| DOCKETED | |
|---|---|
| **Docket Number:** | 19-IEPR-10 |
| **Project Title:** | Climate Adaptation |
| **TN #:** | 229928 |
| **Document Title:** | California Hydrogen Business Council Comments - CHBC Comments Joint Agency Workshop on Climate Adaptation |
| **Description:** | N/A |
| **Filer:** | System |
| **Organization:** | California Hydrogen Business Council |
| **Submitter Role:** | Public |
| **Submission Date:** | 10/2/2019 7:23:37 AM |
| **Docketed Date:** | 10/2/2019 |

*Comment Received From: California Hydrogen Business Council*
*Submitted On: 10/2/2019*
*Docket Number: 19-IEPR-10*

## CHBC Comments Joint Agency Workshop on Climate Adaptation

*Additional submitted attachment is included below.*

CALIFORNIA HYDROGEN BUSINESS COUNCIL

*Hydrogen Means Business in California!*

**Main Office**: 18847 Via Sereno Yorba Linda, CA 92886 **DC Office:** 1211 Connecticut Ave NW, Ste 650 Washington, DC 20036

Phone: (310) 455-6095 | Fax: (202) 223-5537
info@californiahydrogen.org | www.californiahydrogen.org



# CHBC Comments Joint Agency Workshop on Climate Adaptation
# Docket Number 19-IEPR-10

October 2, 2019

## I. Introduction

The California Hydrogen Business Council (CHBC)[1] appreciates this opportunity to provide comments on the August 8, 2019 Joint Agency Workshop on Climate Adaptation. 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.

Due to the effects of anthropogenic climate change, California is increasingly grappling with challenges like planned and unplanned electricity grid shutdowns related to wildfires, which requires a diverse set of energy solutions to ensure reliable and resilient energy services. Business as usual is not sufficient. Hydrogen ought to be a prominent part of the strategy to adapt to our changing climate. For example, solutions that ought to be implemented are:

- Fuel cells that supply electricity fueled by renewable gas, such as hydrogen. As the US Department of Energy explains, "*Fuel cells directly convert the chemical energy in hydrogen to electricity, with pure water and potentially useful heat as the only byproducts. Hydrogen-powered fuel cells are not only pollution-free, but also can have more than two times the efficiency of traditional combustion technologies.*"[2] When the hydrogen is made via renewable pathways, such as using gas derived from organic waste or using renewable electricity, hydrogen fuel cells are also greenhouse gas free over their lifecycle. Fuel cells, unlike conventional back up power generators that run on fossil fuels, or battery back-up power, are able to provide zero emissions long duration storage and generation for use in microgrids and onsite back-up power.

[1] 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 are listed here: www.californiahydrogen.org/aboutus/chbc-members/
[2] https://www.energy.gov/sites/prod/files/2015/11/f27/fcto_fuel_cells_fact_sheet.pdf

- Hydrogen produced from electrolyzers with grid electricity or generated by dedicated renewables deployed onsite can be used in campus or community microgrids, able to operate in island-mode, in the case of emergencies that shut down the electricity system.

## II. COMMENTS

### a. Hydrogen solutions can help maintain critical energy services to mitigate the impacts of electricity grid shutdowns that are becoming more frequent and prolonged as the climate changes.

The increased magnitude and frequency of wildfires, due in part to man-made climate change,[3] are leading to both fire-preventive planned power grid shutdowns that can last days, as well as unplanned shutdowns when wildfires occur that can last weeks or longer. Most impacted homes rely on gas appliances and gas back up generation to provide their sole source of building energy.

As Californians plan for and try to cope with power shutdowns, the demand for combustion-based fossil fuel backup generators has furthermore been rising as much as 1400%, which is counterproductive to decarbonization and air quality efforts.

California policymakers must recognize the great extent to which gas provides critical resources for Californians when electricity becomes unavailable, while enabling the transition toward renewable and zero carbon gas, just like California is planning for electricity.

Solar and battery storage, while essential technologies to both mitigating and adapting to climate change, will not be enough, contrary to predominant assumptions. Electricity output from solar panels is significantly reduced during smoky fire conditions, cannot supply sufficient power during a shutdown unless they are not grid-tied, and in worst case, are prone to melting in fires or collapsing when buildings are severely damaged in earthquakes. Battery storage is an excellent solution for short-duration back up supply, but is not technically capable of providing long-duration storage and generation across all weather and circumstances. A multipronged, technology diverse strategy is needed.

