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California Hydrogen Business Council Comments on Workshop on Distributed Energy Resources Research Roadmap

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California Energy Commission
Docket No. 19-MISC-01

I. INTRODUCTION

The California Hydrogen Business Council (CHBC)[1] appreciates this opportunity to share comments on the May 29 California Energy Commission (CEC) workshop and the *Distributed Energy Resources Integration Research Roadmap Draft Final Project Report* (DER Research Roadmap), docketed on May 22, 2020.

CHBC comments are focused on the following points:

1. **We wish to clarify for the record that zero emissions hydrogen fuel cells are commercially available and urge the CEC to add hydrogen fuel cells to the technologies considered for research on microgrids and backup generation, in order to ensure that resiliency does not compromise State clean air and climate goals.**
2. **We strongly support the DER Research Roadmap including green electrolytic hydrogen among priorities identified for energy storage research, focusing on the need to research green electrolytic hydrogen both as a long duration storage resource generally, and also as a long duration storage resource specifically for community response to PSPS events.[2]**
3. **We wish to clarify issues and add data to the record regarding hydrogen fueling and fuel cell safety.**

[1] The CHBC is comprised of over 100 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 dependence on oil. 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. Members of the CHBC can be found here: https://www.californiahydrogen.org/aboutus/chbc-members/

[2] See DER Roadmap Report, p. 9 and A-5

4. **To help address concerns stated in the report about the risks of overhead power lines to reliability of multi-customer microgrids, we urge the state to diversify its research to include use of the underground gas pipeline as a key component of its all-weather resilience strategy, while simultaneously making displacement of fossil natural gas with clean fuels like low and zero carbon hydrogen part of this research effort to ensure climate targets are met.**

These points are elaborated on in the Comments section below.

II. COMMENTS

a. We wish to clarify for the record that zero emissions hydrogen fuel cells are commercially available and urge the CEC to add hydrogen fuel cells to the technologies considered for research on microgrids and backup generation, in order to ensure that resiliency does not compromise State clean air and climate goals.

Whereas the DER Research Roadmap states that "emissions free back-up generators do not appear to be available in the market,"[3] fuel cell systems that emit zero criteria air pollutants, including those fueled by hydrogen, are commercially available and have been deployed for years, for example, by telecommunications companies. According to the National Fuel Cell Research Center, there are more than 5,000 telecommunication and cable locations using fuel cell systems for backup power in North America, hundreds of which are in California.[4] In fact, fuel cells that can run on stored hydrogen that is scalable to the required runtime have been commercially deployed since the early 2000s.

Hydrogen fuel cells paired with electrolyzers are also commercially available for microgrids. The award-winning Stone Edge Farm microgrid, for example, uses solar powered electrolysis for hydrogen production and 26 kW fuel cells and hydrogen storage to provide reliable and long-duration backup power when the grid goes down. This microgrid emits zero criteria air

[3] DER Research Roadmap, p. 2

[4] See map of California Altergy and Plug Power hydrogen fuel cell installations at: http://casfcc.org/Map_Of_CA_Fuel_Cell_Installations_PEM.html

pollutants, toxics or greenhouse gas emissions over its lifecycle, with silent operation and a minimal footprint. During the October 2017 Sonoma wildfires, the site was evacuated, and this microgrid continued to reliably operate for over a week via remote control and monitoring.

We highly encourage fuel cells, including hydrogen fuel cells, to be incorporated into CEC's research on DER technologies for backup generation and microgrids to bring down costs and accelerate widespread adoption. Hydrogen fuel cells present an immediate pathway to eliminate greenhouse gas emissions across the lifecycle of fuel cells, enabling California to advance its carbon and short-lived climate pollutant (SLCP) reduction targets, along with its resilience and clean air goals. Currently, conventional fossil fuel combustion generators are on the rise to cope with Public Safety Power Shutoffs (PSPS) and unplanned outages due to disasters like wildfire,[5] which heighten air quality problems that threaten to be particularly deleterious in the age of COVID-19. By supporting hydrogen fuel cell research and development, California quickly can provide reliable, clean, affordable alternatives that are urgently needed.

b. We strongly support the inclusion of green electrolytic hydrogen among areas identified as a priority for energy storage research, identifying the need to research green electrolytic hydrogen as a long duration storage resource generally, and also as a long duration storage resource specifically for community response to PSPS events.

