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CHBC 22-IEPR-05 Hydrogen Workshop Comments

Additional submitted attachment is included below.

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California Energy Commission
Docket No. 22-IEPR-05
715 P Street
Sacramento, CA 95814

July 12, 2022

RE: COMMISSIONER WORKSHOP ON THE ROLE OF HYDROGEN IN CALIFORNIA'S CLEAN ENERGY FUTURE

I. INTRODUCTION

The California Hydrogen Business Council (CHBC)[1] appreciates the opportunity to respond to the Commissioner Workshop on the Role of Hydrogen in California's Clean Energy Future ("Workshop"). The CHBC is encouraged by the focused workshop on hydrogen's role in California's clean energy future but notes hydrogen is a solution that is being deployed today across the global economy. The CHBC's comments will respond to the following topics covered in the Workshop:

- **Forecasts of Hydrogen Opportunities in Economywide Decarbonization**
- **Current Use of Hydrogen & Near-term Opportunities to Expand Use for MDV/HDV/Off-Road/Marine Applications**
- **Emerging Projects & Opportunities for Hydrogen in Economywide Decarbonization**

II. COMMENTS

a. Forecasts of Hydrogen Opportunities in Economywide Decarbonization

i. Hydrogen Production and Waste to Energy Cycle

Hydrogen is the most abundant element in the universe. Harnessing the molecule (H2) as an energy carrier is the next step in the energy evolution leading to a cleaner, healthier, and more sustainable environment. The versatility of hydrogen production, storage and end-uses provides many of the same

[1] The CHBC is comprised of over 135 companies and agencies involved in the business of hydrogen. Our mission is to advance the commercialization of hydrogen in the energy sector, including transportation, goods movement, and stationary power systems to reduce emissions and help the state meet its decarbonization goals**. The views expressed in these comments are those of the CHBC, and do not necessarily reflect the views of all of the individual CHBC member companies.** CHBC Members are listed here: https://www.californiahydrogen.org/aboutus/chbc-members/

benefits as our fossil-based energy system as it relates to productivity, reliability, resiliency, and economic benefits without the negative environmental consequences. These findings are supported by the Intergovernmental Panel on Climate Change[2] (IPCC), an academic advisory body to the United Nations. For decades, Californians sought to "close the loop" on waste. Whether the source be organic waste or curtailed renewable energy, hydrogen is the answer to some of our greatest clean energy and transportation challenges.

Electrolysis of sustainably sourced water to hydrogen is needed to underpin the economics of renewable electricity through 100 percent utilization of wind and solar assets. Electrolysis will be a predominant source for hydrogen and will often be paired with dedicated "behind the meter" renewable electricity generation. Beyond fuel production, electrolyzer loads can be managed to support the grid during peak demand. Clean hydrogen can be used in turbines and fuel cells to provide firm power and peaking power to the grid. Excess hydrogen can be stored in geologic formations and compression tanks, to be dispatched when the grid or pipeline requires it. Months of excess energy, not hours, are available with these technologies and provide benefits to Californians without requiring reductive behavioral and lifestyle changes to achieve our climate goals.

Upcycling biomethane, biomass, and even non-recyclable municipal waste feedstocks to hydrogen presents a tremendous opportunity to deliver on the mandated emissions reductions required by SB 1383 (Lara, Chapter 395, Statutes 2018) and the Short-Lived Climate Pollutant Reduction Strategy[3]. Hydrogen mitigates anthropogenic emissions by utilizing emissions from landfills, Publicly Owned Treatment Works (POTWs), and disposal of biomass, including agricultural waste streams and those from wildfire mitigation activities, to produce low-to-negative carbon hydrogen. Transforming anthropogenic emissions into hydrogen is a low-cost solution to removing short-lived climate pollutants and creating renewable energy.

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[2] https://www.ipcc.ch/sr15/chapter/chapter-4/

[3] Short-Live Climate Pollutant Strategy. https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.

Newer hydrogen production technologies like steam/CO2 reforming, which produces hydrogen without combustion[4], utilizes anthropogenic sources as well as municipal solid waste to produce negative carbon hydrogen for use in our energy and transportation sectors. Further, advances in renewable dimethyl ether, ammonia, and other energy dense molecules as hydrogen carriers can use existing infrastructure to reduce the delivered cost of hydrogen[5]. Additionally, repurposing existing and new steam methane reformation facilities with renewable feedstock is a first step to cost-effectively decarbonizing hydrogen production that will encourage the uptake of fuel cells[6]. In turn, ramping up market demand for renewable hydrogen will create an initial virtuous cycle.

