September 3, 2021

Ms. Rajinder Sahota, Deputy Director
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: GHC Comments on CARB's 2022 Scoping Plan Update - Scenario Concepts Technical Workshop

Introduction

The Green Hydrogen Coalition (GHC)[1] appreciates the opportunity to comment on the California Air Resources Board's (CARB) *2022 Scoping Plan Update - Scenario Concepts Technical Workshop*. GHC seeks to offer insights into the benefits and opportunities green hydrogen represents for California to achieve carbon neutrality by 2045.

GHC is a California educational non-profit organization founded in 2019 to facilitate policies and practices to advance the production and use of green hydrogen at scale in all sectors to accelerate a carbon-free energy future. GHC defines green hydrogen as hydrogen produced from non-fossil-fuel feedstocks and emits zero or de minimis[2] greenhouse gas emissions on a lifecycle basis. This definition should include but should not be limited to the use of both RPS eligible resources and SB 100 eligible resources.

GHC defines green hydrogen by explicitly excluding the use of fossil resources and thus opening the possibility for technological innovation to flourish, enabling new pathways to produce green hydrogen to be considered, so long as they have climate integrity (e.g., photocatalytic, plasma gasification of organic solid waste). Today, electrolytic production of green hydrogen using water as a feedstock is a promising commercial pathway for mass-scale production. It should be encouraged, but other pathways should also be cultivated, particularly pathways that address other societal problems (e.g., open burning of agricultural waste). A broad technology-neutral approach to producing green hydrogen will foster competition and innovation and minimize the risk toward achieving our goal - fighting climate change and protecting the environment.

GHC specific comments on CARB's workshop are below.

[1] https://www.ghcoalition.org/

[2] "De minimis" means an insignificant amount of nonrenewable energy resources allowed to be counted as RPS-eligible. For electrolytic hydrogen, de minimis greenhouse gas emissions would include auxiliary grid loads, provided that such loads do not exceed 10 percent of the total energy input.

I. *Green Hydrogen is key to eliminating fossil fuels in the transportation sector and should be included as a scenario option.*

The single most significant opportunity to reduce emissions in the transportation sector is to replace fossil fuel use. Transportation using green hydrogen can support replacing fossil fuel use and complement battery electric vehicles for decarbonizing transport. Green hydrogen use can also alleviate pressure on the electric grid, smartly utilize gas pipeline infrastructure to decarbonize transportation and create fuel diversity and resiliency for land transport applications.

Green Hydrogen fueled transport is ideally suited for high-utilization, heavy-duty transport applications such as buses and trucks. These are significant categories, accounting for more than a quarter of transport energy usage. These vehicles can be eliminating their emissions via fuel cells or even modified internal combustion engines using green hydrogen. Green hydrogen vehicles can be refueled quickly, like gasoline pumping, taking about five to seven minutes to fill a light-duty vehicle. Additionally, fuel cell vehicles have a similar range to gas vehicles: 250-400 miles. Because green hydrogen is more energy-dense and lighter than gasoline or diesel, using green hydrogen fuel increases the vehicle's payload capacity.

CARB should develop a scenario option that models multiple transportation applications using green hydrogen and various pathways to produce the green hydrogen to supply this network. The applications could include light, medium, and heavy-duty transportation in coastal shipping port regions and dense populations throughout California.

II. *Green hydrogen can support a carbon-free electricity grid while addressing California's reliability concerns and should be included as a scenario option.*

Governor Newsom's Emergency Proclamation[3] highlights the need for California to be more proactive in addressing reliability concerns, especially in the face of increased extreme weather events. Drought conditions across the West have led to a gap in hydro capacity, while prolonged extreme heat has considerably increased peak demand. Meanwhile, these extreme weather phenomena heighten the threat of wildfires, which may lead to transmission outages.

It is evident via the Emergency Proclamation that California needs to move faster to ensure reliability without compromising climate goals, further exacerbating the climate-dependent reliability concerns. GHC believes CARB must prioritize green hydrogen in its scenario options to best support carbon neutrality goals while meeting California's reliability

[3] California, State of. "Governor Newsom SIGNS Emergency Proclamation to Expedite Clean Energy Projects and RELIEVE Demand on the Electrical Grid during Extreme Weather Events This Summer as Climate Crisis Threatens Western States." California Governor Newsom, 30 July 2021, www.gov.ca.gov/2021/07/30/governor-newsom-signs-emergency-proclamation-to-expedite-clean-energy-projects-and-relieve-demand-on-the-electrical-grid-during-extreme-weather-events-this-summer-as-climate-crisis-threatens-western-s/.

concerns. GHC submits that California needs an all-of-the-above approach to its reliability concerns, resiliency needs, and carbon neutrality goals. Given the grid conditions highlighted by the Emergency Proclamation, the state must support resiliency for communities and customers, including California's most vulnerable.