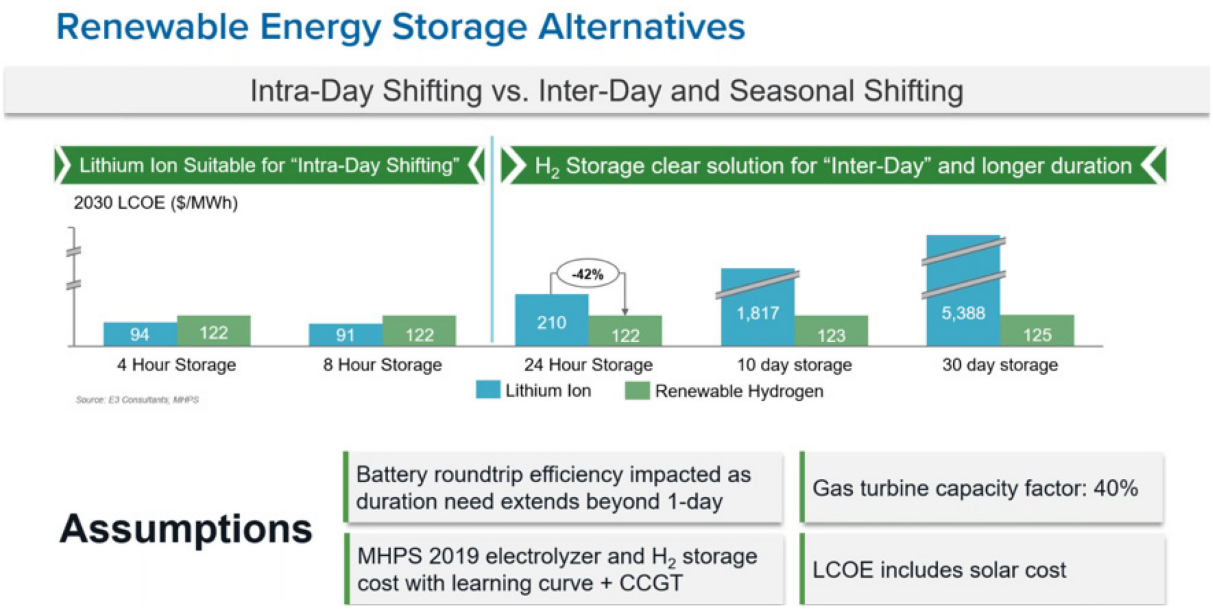
Green electrolytic hydrogen is the most scalable, geographically flexible long duration storage option and more cost effective than lithium ion batteries at longer durations. The CEC has previously acknowledged that "Bulk storage projects, such as pumped hydro and compressed air energy storage, are restricted in terms of project location due to their site-specific nature" and that "best sites for bulk storage projects may not be within […] areas where they are needed."[6] Green electrolytic hydrogen, by contrast, is not subject to drought conditions or as

[5] https://www.nbcnews.com/business/business-news/california-burns-generator-companies-make-power-grab-n1076611
[6] CEC Staff Paper on *Bulk Energy Storage for California:* http://www.energy.ca.gov/2016publications/CEC-200-2016-006/CEC-200-2016-006.pdf; p. 7

many geographical constraints as pumped hydro and compressed air, making it particularly suitable for long duration, seasonal storage.

This is reflected in a report by DNV GL that identifies compressed hydrogen using subsurface storage (salt caverns and depleted hydrocarbon fields) as the most cost-effective solution for seasonal storage in a zero carbon electricity system that relies largely on variable solar and wind.[7] Numerous other researchers encourage hydrogen storage as an important resource in a high renewable generation energy future, such as UCI, which finds that the capacity for hydrogen storage in the current California gas system dwarfs other storage solutions,[8] and a recently released report by the bank HSBC advocates for hydrogen storage to manage curtailment, as variable renewable generation becomes an increasing issue.[9]

Recent analysis by E3 and MHPS likewise shows that hydrogen storage is the clear solution over lithium ion batteries for inter-day and long duration use (see figure below).



