September 17, 2021

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

Re: GHC Comments on CARB's Draft Cap-and-Trade Investment Plan 2022-25

Introduction

The Green Hydrogen Coalition (GHC)[1] appreciates the opportunity to comment on the California Air Resources Board's (CARB) *Draft Cap-and-Trade Auction Proceeds Fourth Investment Plan Fiscal Years 2022-23 through 2024-25* ("Draft Fourth Investment Plan"). GHC supports the state's Cap-and-Trade Program and the use of Cap-and-Trade revenues to further the state's climate, public health, and equity goals.

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 (produces de minimis amounts of greenhouse gases on a lifecycle basis). Some examples of innovative new pathways include, for example, photocatalytic and plasma gasification of organic solid waste. Today, electrolytic production of green hydrogen using water as a feedstock is a commercially viable pathway for mass-scale production. It should be encouraged, as well as other pathways such as reforming biogas and thermochemical conversion of organic waste and non-recyclable plastic and paper that can address other societal problems, including reducing methane emissions associated with landfills and open burning of agricultural/forestry 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 submits the following recommendations to support CARB's *Draft Fourth Investment Plan* priority investments.

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[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. *CARB should prioritize green hydrogen investment for high-utilization, medium, and heavy-duty transportation applications.*

The single most significant opportunity to reduce emissions in the transportation sector is to replace diesel fuel. Transportation using green hydrogen can support the replacement of diesel fuel and complement battery-electric solutions for decarbonization. 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 transportation is ideal for high-utilization, medium, and heavy-duty transportation applications such as fleets, 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 invest funds that focus on high-utilization, medium and heavy-duty transportation applications using green hydrogen and various pathways to produce the green hydrogen to supply this network, complementing California's already significant progress in light-duty hydrogen fueling infrastructure. These projects should prioritize medium and heavy-duty green hydrogen refueling infrastructure in coastal shipping port regions and transit corridors, benefiting communities of concern located in and along these routes, which have historically suffered from the resulting diesel air pollution. Coastal shipping port regions should be a priority also because they are locations of other potential green hydrogen offtake at scale, including thermal electric power generation, oil refining, and other industrial applications.

II. *CARB should prioritize green hydrogen investment to support climate goals while meeting California's reliability concerns.*

California needs 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, leading to planned and unplanned transmission outages. California needs to move faster to ensure reliability without compromising climate goals, further exacerbating the climate-dependent reliability concerns.

CARB should invest funds in green hydrogen to meet greenhouse gas reduction goals while meeting California's reliability concerns. One way to support this is to invest funds aimed at fuel switching polluting backup diesel generators with locally stored green hydrogen onsite

fuel cells or combustion turbines that can provide an alternative, zero-emission, multi-day critical backup power solution. CARB could also invest in consumer education and incentives for purchasing or retrofitting to clean backup alternatives. With the appropriate market design, green hydrogen-powered fuel cells or combustion turbines can be routinely used to provide safe, clean emergency backup power.

Additionally, green hydrogen could also be used as energy storage for bulk, multi-day and seasonal storage used on-demand to balance grid load. Hydrogen storage is unique from other storage technologies in that it has separate power (kW) and energy (kWh) scaling. For example, the size of the fuel cell can be determined independently of the size of the hydrogen storage tank.

When green hydrogen is used as a drop-in fuel replacement for natural gas, it can utilize existing natural gas generation infrastructure to meet daily demand fluctuations, similar to how daily cycling electrochemical batteries are used. However, when a long period of storage, ten hours or more, is required to provide power, it may be significantly more cost-effective to store energy via hydrogen instead of electrochemical batteries. For example, during a long cloudy winter, stored energy may have to last for weeks. In this case, only a renewable fuel like green hydrogen would provide the appropriate scale at a reasonable cost to maintain grid reliability.

CARB should invest funds in green hydrogen long-duration energy storage to support California's reliability needs. Investment types could include replacing natural gas in existing thermal electric generating facilities or providing local distributed backup power to critical facilities.

III. CARB should prioritize green hydrogen investment to decarbonize the industrial sector.

Over 70% of the hydrogen consumed today is used as an industrial feedstock.[3] 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.

CARB should invest funds to transition from gray hydrogen feedstock to green hydrogen feedstock for industrial processes to lower California's industrial sector emissions and increase renewable fuel off-taker opportunities.

[3] International Energy Agency, 2019, The Future of Hydrogen.

IV. CARB should prioritize green hydrogen investment to eliminate the open burning of agricultural waste.

As California phases out the open burning of agricultural waste,[4] green hydrogen can be a promising alternative. Agricultural waste can be transformed from a polluting nuisance to a valuable clean energy source to produce green hydrogen. This green hydrogen can then be used as the feedstock for local fertilizer production, transportation, or electricity to power equipment and infrastructure. Surplus energy could also be transferred to the local grid, allowing the agricultural sector to gain passive income from hydrogen production.

CARB should invest funds that enable the agricultural sector to produce green hydrogen from agricultural waste and use it for local onsite and grid needs. This investment could help build energy dependence, reduce fossil fuel use, divert open burning, and support other sustainable agricultural purposes.

V. CARB should prioritize green hydrogen investment to divert waste from landfills.

As California prepares to implement SB 1383 in 2022, a policy that calls for a 75% reduction in organic waste disposal by 2025,[5] the state will need to invest in alternative solutions while thoroughly evaluating and understanding public health, climate, and environmental impacts. One promising solution is to turn landfill waste into valuable, reusable green hydrogen. Turning landfill waste into green hydrogen can foster economic development and tackle California's methane emissions reduction targets.

CARB should invest funds to transform landfill waste into green hydrogen. The green hydrogen can then be sold to transportation fueling stations and other renewable fuel off-takers. For transportation fueling station sales, LCFS credits should be explored, further enhancing the competitiveness of the green hydrogen.

VI. CARB should prioritize green hydrogen investment to create and support high-quality jobs.

The green hydrogen economy supports CARB's workforce development activities and aligns with AB 398, which aims to help industry, workers, and communities transition to economic and labor-market changes related to statewide GHG reduction goals.[6] Growth in the hydrogen economy will lead to a multitude of new employment opportunities. The Fuel Cell and Hydrogen Energy Association, a national industry group, estimates that the hydrogen economy in the U.S. could generate an estimated $140 billion per year in revenue and support 700,000 jobs by 2030.[7] Many of these jobs will take advantage of technical and manufacturing skills to support well-paying careers. Skills utilized in today's fossil fuel

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[4] 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

[5] https://www.calrecycle.ca.gov/organics/slcp

[6] Assembly Bill (AB) 398 (E. Garcia, Chapter 135, Statutes of 2017)

[7] Fuel Cell and Hydrogen Energy Association, Road map to a US Hydrogen Economy.

industry, from upstream, to midstream, to downstream, are transferable to roles supporting the green hydrogen industry.

CARB should invest funds in green hydrogen workforce development. This investment can provide significant opportunities to advance high-quality employment with strong labor market outcomes and improved job quality, providing meaningful economic development benefits for individuals and communities.

Conclusion

GHC thanks CARB for its thoughtful leadership in framing the *Draft Fourth Investment Plan* 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 Cap-and-Trade Program.

Respectfully submitted,

Janice Lin
Founder and President

Nicholas Connell
Policy Director

GREEN HYDROGEN COALITION
regulatory@ghcoalition.org