Thermochemical conversion of biomass to hydrogen is another way to manage the waste from forestry and agricultural operations. Under this scenario, hydrogen provides favorable economics to mitigating wildfire risks while lowering emissions by eliminating the open combustion-based practices highlighted by the state procurement of incinerators in recent budgets for CalFire. A study from Lawrence Livermore National Laboratory states that "[g]asifying biomass to make hydrogen fuel and CO2 has the largest promise for CO2 removal at the lowest cost and aligns with the State's goals on renewable hydrogen."[7]

Each of these clean hydrogen production pathways are necessary to achieve carbon neutrality across the state's economy. They provide critical co-benefits and "close the loop" on maximizing large-scale renewable energy projects and minimizing dangerous short-lived climate pollutant emissions. The creation of a high-value energy carrier for the transportation, industrial, agricultural and electricity sectors also manage investment risk leading to better economic outcomes.

ii. Hydrogen End Uses that Decarbonize the Economy: Hydrogen in Pipelines

[4] Raven SR. https://ravensr.com/steam-reformer-system/.
[5] Oberon Fuels. https://oberonfuels.com/dmeforhydrogen/; https://www.energy.gov/sites/prod/files/2015/01/f19/fcto_nh3_h2_storage_white_paper_2006.pdf.
[6] https://reglobal.co/repurposing-infrastructure-for-hydrogen-in-a-net-zero-future/.
[7] https://gs.llnl.gov/sites/gs/files/2021-08/getting_to_neutral.pdf, page 5.

In the transition to carbon neutrality, with hydrogen as a key resource, California can leverage the skills and infrastructure from our robust oil, gas, and utility sector as a backbone for distribution of renewable and clean hydrogen throughout the state. Starting with a blending standard to lower the carbon content of our natural gas supply and the buildout and/or conversion of dedicated hydrogen pipelines in industrial clusters, we can fully transition the energy utilized by industry, all while maintaining the existing workforce[8]. The virtuous cycle that will accelerate through reusing and retrofitting existing pipelines throughout the state will be the backbone for unlocking scale while maintaining high-road jobs of pipefitters, laborers, operating engineers, steelworkers, and utility workers that would not otherwise be replaced in a decarbonized economy without hydrogen. Repurposing infrastructure also preserves significant ratepayer investments in the multibillion-dollar pipeline network while allowing the rapid scaling of hydrogen production and off-takers throughout the state. The transition of pipeline infrastructure is critical to creating a virtuous cycle where diverse production pathways of decarbonized hydrogen leads to diverse off-takers resulting in sector-to-sector transitions. This avoids the environmental and economic impacts of leakage that will result if we do not provide viable and economically sound solutions for every segment of every sector.

b. Current Use of Hydrogen & Near-term Opportunities to Expand Use for MDV/HDV/Off-Road/Marine Applications

i. Hydrogen powered fuel cell electric vehicles on the road today and the future of a statewide fueling network

Hydrogen powered fuel cell electric vehicles (FCEVs) are an important technology that offer benefits battery electric vehicles (BEVs) cannot fully serve in the effort to decarbonize California's heavily polluting transportation sector. FCEVs through the light, medium, and heavy-duty space are long-

[8] https://www.utilitydive.com/news/socalgas-begins-developing-100-clean-hydrogen-pipeline-system/619170/#:~:text=SoCalGas%20continues%20to%20explore%20whether,decarbonization%2C%20according%20to%20Navin%20said.; https://www.pge.com/en_US/about-pge/media-newsroom/news-details.page?pageID=66b8ed99-3175-48da-95d6-1a1fde0a4f18&ts=1651546270622; Hydrogen Blending Projects in the US. https://www.cleanegroup.org/ceg-projects/hydrogen/projects-in-the-us/.

range, lightweight, easily recyclable, and require quick public refueling--similar to the refueling experience of today's gas and diesel-powered vehicles.[9] When considering our super-commuters and the growing role of transportation networking companies, demand for FCEVs will increase rapidly once sufficient infrastructure exists to allow statewide refueling. Therefore, FCEVs offer solutions to passenger and fleet drivers whose lifestyle and duty cycles are not served by the charging experience of battery electric vehicles (BEV) or the weight of a BEV.[10] The vehicle weight advantage associated with long-range and rapidly refueling benefits of fuel cells will allow existing commercial transportation business models to be maintained as they offer the same operational efficiency. For these reasons, FCEVs are an optimal option for public transit and goods movement, particularly in high-heat regions.

Today, FCEVs are on California's roads, at the ports, and in warehouses, working to decarbonize the transportation sector and improve air quality. FCEV cars, trucks, buses, and off-road vehicles like forklifts have been operating successfully and providing California with another sustainable option in transportation. FCEV cars are utilizing the publicly available refueling infrastructure[11]; FCEV trucks are being deployed alongside heavy-duty fueling infrastructure[12]; FCEV buses fuel on-site[13]; and off-road vehicles tap into mobile and on-site refueling options[14]. FCEV technology in on and off-road applications is not an opportunity for the future—the technology is being deployed today and working towards a commercialized future.

