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20-EPIC-01 CHBC Comments on Technology Advancements for Energy Storage

Additional submitted attachment is included below.

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California Energy Commission
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July 30, 2021

RE: Electric Program Investment Charge 2021-2025 Investment Plan Scoping, Technology Advancements for Energy Storage

I. INTRODUCTION

The California Hydrogen Business Council (CHBC)[1] appreciates the invitation to respond to the EPIC workshop on technology advancements for energy storage, and respectfully submits the following comments in response to "Panel 4: Addressing Long Duration Energy Storage Market—Opportunities and Gaps."

The CHBC applauds CEC's work in administering the EPIC program. The EPIC program has been instrumental in funding the research and development of innovative technologies that have helped California significantly reduce greenhouse gas (GHG) emissions. It is imperative the EPIC program continue these efforts by committing to research and development of new and emerging zero and low carbon technologies, such as long duration energy storage (LDES) of renewable energy sources, such as hydrogen, through California's existing and retired infrastructure, such as depleted oil fields, rock formations, and pipelines.

II. DISCUSSION

Hydrogen is a clean burning, diverse energy carrier that can be stored for an insurmountable duration and acts as a firm dispatchable resource for the electric grid when derived from renewable resources like wind and solar.[2] California's renewable energy produced from wind and solar has grown

[1] The CHBC is comprised of over 120 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/

[2] https://www.fchea.org/in-transition/2019/7/22/unlocking-the-potential-of-hydrogen-energy-storage.

exponentially and must continue to grow to support the state's decarbonization goals. However, as wind and solar have grown, California's over-supply of renewable power—which occurs when California's weather is most suitable for wind and solar generation[3]--has also grown. Over-supply results in resource curtailment, which is the intentional reduction of energy that could be produced from these resources.[4] In 2018, the California Independent System Operator (CAISO) reported that approximately 461 GWh of solar and wind energy was curtailed that year.[5] That means 461 GWh of solar and wind energy was lost and Californians relied on fossil fuels to make up for renewable energy that could otherwise have been stored and redeployed when needed. In 2019, CAISO data show a significant increase of over 700 GWh of curtailed solar and wind power and up to as much as 12,000 GWh are expected to be curtailed by 2030. This year, in 2021, the CAISO hit a record of over 300MWh of curtailed renewables in March.[6]

Because of climate change, California is facing an increasing need to deploy more renewable power and gas resources to combat extreme weather conditions and reduce GHG emissions that result from traditional power generation by fossil fuels. There are a host of LDES options that present the potential to store large volumes of renewable hydrogen including depleted oil fields, rock formations, and pipelines. These options are not subject to drought conditions and could potentially store hydrogen in large volumes for long durations. Depleted oil fields, rock formations, and pipelines show tremendous potential for the LDES of hydrogen based on previous studies[7] and projects currently in operation. For example, depleted oil fields are being utilized in Texas as viable options for LDES.[8] And, in England, a pipeline storage project of 400 MW is under construction.[9] California will have an increasing need for reliable LDES of firm dispatchable resources, such as renewable hydrogen, to achieve the state's decarbonization goals and keep the power on at home.

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[3] Denholm, P., O'Connell, M., Brinkman, G., Jorgenson, J. "Overgeneration from Solar Energy in California: A Field Guide to the Duck Chart." (2015). https://www.nrel.gov/docs/fy16osti/65023.pdf.
[4] *Id.*
[5] http://www.caiso.com/informed/Pages/ManagingOversupply.aspx.
[6] California ISO - Managing Oversupply (caiso.com)
[7] 5030aece27ab4701808c08c0b8873e97.pdf (dnvgl.com); Renewables can make hydrogen green | Insight | HSBC Holdings plc.
[8] https://www.power-technology.com/features/featurecould-depleted-oil-wells-be-the-next-step-in-energy-storage-5680002/.
[9] https://ieefa.org/highview-power-says-its-long-duration-energy-storage-pipeline-totals-400mw-4gwh/.

a. Depleted Oil Fields

Depleted oil fields have been used for the storage of natural gas successfully,[10] but as California transitions to the use and storage of clean energy resources like renewable hydrogen, the potential of LDES of renewable hydrogen within depleted oil fields must be studied, and if viable, implemented. Repurposing depleted oil fields that have already been surveyed and evaluated for storage of natural gas will reduce costs and time in determining the viability of hydrogen storage.[11] California has a plethora of oil wells making up the state's oil fields; there are about 70,000 active and 35,000 idle oil wells within the state—all of which continue to contribute to GHG emissions and the emission of carcinogens in the surrounding areas.[12] Tapping into this existing infrastructure for storage of renewable hydrogen (which only emits water) could clean the air of local communities and accelerate the transition to clean energy. As the CEC explores this opportunity, the CHBC recommends the research include the possible impacts of renewable hydrogen storage within existing and depleted oil fields on the local communities' health and air quality, to ensure a decrease in harmful emissions.

b. Rock Formations

Similar to depleted oil fields, rock formations as storage of renewable hydrogen is an emerging technology that has the potential for successful storage but is in need of further evaluation. Salt caverns have been a promising resource for renewable hydrogen storage due to the large storage capacity, low investment cost, high sealing potential, and low cushion gas requirement.[13] Unfortunately, there are no salt caverns within California, and therefore, not an option for renewable hydrogen storage within the state.[14] Rock formations, however, may be a substitute for salt caverns and must be studied to determine viability of the technology. Previously, rock formations were developed for the storage of liquid hydrocarbons and have the potential for storage of renewable hydrogen, so long as sufficient pressure is

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[10] Donadei & Schneider, Compressed Air Energy Storage in Underground Formations: Depleted Oil and Gas Fields, 2016.
[11] ACS Energy Lett. 2021, 6, 2181-2186, "Offshore Geological Storage of Hydrogen: Is This Our Best Option to Achieve Net-Zero?"
[12] https://www.latimes.com/projects/california-oil-well-drilling-idle-cleanup/#:~:text=Do%20you%20live%20within%20600,active%20or%2035%2C000%20idle%20wells%3F.
[13] Caglayan, et al., February 2020, "Technical Potential of Salt Caverns for Hydrogen Storage in Europe."
[14] https://www.eia.gov/dnav/ng/hist/na1393_sca_2a.htm.

applied to prevent leakage of the hydrogen gas.[15] Like depleted oil fields, rock formations already exist and scaling them for renewable hydrogen storage could be cost effective and accelerate the transition to clean energy storage.

c. Pipelines

Another abundant California resource is the state's pipeline gas grid distribution system. Currently, hydrogen is injected and blended into existing natural gas pipelines for the purpose of decarbonizing the gas grid.[16] However, pipelines could also serve as LDES of renewable hydrogen. The amount of renewable hydrogen that can be blended into the existing pipeline system is being studied at 20%.[17] For the pipeline system to be a viable LDES option for California, more studies need to be done to determine a higher hydrogen blend beyond 20%. Because hydrogen has the potential to embrittle the steel and welds used to fabricate natural gas pipelines,[18] the CHBC recommends studying how California can modify the existing natural gas pipeline system to carry a higher blend of renewable hydrogen for storage purposes.

Finally, the CHBC recommends in the evaluation of the viability of the pipeline gas grid distribution system as LDES, the research include all necessary safety measures to keep local communities protected and build trust in the use and storage of renewable hydrogen. CHBC supports research and development of safety and integrity measures through an equity lens that considers low-income and marginalized communities that live near existing pipeline gas grid distribution systems.

I. CONCLUSION

It is imperative California maximize its renewable resources to create a reliable LDES and distribution system with renewable hydrogen. Research and demonstration projects conducted through the EPIC program on the LDES potential of depleted oil fields, rock formations, and pipelines provide a

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[15] Kruck, August 2013, "Overview on all Known Underground Storage Technologies for Hydrogen."
[16] https://www.greentechmedia.com/articles/read/green-hydrogen-in-natural-gas-pipelines-decarbonization-solution-or-pipe-dream.
[17] https://www.fchea.org/in-transition/2021/3/8/hydrogen-blending.
[18] https://www.energy.gov/eere/fuelcells/hydrogen-pipelines.

potential means for maximizing the capture of intermittent wind and solar energy resources and shifting that energy to periods of non-production and other market sectors. The CHBC respectfully recommends the CEC include LDES in the 2021-2025 Investment Plan, specifically, the LDES possibilities for hydrogen in depleted oil fields, rock formations and pipelines.

The CHBC appreciates the opportunity to submit comments on the 2021-2025 Investment Plan Scoping for technology advancements for energy storage and respectfully requests considerations of the aforementioned recommendations. The CHBC encourages the CEC to engage stakeholders throughout the plan scoping and looks forward to assisting the CEC in any way our organization is able.

Respectfully Submitted,

Policy Director
California Hydrogen Business Council