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GHC Comments following the Friday, October 28, 2022, Workshop on Clean Energy Alternatives for Reliability

Additional submitted attachment is included below.

November 10, 2022

The Honorable Siva Gunda, Vice Chair
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: Comments of the Green Hydrogen Coalition following the Friday, October 28, 2022, Lead Commissioner Workshop on Clean Energy Alternatives for Reliability

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Dear Vice Chair Gunda,

The Green Hydrogen Coalition (GHC)[1] submits these comments in response to the California Energy Commission's (CEC) October 28, 2022, workshop on clean energy alternatives for reliability. The GHC commends the CEC's leadership on this important issue and urges the Commission to move forward quickly and aggressively with additional hydrogen reliability measures that do not increase either air pollution or climate change.

The GHC is a California educational 501(c)(3) non-profit organization. GHC was formed in 2019 to recognize the game-changing potential of "green hydrogen" to accelerate multi-sector decarbonization and combat climate change. GHC's mission is to facilitate policies and practices that advance green hydrogen production and use across all sectors of the economy to accelerate a carbon-free energy future and a just energy transition. Our sponsors include renewable energy users and developers, utilities, and other supporters of a reliable, affordable green hydrogen fuel economy for all.

In the following comments, the GHC urges the CEC to classify green hydrogen as an eligible form of long-duration energy storage and update the list of eligible resources to include green hydrogen-fueled linear generators and turbines. Each of these recommendations is described in detail below.

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

COMMENTS

1. Include Green Hydrogen as a Long Duration Energy Storage Resource

Green hydrogen[2] should be included as an eligible technology in the CEC's Long-duration Energy Storage (LDES) Program. Green hydrogen is an ideal resource for bulk, multi-day, and seasonal energy storage. Hydrogen can be stored in bulk for long periods and used on demand for balancing load on the grid.[3] With increasingly high penetrations of variable renewable energy resources on the electric grid, long-duration and seasonal energy storage will be required to stabilize the load and maintain electric reliability. When 12 hours or more of energy storage is required to provide power, it is significantly more cost-effective to store energy via green hydrogen than other storage options.

In fact, a study by the National Renewable Energy Laboratory (NREL) found that using green hydrogen for energy storage applications of 13 hours or more would make financial sense using today's technology[4] since hydrogen offers separate power (kilowatt) and energy (kWh) scaling. For example, the size of the electrolyzer can be determined independently of the size of the hydrogen storage tank. During a long and cloudy winter, stored energy may have to last for weeks. In such a scenario, only a renewable fuel like hydrogen would provide the appropriate scale at a reasonable cost to maintain grid reliability.

Furthermore, hydrogen is the only molecule that is sufficiently abundant to store the amount of energy that will be required to achieve a global 100% renewable energy system. A recent simulation completed by the University of California, Irvine (UCI) showed that the global solar and wind dynamic production needed to meet total world annual energy demand would require

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[2] Hydrogen that is not produced from fossil fuel feedstock sources and produces near-zero greenhouse gas emissions (e.g., <=0.45 kg CO2e per kg H2) on a well-to-gate lifecycle basis.

[3] Diringer, Elliot et al., (2019), Getting to Zero: A U.S. Climate Agenda, Center for Climate and Energy Solutions, https://www.c2es.org/content/getting-to-zero-a-u-s-climate-agenda/

[4] Penev, Michael et al. (2019), Energy Storage: Days of Service Sensitivity Analysis, National Renewable Energy Laboratory, Presentation. https://www.nrel.gov/docs/fy19osti/73520.pdf

nearly 20,000 terawatt-hours (TWh) of energy storage.[5] Sufficient quantities of metals needed for battery production, such as lithium and cobalt, simply do not exist on the planet to store that much energy, underscoring the need for alternative bulk storage solutions. Therefore, meeting the level of storage needed in California with only batteries is both cost- and technology-prohibitive.

Green hydrogen, when used as a multi-day storage resource, can provide carbon-free grid support during worst-case scenario grid-disconnection events, such as those increasingly occurring because of natural disasters, including wildfires. Green hydrogen can deliver carbon-free grid support either by replacing natural gas in existing thermal electric generating facilities or by providing local distributed backup power to essential buildings, such as hospitals or fire stations. For example, the large salt dome formation in Utah near the Intermountain Power Project (IPP) plant can be used for long-term storage of green hydrogen and provide a strategic renewable energy reliability reserve for the electric system.[6] Moreover, this reserve would also be available as a backup fuel source for transportation, industrial, and other activities.

For these reasons, the GHC urges the CEC to include green hydrogen in the list of eligible long-duration storage technologies and to prioritize its use in the Long-duration Energy Storage Program.

2. ***Update The Preliminary List of Eligible Resources to Reflect Additional Green Hydrogen Generation Applications***

The staff presentation on October 28, 2022, provided a preliminary list of eligible resources and technologies resources.[7] The GHC asks that this list be updated to include green hydrogen-fueled linear generators and turbines due to their ability to provide clean, firm power. Green hydrogen-fueled linear generators are fully dispatchable and fuel-flexible, with the ability to deliver clean, firm power at low cost. Modular and scalable linear generators can be deployed where the demand exists, either at a local level or at utility scale. Fast-ramping with 24/7 load-following capability,

[5] Tirado Creixell, Núria (2018), Resource, Recycling and Waste Challenges for Storage Resources in a 100% Renewable Economy, University of California, Irvine, https://upcommons.upc.edu/handle/2117/171926
[6] See https://www.ipautah.com/ipp-renewed/
[7] CEC Workshop on Reliability, October 28, 2022, staff presentation slide 53, "Preliminary List of Resource Options."

linear generator technology can instantaneously respond to load fluctuations as well as grid outages caused by wildfires, extreme weather events, or other unforeseen disruptions.

Green hydrogen-fueled turbines are also instrumental in providing clean, dispatchable power and bridging anticipated capacity gaps. With current turbine technology capable of providing 450 MW of output per turbine, this technology will be necessary to account for the gigawatt level capacity deficiency while also minimizing the impact on ratepayers. In the absence of high-efficiency turbine technology, the grid will rely on less-efficient and higher-emitting plants to meet the demand requirement at various times of the year. Additionally, the implementation of green hydrogen-fueled turbine technology will prevent the deployment of stranded assets as California moves to a zero-carbon grid. This will not only provide emission reduction benefits but also long-term cost benefits due to the flexible fuel capabilities of the technology.

For these reasons, the GHC asks the CEC to include green hydrogen-fueled linear generators and turbines in its eligible resource list.

CONCLUSION

The GHC appreciates the opportunity to provide these comments and looks forward to collaborating with the CEC and other stakeholders on this effort.

Respectfully submitted,

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