As a tool for reaching the state's zero-emission, air quality, and decarbonization goals, FCEVs offer great promise since they are zero emission and operate on hydrogen. First, although hydrogen is only required to be 40 percent renewable to receive funds through the Low Carbon Fuel Standard

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[9] https://afdc.energy.gov/vehicles/fuel_cell.html#:~:text=Unlike%20conventional%20internal%20combustion%20engine,a%20tank%20on%20the%20vehicle..

[10] https://www.energy.gov/sites/default/files/2014/03/f9/thomas_fcev_vs_battery_evs.pdf.

[11] https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/hydrogen-refueling

[12] https://cte.tv/norcal-zero-announcement/; https://www.autoevolution.com/news/here-s-nikola-s-plan-to-sell-hydrogen-to-its-fcev-trucks-and-anyone-else-that-needs-it-182423.html;

[13] https://www.sunline.org/projects/alternative-fuels/clean-fleet; https://www.actransit.org/zeb

[14] https://www.plugpower.com/fuel-cell-power/gendrive/; https://www.airproducts.com/applications/material-handling-forklifts.

(LCFS)[15], stations that are funded through the LCFS program dispense, on average, 90 percent renewable hydrogen fuel content.[16] The electric grid, which powers the charging system of BEVs, was only 33 percent renewable on average in 2020[17]. Further, hydrogen fueling infrastructure is well-positioned to become self-sustaining at the end of the decade. Based on the ARB's Hydrogen Fueling Infrastructure Self-Sufficiency Report[18], approximately $300M more is needed to create a self-sustaining light- and medium-duty fueling market. A robust FCEV market will provide an economic pathway forward for existing fueling stations, which number in the several thousands, to transition from gasoline and diesel to hydrogen. Moreover, many fueling station stores are predominantly small, minority-owned businesses[19]. Having a viable pathway for these business owners and their employees will allow them to keep their businesses as we transition away from fossil fuels and create a clean energy economy.

c. Emerging Projects & Opportunities for Hydrogen in Economywide Decarbonization

i. Hydrogen terminology that will meet California's climate goals

Identifying hydrogen's eligibility for inclusion in state decarbonization plans through a carbon intensity score, a tangible metric, rather than a color wheel, a feedstock identifier, is a more effective tool at capturing how much carbon is reduced from the atmosphere by using hydrogen as compared to diesel or gasoline. Defining various types of hydrogen fuels based on a limited color wheel of the feedstock is inefficient because it cannot capture the decarbonizing potential of developing hydrogen feedstocks like municipal waste, biomass, biogas, and solid waste. Instead, the decarbonization potential of fuels, including hydrogen, should be determined through a carbon intensity score, the same metric used in the California Air Resources Board's highly successful Low Carbon Fuel Standard (LCFS) and in the federal Infrastructure Investment and Jobs Act's definition of "clean hydrogen[20]." A carbon intensity score captures the lifecycle emissions of a fuel with a metric of carbon emissions as compared to diesel and

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[15] https://ww2.arb.ca.gov/resources/documents/lcfs-zev-infrastructure-crediting.
[16] https://ww2.arb.ca.gov/sites/default/files/2021-09/2021_AB-8_FINAL.pdf.
[17] https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2020-total-system-electric-generation.
[18] https://ww2.arb.ca.gov/resources/documents/self-sufficiency-report
[19] https://www.cnbc.com/2020/03/18/americas-gas-stations-and-convenience-stores-grapple-with-an-uncertain-future.html.
[20] https://www.congress.gov/bill/117th-congress/house-bill/4909/text.

gasoline and could be compared to other fossil fueled based sources for various other end uses like building heat and energy storage. Hydrogen, on a carbon intensity score, can have as low as -105 carbon intensity to as much as 70 carbon intensity depending on the production feedstock and process[21]. Pinpointing a carbon intensity metric as a basis for eligibility creates competition of fuel producers that drives down costs and engenders innovation as fuel producers work to meet decarbonization targets.

III. CONCLUSION

The CHBC respectfully requests consideration of our comments on the Workshop. Hydrogen is an essential decarbonization pathway and a resource that will go wasted if not invested in by both the public and private markets. There are end uses successfully operating today on hydrogen that contribute to meeting California's climate targets. With proper planning and incorporation of hydrogen in our energy and transportation sectors, California can meet its decarbonization and air quality goals and contribute to job growth in California. Thank you for your time and consideration. We look forward to working with you on the IEPR.

Respectfully Submitted,

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[21] https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities.