wide hydrogen supply to be a “weighted average CI of 75 gCO<sub>2</sub>e/MJ (non-EER adjusted) for dispensed fuel or a renewable content of 40 percent or greater.” Note the importance of “or” in this requirement, since both requirements go beyond the requirements of SB 1505 (Lowenthal, 2006)<sup>1</sup>, allowing efficient and effective outcomes in increasing renewable content and decreasing carbon intensity of hydrogen supply while also building station capacity.

The currently proposed criteria for eligible hydrogen production states “weighted average CI of 75 gCO<sub>2</sub>e/MJ (non-EER adjusted) for dispensed fuel and a renewable content of 40 percent or greater.” Note the use of “and” in this requirement. With this criterion, the only lookup pathway eligible for this program would be HYER, electrolysis produced with wind or solar (per *CA-GREET 3.0 Lookup Table Pathways-Technical Support Documentation*, Table F.3). All other pathways

---

<sup>1</sup> SB 1505 (2006) required: (a) “... on a statewide basis, no less than 33.3 percent of the hydrogen produced for, or dispensed by, fueling stations that receive state funds be made from eligible renewable energy resources...”; and (b) “... on a statewide basis, well-to-wheel emissions of greenhouse gases for the average hydrogen powered vehicle in California are at least 30 percent lower than emissions for the average new gasoline vehicle in California when measured on a per-mile basis.”

using renewable feedstocks including electrolysis from the grid (HYEG) and renewable natural gas pathways (HYB and HYBL) would be excluded as they have a CI > 75 gCO<sub>2</sub>e/MJ (non-EER adjusted).

To develop a viable hydrogen supply industry with the increasing renewable content and decreasing carbon intensity incentivized by the HRI, it is imperative that all renewable pathways be eligible under this program and, as such, we request that eligibility requirements be changed to **“weighted average CI 40 percent lower than the current year gasoline standard pathway (with EER adjustment) for dispensed fuel and a renewable content of 40 percent or greater.”** This approach also keeps targets directly linked to those of the overall program.

- **Renewable Power Usage in Production, Distribution, and Dispensing:** Electrical power is an important input in all aspects of hydrogen production, compression, liquefaction, distribution, and dispensing. Electricity is the primary input when hydrogen is produced by electrolysis from water, but electrical power is also a significant source of energy for compression, liquefaction, pumping, and refrigeration of hydrogen produced by any method. Therefore, it is important that the LCFS regulations recognize renewable electricity as such whenever it is used in a hydrogen pathway.

For example, in proposed Sections 95481, 95486, and 95488, the credits available for improvements in the CI of electricity used for the production of hydrogen by electrolysis should also be available for improvements in the CI of electricity used for compression, liquefaction, distribution or dispensing.<sup>2</sup> Further, the *Time-of-Use* pathway definition (rather than *Smart Electrolysis* definition) should be restored to include electrical power used in all hydrogen production pathways.<sup>3</sup> Lastly, the Book-and-Claim Accounting should be allowed for use for all aspects of hydrogen production.<sup>4</sup>

---

<sup>2</sup> **Section 95481.(a)(113)** “Renewable Hydrogen” means hydrogen derived from (1) electrolysis of water or aqueous solutions using renewable electricity; (2) catalytic cracking or steam methane reforming of biomethane; or (3) thermochemical conversion of biomass, including the organic portion of municipal solid waste (MSW). Renewable electricity, for the purpose of renewable hydrogen production by electrolysis **or for hydrogen compression, liquefaction, distribution or dispensing**, means electricity derived from biomass, including the organic portion of MSW, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, electricity generated from a small hydroelectric facility of 30 megawatts or less, biogas, ocean wave, ocean thermal, and tidal current.

<sup>3</sup> **Section 95486.1(e)(2): Time-of-Use Pathways** for Hydrogen Production. An entity can generate credits, in addition to credits generated pursuant to subsection (1), above, for improvements in the CI of electricity used for electrolysis, **or for hydrogen compression, liquefaction, distribution or dispensing**, to produce hydrogen due to time of use smart electrolysis pursuant to section 95488.5 and the credit calculation in section 95486.1(c)(2)(B), where: Electricity is the total quantity of low-CI electricity supplied to the electrolyzer for hydrogen production, **or used for hydrogen compression liquefaction, distribution or dispensing**.