Fuel cells are an essential complement to solar and battery technology. They are capable of providing zero emissions long-duration storage and electricity generation onsite or for microgrids, even under extreme conditions. Fuel cells withstood the 2019 Ridgecrest earthquakes, Sonoma fires in 2018 and the 6.0 magnitude Napa earthquake in 2014, and they provided continuous generation to nine microgrids during four storms that buffeted the East Coast from March 2-22, 2018 causing millions to lose power. Fuel cells emit zero criteria pollutants, and when fueled by renewable hydrogen, emit zero greenhouse gas over their lifecycle. This ought to be a high priority in California's climate adaptation strategy.

Renewable hydrogen can be produced from organic waste pathways (biomethane, biogas, pyrolysis of organic material) or electrolysis powered by renewable electricity. Unlike batteries, which discharge over time, hydrogen can be stored for months, making it an ideal fuel to use for emergency situations like power grid shutdowns. Unlike conventional fuels used for emergencies like diesel, natural gas, and propane, hydrogen is also free of greenhouse gas.

[3] https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019EF001210

**b. As California's climate mitigation strategies bring new challenges to which the electricity system must adapt, such as increased variable renewable generation and rising load from electrified transportation and building end uses, hydrogen technologies can help stabilize the grid and provide long duration, large scale storage.**

Further putting pressure on the electricity system as California addresses a changing climate are increased amounts of intermittent renewable generation and increased electrical loads from electrification of vehicles and building end uses. While these solutions are needed to mitigate climate change, they also create new challenges to which California's electricity system must adapt.

Hydrogen produced from electricity can play a critical role in California to support grid resiliency and offer ancillary grid services that address both long-term and short-term energy system needs. Today, renewable hydrogen produced from excess renewable electricity via electrolysis can be used as a dispatchable load-balancing resource that complements intermittent renewable generation and acts as a flexible energy storage medium that is capable of long (greater than 4hrs of discharge) duration, which will be needed with high levels of renewable power generation. Hydrogen can be produced during peak load times and converted back into electricity through a zero emissions fuel cells or gas turbines when solar or wind energy is not available – or used for other beneficial applications, such as zero emissions transportation or industry. In this way, hydrogen supports increased deployment of intermittent, renewable power production assets into microgrids and the utility grid network as a whole, as well as increased electrification of end uses that require flexible sources that can store and dispatch large amounts of electricity.

Hydrogen is an especially promising energy storage solution that is cheaper than battery energy storage when massive amounts of energy or long durations are required (for example for seasonal shifting of renewable energy). This is not to say that different storage technologies are mutually exclusive, as they can be deployed in complementary ways. A 1,000 MW project combining clean hydrogen storage, compressed air, and flow batteries is currently under development in Utah.[4]

Hydrogen produced from renewable sources like organic waste and renewable electricity can be integrated as distributed energy resources across California to help decarbonize the natural gas grid. Blending hydrogen into the existing natural gas infrastructure can help reduce significant upfront capital costs involved in developing new transmission and distribution energy infrastructure.

Hydrogen is being pursued as a renewable integration and climate protection strategy on the federal level in the US and around the world outside. For example:

- **U.S. Department of Energy's H2 @ Scale Initiative**, which is committed to exploring the potential for wide-scale production and utilization of hydrogen in the U.S. to foster grid resiliency, jobs, and other benefits. Demonstrating its continued commitment, the program recently announced $31 million of funding to research and develop electrolytic hydrogen for multiple applications.[5]
- **Both of the former U.S. Department of Energy Secretaries under President Obama are also focusing on renewable hydrogen** as a key component of their continued effort to build a clean energy future. Secretary Chu advocates for storing electrolytic hydrogen produced with renewables underground, in

[4] https://amer.mhps.com/world%E2%80%99s-largest-renewable-energy-storage-project-announced-in-utah.html
[5] https://www.energy.gov/eere/fuelcells/h2scale

order to overcome the limitations of batteries to supply the scale of storage needed in a climate safe future.[6] He also recently forecast that the falling cost of renewable electricity holds promise to make renewable electrolytic hydrogen cost competitive with hydrogen produced with natural gas.[7] Secretary Moniz recently oversaw a report that identified hydrogen as among the handful of "breakthrough technologies" that are "major potential contributors to California's deep decarbonization over the long-term," adding that "(t)he work must pick up the pace today and be sustained to support their development."[8]

- **In North America**, in addition to the aforementioned 1 GW storage project under development in Utah that will include hydrogen storage and hydrogen electricity generation,[9] a 2.5 MW electrolytic hydrogen storage project is also already up and running in Ontario, Canada, procured by national transmission grid operator to help integrate renewables and stabilize the grid.[10]

- **The European Commission** issued an extensive report in November 2018 that found the only ways to achieve deep decarbonization of 90+% greenhouse gas emissions below 1990 levels by 2050 involve aggressively pursuing diversified approaches that focus not only on electrification nor decarbonized gaseous fuels like hydrogen, SNG, or bio-based gas alone, but rather all of the above. Additional strategies include efficiency, a circular economy, and smart technologies. Net carbon neutrality by 2050 and net negativity thereafter would require this same strategy, in addition to additional carbon capture or advanced management of land sinks.[11]

- **In Europe, there are over 30 power-to-gas (hydrogen or methane) projects** that are operational or in development.[12]

- **In the United Kingdom (U.K.),** Keele University is exploring hydrogen blending into its private gas network beginning to reduce carbon emissions from heating buildings.[13] The HyDeploy Project plans to blend up to 20% hydrogen as part of their decarbonization efforts.[14] Leeds, one of the largest cities in the U.K., launched the Leeds H21 City Gate hydrogen project[15] in 2016, targeting the conversion of the existing natural gas supply and distribution system to deliver hydrogen to consumers.

- **France** is pursuing a "hydrogen strategy" to utilize hydrogen across all sectors with a goal of 10% hydrogen penetration in their industrial gas use by 2023 and 20% to 40% by 2028.[16]

---

[6] *Obama Secretary Flat on Battery Plants, The Australian*, February 1, 2018
[7] *Get Ready For 1.5¢ Renewable Electricity, Steven Chu Says, Which Could Unleash Hydrogen Economy,* Jeff McMahon, *Forbes*, April 2, 2019
[8] *Optionality, Flexibility, and Innovation – Pathways for Deep Decarbonization in California*, Energy Futures Initiative (Secretary Ernst Moniz, Founder & CEO); April 2019
[9] https://www.greentechmedia.com/articles/read/utah-aims-to-shatter-records-with-1000-mw-energy-storage-plant#gs.iwx5ic
[10] https://www.hydrogenics.com/2018/07/16/north-americas-first-multi-megawatt-power-to-gas-facility-begins-operations/
[11] *A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy,* European Commission, November 28, 2018 Specifically, the first five scenarios focus on impacts of specific technology pathways, varying in the intensity of application of electrification, hydrogen, electrolytic fuels, end user energy efficiency, as well as the role of a circular economy, as actions to reduce emissions. The study found that while all of these can likely achieve 80% greenhouse gas reductions below 1990 levels, none can achieve deeper decarbonization. To reduce emissions at least 90% below 1990 levels, all five pathways must be aggressively pursued in combination (the sixth pathway). To achieve net carbon neutrality followed by net carbon negativity, however, the seventh and eighth pathways studied add to the combination scenario either negative emissions technology in the form of bioenergy combined with carbon capture and storage, or reliance on a circular economy, change in consumer choices that are less carbon intensive, and strengthening the land use sink to reduce the need for negative emissions technologies.
[12] http://europeanpowertogas.com/projects-in-europe/
[13] https://networks.online/gphsn/news/1000904/trial-explore-blending-hydrogen-gas-network
[14] https://networks.online/gphsn/news/1000904/trial-explore-blending-hydrogen-gas-network
[15] https://www.northerngasnetworks.co.uk/2016/07/12/watch-our-h21-leeds-city-gate-film/
[16] https://fuelcellsworks.com/news/french-minister-unveiled-his-100m-hydrogen-plan/