GHC recommends CARB develop a scenario option that looks at a coordinated electric and gas sector optimization in how green hydrogen industrial hubs can serve local resiliency needs during Public Safety Power Shutoff (PSPS) events and other unplanned outages while achieving California's climate priorities. For example, locally stored green hydrogen can be used in backup generating units for long-duration backup power. Additionally, green hydrogen transported through a gas pipeline can meet energy needs when the electric grid cannot.

Notably, the Emergency Proclamation would waive existing restrictions on specific backup generators (BUGs) originally intended to protect local communities and meet California's climate goals. Rather than sacrificing the health and safety of customers and risking climate goals, GHC recommends CARB consider how to leverage green hydrogen to support reliability while achieving carbon neutrality in California by 2045.

III. Biomass can be converted to green hydrogen for various end-uses and should be included as a scenario option.

Green hydrogen production from biomass can be a promising alternative for future decarbonized applications. This opportunity aligns with SB 1383 landfill organics diversion goals,[4] the phase-out of agricultural burning,[5] and California's wildfire mitigation efforts. For this reason, GHC recommends CARB to include a scenario option that would convert woody biomass and solid biomass waste to green hydrogen. This option can eliminate open burning while reducing short-lived climate pollutants (SLCPs) and help create value for wastes and encourage recycling biomass and other organic material into valuable fuels.

IV. Green hydrogen is the solution to decarbonizing industrial feedstock and processes and should be included as a scenario option.

Over 70% of the hydrogen consumed today is used as an industrial feedstock.[6] Processes such as ammonia for fertilizers, production of methanol, and oil refining all require hydrogen. Industrial applications in California using hydrogen are well-positioned to switch from gray hydrogen to green hydrogen. Gray hydrogen users are good offtake candidates for large-scale green hydrogen projects: they have significant existing hydrogen demand and related infrastructure in place, and refineries and ammonia plants are often located in geographic clusters, making them convenient off-takers of large green hydrogen projects. Thus, CARB

[4] SB-1383 Short-lived climate pollutants: methane emissions: dairy and livestock: organic waste: landfills. (2015-2016)
[5] https://somachlaw.com/policy-alert/carb-approves-phased-in-agricultural-burning-ban-in-san-joaquin-air-quality-management-district/#:~:text=Farmers%20and%20ranchers%20in%20the,burning%20by%20January%201%2C%202025
[6] International Energy Agency, 2019, The Future of Hydrogen.

should include a scenario option that converts existing demand for gray hydrogen to green hydrogen to lower the carbon footprint of numerous industrial processes.

Secondly, industrial processes (e.g., steel, cement, glass, and chemicals) that require high temperatures to manipulate raw inputs into valuable outputs usually depend on other fossil fuels as a heat source. Due to the high-temperature needs, this sector is difficult to electrify. However, green hydrogen offers a solution by acting as a fuel to supply high heat for these processes. A transition to clean-burning and renewably generated green hydrogen for these applications would be an essential CARB scenario option to reduce point-source pollutants at industrial sites in California.

Overall, CARB should prioritize its industrial modeling efforts using green hydrogen. This opportunity will present large GHG emission reductions, providing significant environmental benefits, as well as potential monetary benefits for participating industrial sites in CARB's carbon markets.

V. CARB's scenarios should not exclude combustion technology options.

Power plants provide centralized energy generation and are essential parts of our electrical system, providing both baseload and peaking load power. In 2020, 37% of California's electricity generation was produced from natural gas power plants physically located in California.[7] Many of these existing assets can be updated, repowered, and converted to use green hydrogen. Green hydrogen gas also eliminates particulate, sulfur, carbon dioxide, and carbon monoxide emissions, as no carbon or other impurities exist in the fuel.

Hydrogen can be safely combusted in a gas turbine and has environmental benefits over other fuels. Hydrogen has a wide range of flame stability in a fuel-air mixture, which means it is very stable from an operational standpoint. Hydrogen combustion can be temperature controlled and is ten times faster than natural gas. These factors help reduce NOx production in the combustion process, bringing NOx emissions down to 2 ppm or less.[8]

For this reason, CARB should not exclude combustion technologies in its scenario options. Rather than pick technology winners or losers, the plan should focus on maximizing carbon reductions. Focusing on specific technologies unrelated to lifecycle carbon emissions should be outside the scope of a climate change scoping plan.

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[7] https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2020-total-system-electric-generation

[8] Ditaranto, Mario, et al. "Concept of Hydrogen Fired Gas Turbine Cycle with Exhaust Gas Recirculation: Assessment of Process Performance." Energy, vol. 192, 2020, p. 116646., doi:10.1016/j.energy.2019.116646.

Conclusion

GHC thanks CARB for its thoughtful leadership in framing the *Scoping Plan Update - Scenario Concepts Technical Workshop* and for this opportunity to comment on the process. We look forward to continuing to work with CARB to understand how green hydrogen can become an essential piece of California's carbon neutrality strategy.

Respectfully submitted,

Sincerely,

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