[7] *The Promise of Seasonal Storage*, DNV GL, March 2020 https://www.dnvgl.com/publications/the-promise-of-seasonal-storage-168761?utm_campaign=EN_ADV_GLOB_20Q1_PROM_STOR_Seasonal%20Storage%20Report%20Launch&utm_medium=email&utm_source=Eloqua

[8] Slide 15 https://www.californiahydrogen.org/wp-content/uploads/2018/11/20181106-ESNA-CHBC-HES-Workshop_Brouwer.pdf

[9] https://www.gbm.hsbc.com/insights/global-research/renewables-can-make-hydrogen-green

We appreciate the DER Research Roadmap also acknowledging the important role green electrolytic hydrogen can play in providing long duration storage to help ensure communities maintain reliable energy during PSPS events. While distributed solar powered batteries can be well suited to provide resilient power in microgrids or as onsite back up generation for short periods, they will be inadequate and too costly to meet electricity needs during multi-day outages and technically unable to provide reliable power in inclement weather and smoky conditions. Green electrolytic hydrogen, however, can be stored for long periods, ready for use when needed, without discharging like batteries do. It can also be stored underground, safe from weather conditions. When used in fuel cells on a microgrid or onsite backup power system, green electrolytic hydrogen can provide zero criteria emissions power 24/7/365 under all weather conditions. This is discussed further below.

c. We wish to clarify the record regarding hydrogen fueling and fuel cell safety by adding data that address this issue.

The DER Research Roadmap states, "Recent incidents of lithium ion battery fires and fuel cell explosions have prompted concerns from customers and investors about the safety of energy storage systems."[10] However, the document cites as evidence an article on two fires that occurred last year at two hydrogen facilities, not fuel cell systems. The first was a hydrogen production plant in Santa Clara, CA, and the second a hydrogen fueling station in Norway.[11] The CHBC offers the following facts regarding the safety of hydrogen to clarify the record on this important issue:

1. Hydrogen is less flammable or explosive in air than natural gas or gasoline.
2. Hydrogen, along with other fuels, has been safely deployed in California in accordance with well-established installation guidelines. In the event of a leak, hydrogen is non-toxic, nonpoisonous and environmentally benign. It does not create water or air pollution and is not a greenhouse gas.[12]

[10] DER Research Roadmap, A-5
[11] The article cited is here: https://arstechnica.com/science/2019/06/after-june-fires-energy-group-says-hydrogen-is-futures-fuel/
[12] U.S. Department of Energy Fuel Cell Technologies Office, Safety Codes and Standards, March 2017. Available at: https://www.energy.gov/sites/prod/files/2017/03/f34/fcto_h2_safety.pdf

3. Because hydrogen is lighter than air, it dissipates into non-flammable concentrations and rises rapidly, unlike liquid fuels that pool on the ground and remain concentrated and flammable for a long time.
4. Hydrogen fuel cell electric buses and cars operate safely in major cities around the world and in California today. Most stationary power systems use hydrogen that is similarly pressurized to less than 3,000 psi and more often to 2,400 psi, which is the industrial standard for compressed gases. To store more gas in a smaller footprint, higher pressure tanks can be used. These tanks have been tested and certified to meet industry standard.
5. Fuel cells must meet several specific safety codes, such as the following:
    - Building and fire codes are in place for batteries, generators and fuel cell systems on any fuel, including National Fire Protection Association (NFPA) Standard 853 (the "Standard for the installation of stationary fuel cells") which was first published in 2000 and which latest edition was released in 2020.
    - ANSI/CSA America FC 1-2012, Stationary Fuel Cell Power Systems (FC 1) standard.[13]
    - NFPA 52 and NFPA 55 define set back distances for hydrogen.[14]
    - Further comprehensive information on stationary fuel cell codes and standards is both public and readily available.[15]

d. To help address concerns stated in the report about the risks of overhead power lines to reliability of multi-customer microgrids, we urge the state to diversify its research to include use of the underground gas pipeline as a key component of its all-weather resilience strategy, while simultaneously making displacement of fossil natural gas with clean fuels like low and zero carbon hydrogen part of this research effort to ensure climate targets are met.

[13] CSA Group Fuel Cell Power Systems. Available at: https://www.csagroup.org/testing-certification/product-areas/power-generation-energy-storage/fuel-cell-power-systems/
[14] https://afdc.energy.gov/fuels/setbacks_text.html
[15] http://www.fuelcellstandards.com/stationary_apps.html

The DER Research Roadmap rightly cautions that "(t)he same high-risk conditions that would require public safety power shutoff events on the conventional grid (for example, high winds) would also apply to overhead lines in larger multi-customer microgrids. Those projects would only be able to operate and add resilience benefits when high-risk conditions were present around the transmission lines serving the area but not the area itself." To address this concern, we recommend that research include making use of the gas pipeline, which is underground and therefore comparatively less vulnerable to weather events than overhead electricity lines, while displacing fossil natural gas with clean hydrogen to advance state climate goals.