- **In Germany,** electrolytic hydrogen based gas (power-to-gas) and liquid are cornerstones of deep decarbonization, with national recognition that getting to 90+% greenhouse gas emissions or near carbon neutrality will not be possible without this. The German Energy Agency aims to ensure electrolytic hydrogen is fully commercialized by 2022.[17]

- **In the Netherlands,** a 440 MW combined cycle gas turbine in a 1.32-GW Magnum gas-fired power plant is expected to run on 100% hydrogen using technology provided by Mitsubishi Hitachi by end of 2023.[18]

- **Japan** is aiming to be the world leader in decarbonizing by becoming a hydrogen-based society and is adopting a multi-pronged strategy for realizing this vision.[19] Showcasing this ambition, the 2020 Olympics in Japan aims to run entirely on hydrogen. A report prepared for Japan by the International Energy Agency declares: "*This is a critical year for hydrogen. It is enjoying unprecedented momentum around the world and could finally be set on a path to fulfil its longstanding potential as a clean energy solution. To seize this opportunity, governments and companies need to be taking ambitious and real-world actions now*."[20]

- In **China**, the "father" of China's electric vehicle industry and vice chairman of China's national advisory body for policy making, Wan Gang, who convinced Chinese leaders twenty years ago to adopt battery electric vehicle technology, is now saying the country should be looking into "establishing a hydrogen society" and is seeking to have China similarly become a global leader in developing hydrogen technology.[21]

- The **South Korean** government also reportedly has a US$2.33 billion public-private investment plan to accelerate hydrogen fuel cell infrastructure, manufacturing capabilities and technology development for transportation and stationary applications.[22]

- Hydrogen is also gaining interest in the **Middle East**, with a multi-megawatt solar hydrogen project breaking ground in Dubai,[23] among other projects.

- **In Australia,** hydrogen is being pursued as a strategy in individual states like South Australia, which plans to transition to a renewable hydrogen economy to achieve low emissions across sectors and become a global hydrogen market leader.[24]New South Wales is developing an electrolytic hydrogen storage project that will use existing gas pipelines to store and transport renewable electricity in the form of hydrogen.[25] Hydrogen is also on the national agenda of Australia. The nation's Chief Scientist states that the country's "vision is a future in which hydrogen provides economic benefits to Australia through export revenue and new industries and jobs, supports the transition to low emissions energy across

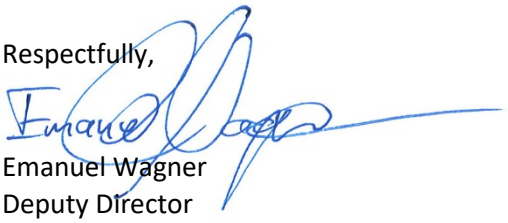
[17] https://www.dena.de/en/topics-projects/projects/energy-systems/power-to-gas-strategy-platform/
[18] https://www.mhps.com/news/20180308.html
[19] https://www.meti.go.jp/english/press/2017/pdf/1226_003a.pdf
[20] P. 1, *The Future of* Hydrogen, *Seizing Today's Opportunities, Executive Summary and Recommendations,* IEA, June 2019 https://webstore.iea.org/download/summary/2803?fileName=English-Future-Hydrogen-ES.pdf
[21] https://www.supplychainbrain.com/articles/29843-chinas-father-of-electric-cars-says-hydrogen-is-the-future
[22] p. 56, *Hydrogen for Australia's Future,* Hydrogen Strategy Group (Chaired by Australia Chief Scientist, Dr. Alan Finkel); August 2018
[23] https://gulfnews.com/uae/first-green-hydrogen-project-breaks-ground-in-dubai-1.1549175502065
[24] http://www.renewablessa.sa.gov.au/content/uploads/2019/09/south-australias-hydrogen-action-plan-online.pdf
[25] https://arena.gov.au/news/hydrogen-to-be-trialled-in-nsw-gas-networks/

electricity, heating, transport and industry, improves energy system resilience and increases consumer choice."[26]

## III. Conclusion

The CHBC appreciates this opportunity to comment on California's Climate Adaptation Strategy and looks forward to working with the Energy Commission to implement hydrogen solutions to ensure a more reliable and resilient energy system in the face of challenging times ahead.

Respectfully,



Emanuel Wagner
Deputy Director
California Hydrogen Business Council

[26] p. i, ibid.