<sup>4</sup> **Section 95488.8(i)(1): Book-and-Claim Accounting for Renewable or Low-CI Electricity Supplied as a Transportation Fuel or Used to Produce Hydrogen**. Reporting entities may use indirect accounting mechanisms for renewable electricity to reduce the CI of electricity supplied as a transportation fuel or for hydrogen production through electrolysis, **and for hydrogen compression, liquefaction, distribution or dispensing**, provided the conditions set forth below are met:

Similar changes would follow in Section 95488.1, Section 95488.5, Section 95488.10(a)(4) and Section 95491. Without these changes, a hydrogen producer has very limited incentive to improve renewable content within a given pathway.

- **Deadline to Open:** as drafted, the regulation requires that “a station must be operational within 24 months of application approval.” (Sec. 95486.2(a)(4)(F).) We believe this deadline is an appropriate requirement to develop approved stations, but suggest that it should not result in a forfeiture of HRI credits when delays are caused by permitting agencies and not by the applicant. Permitting delays that exceed 30 days should be excluded from the 24-month period.
- **Maximum quantity of infrastructure credits:** we encourage setting the **limit for HRI at 3.5 percent of overall program deficits**, and suggest ARB staff provide analysis and forecast well in advance of reaching this cap, to provide certainty and stability to the market. The generation of HRI credits will result from the successful development of hydrogen refueling infrastructure and the decarbonization of the hydrogen supply. Setting the maximum quantity of HRI credits at 3.5 percent will give appropriate running room to enable this success case without undue impact on the overall LCFS policy. Setting the maximum number of HRI credits at 2.5 percent of program deficits may unduly restrict the HRI pathway if the LCFS is successful in catalyzing the development of low-carbon fuels and therefore generates fewer deficits.
- **Reporting and Recordkeeping Requirements:** we strongly encourage removing the requirement to report “station costs and revenues” as this will cause commercial difficulty for station developers and operators in contracting activities, will inhibit private investment, and is not needed for ARB’s administration of the program. The referenced “intended goals of reducing station costs and the retail price of dispensed hydrogen over time” can be observed in the marketplace and through other existing reporting structures like the ARFVTP program.
- **Applications for Expanded HRI Refueling Capacity:** we encourage **resetting the 15-year crediting period for incremental increases in capacity**. This would put station expansion on par with new station development for investment, and would avoid the potential unintended result of overbuilding new station capacity while neglecting existing “mid-life” stations. We also encourage **setting the required station throughput for expansion eligibility at 35%** to enable expansion in refueling capacity to support increasing adoption of fuel cell electric vehicle in areas of rapid market growth. Expansion of station capacity will be important in a success case of increasing contribution from hydrogen and fuel cell electric vehicles to California’s emission reduction goals.

In closing, we believe the HRI can be effective for accelerating the build out of hydrogen refueling stations and reducing the carbon intensity of hydrogen supply, consistent with Executive Order B-48-18 and Board Resolution 18-17, and the LCFS policy intent.

Thank you for your consideration.

For further information on this proposal, please contact the company representatives listed below.

**David P. Edwards, PhD**

Director, Hydrogen Energy  
Air Liquide

**Dr. Shane Stephens**

Founder and Chief Development Officer  
FirstElement Fuel

**Stephen Ellis**

Manager, Fuel Cell Vehicles  
American Honda Motor Co, Inc.

**Debbie Bakker**

Director, Regulatory Affairs  
Hyundai Kia America Technical Center, Inc.

**Nitin Natesan**

Business Development Manager –  
Hydrogen Fueling  
Linde LLC

**Matthew Forrest**

Senior Project Engineer  
Mercedes-Benz Research & Development  
North America, Inc.

**Mikael Sloth**

Vice President Business Development  
NEL Hydrogen A/S

**Wayne Leighty, MBA, PhD**

Hydrogen Business Development Manager, North America  
Shell New Energies

**Michael Lord**

Executive Engineer  
Toyota Motor North America

**Joe Gagliano**

Business Development Manager  
United Hydrogen

**Jeff Serfass**

Executive Director  
California Hydrogen Business Council

**Brian Goldstein**

Executive Director  
Energy Independence Now