Natural gas already plays an important role during power shut downs by allowing people with gas appliances to continue to cook and use heat, as well as to fuel onsite gas power generators that keep lights, medical equipment, and other critical electricity running. But ongoing or increased use of fossil natural gas is not aligned with California's climate goals. To ensure Californians can access the resilience benefits of existing gas infrastructure, while advancing state greenhouse gas emissions reduction targets, we urge the Energy Commission to support research and development of projects that displace fossil natural gas in the pipeline with cleanly produced hydrogen, such as hydrogen produced with electricity (green electrolytic hydrogen) or organic waste feedstocks, with a view specifically toward better understanding the benefits for disaster resiliency.

Groundwork for such research is already happening in California. UC San Diego's campus microgrid, for example, includes a 2.8 megawatt fuel cell fueled with methane produced by a local wastewater treatment plant and delivered via gas pipeline. If a project like this were to blend the methane with low or zero carbon hydrogen, it would maintain all its resilience benefits, while increasing its climate benefits by reducing the risk of leaking methane – a potent short-lived climate pollutant – proportionally to the percentage of hydrogen injected to displace natural gas.

California is currently in the process of establishing hydrogen pipeline blending limits[16], making such research all the more timely. Research and development in other frontrunner regions on carbon neutrality and clean energy are already looking to take such a step further and envisioning converting all or most of existing pipeline systems to all decarbonized gas, with an emphasis on hydrogen made from zero carbon feedstock (e.g. renewable electricity and gas produced from organic waste). For example, Germany's gas system operators have mapped out transitioning 90% of 5,900 kilometers of existing gas pipeline infrastructure to carry hydrogen and have issued plans for starting with a 1,200 kilometer conversion.[17] A recent report by gas transmission system operators in Europe calls for needing to look into how to accommodate 100% hydrogen in their networks.[18] The UK[19], Australia,[20] New Zealand[21] and Japan[22] are also conducting research and implementing projects aimed at converting gas pipelines to carry up to 100% hydrogen. California would be aligned with this global effort to include converting its massive and valuable gas pipeline network to carry decarbonized hydrogen and potentially other zero carbon gases.

III. CONCLUSION

The CHBC once again thanks the CEC for this opportunity to provide input on the DER Research Roadmap and looks forward to working further with the CEC to better understand the role of hydrogen and hydrogen fuel cells in this important effort.

Best regards,

William Zobel
Executive Director | California Hydrogen Business Council

[16] CPUC R.1302008, Phase 4
[17] https://www.rechargenews.com/transition/german-pipeline-operators-present-plan-for-world-s-largest-hydrogen-grid/2-1-810731
[18] P. 48 https://entsog.eu/sites/default/files/2019-12/ENTSOG%20Roadmap%202050%20for%20Gas%20Grids.pdf
[19] https://www.northerngasnetworks.co.uk/2019/07/04/worlds-first-100-hydrogen-testing-facility-unveiled/; https://www.h21.green/
[20] See *Australia's National Hydrogen Strategy*, Council of Australian Governments Energy Council; 2019 https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf; *South Australia's Hydrogen Action Plan*; 2018 http://www.renewablessa.sa.gov.au/content/uploads/2019/09/south-australias-hydrogen-action-plan-online.pdf; *Hydrogen Communities,* KPMG; 2019; https://arena.gov.au/assets/2019/10/hydrogen-communities.pdf; 100% Hydrogen Test Facility at Canberra https://www.evoenergy.com.au/emerging-technology/hydrogen-test-facility
[21] *Green Hydrogen Strategy – A Vision for Hydrogen in New Zealand*, New Zealand Government; September 2019 https://www.mbie.govt.nz/dmsdocument/6798-a-vision-for-hydrogen-in-new-zealand-green-paper
[22] Basic Hydrogen Strategy, Japanese Ministry of Economy, Trade and Industry; 2017 https://www.meti.go.jp/english/press/2017/pdf/1226_003a.pdf