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Green Hydrogen Coalition Comments on the SB 100 Workshop on Non-Energy Benefits, Social Costs and Reliability

Additional submitted attachment is included below.

November 12, 2021

Email to: docket@energy.ca.gov
Docket Number: 19-SB-100
Subject: SB 100 Workshop on Non-Energy Benefits, Social Costs and Reliability

Re: COMMENTS OF THE GREEN HYDROGEN COALITION (GHC) TO THE CALIFORNIA ENERGY COMMISSION ON THE NOVEMBER 1 JOINT AGENCY WORKSHOP ON PLANNING FOR SB 100 ANALYSIS OF NON-ENERGY BENEFITS, SOCIAL COSTS AND RELIABILITY

1. INTRODUCTION

GHC[1] 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 in all sectors of the economy to accelerate a carbon-free energy future. Our sponsors include renewable energy users and developers, utilities, and other supporters of a reliable, affordable green hydrogen fuel economy for all.

GHC defines green hydrogen as hydrogen produced from non-fossil fuel resources and has climate integrity – emits zero or de minimis[2] greenhouse gases on a lifecycle basis. Green hydrogen can be used as a fuel for electricity production and a means for multi-day and seasonal renewable energy storage. In addition, once scaled, green hydrogen can help California move away from fossil fuel use in other applications such as transportation, industrial, maritime, and aviation. Considering that hydrogen is a mainstream commodity that can be utilized in many applications across many sectors of the economy, the production

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

[2] "De minimis" means an insignificant amount of non-renewable energy resources (does not exceed 10 percent of the total energy inputs) allowed to be counted as RPS-eligible. See Green, Lynette, Christina Crume. 2017. Renewables Portfolio Standard Eligibility Guidebook, Ninth Edition. California Energy Commission, Publication Number: CEC-300-2016-006-ED9-CMFREV.

and use of green hydrogen will be essential to decarbonize sectors beyond electricity, further enabling the attainment of our climate goals.

These comments address the "SB 100 Modeling" presentation made by the California Energy Commission (CEC) staff at the November 1 Joint Agency Workshop on Planning for SB 100 Analysis of Non-energy Benefits, Social Costs and Reliability.

2. COMMENTS

The CEC Should Develop A Policy Scenario That Models Green Hydrogen For Multi-Day And Seasonal Bulk Energy Storage And As A Zero-Carbon Alternative To Natural Gas

Historically, grid issues such as load growth, rising peak demand, network congestion, and system reliability have been addressed by building additional natural gas-based thermal electric generation and transmission and distribution (T&D) infrastructure. However, as California continues to decarbonize the grid and reduce its dependence on natural gas, California will need to take an innovative approach to address said grid issues. Simply adding additional renewables and T&D will not address California's reliability needs in the absence of natural gas or an alternative zero-carbon fuel. Not to mention that permitting and building new transmission pathways is a long, risky, and complex process, and such infrastructure is costly to construct. Additionally, as load grows on the grid due to the increasing electrification of industry and the vehicle fleet, it will cost billions of dollars to electrify everything fully.

The only way to ensure California can address said grid issues and keep ratepayer costs comparable to today is to repurpose the existing gas system with a zero-carbon fuel such as green hydrogen. Thermal generation will remain essential to provide reliability, resiliency, and resource adequacy in a future decarbonized California to support weather-dependent intermittent renewable resources and fluctuations in demand. Ultimately, the critical value of thermal generation will be to deliver the capacity backup needed to help ensure reliability during multi-day periods where renewable production is significantly lower than demand. Local, onsite green hydrogen generation produced with renewable electricity can serve as a fuel and long-duration energy storage for thermal generation resources to produce local dispatchable resilient clean electricity. It can also address the opportunity to repurpose existing gas infrastructure while maintaining reliability. Once 100% green hydrogen pipeline transport is possible, these turbines can be converted to 100% hydrogen turbines in the long term.

Even in the absence of 100% green hydrogen pipeline transport, repurposing gas infrastructure with green hydrogen is still feasible today, with major turbine manufacturers such as MHPS, GE, and Wartsila offering high power (800 MW+) hydrogen-ready gas turbines. GE's 9F.03 gas turbines can routinely run on 50% hydrogen and, in some specific cases, have run on up to 70-90% fuel-blend.[3] GE has 70 of these plants installed around the world that currently provide flexible energy. Additionally, MHPS has been developing high efficiency, low NOx combustion systems, which can use up to a 30% hydrogen/70% natural gas fuel mixture, and has announced the capability to use 100% hydrogen in its turbines by 2025.[4]

Equally, blending green hydrogen with natural gas would allow for the use of the existing natural gas pipeline network with minimum infrastructure investment. The presence of up to 15% hydrogen by volume in natural gas pipelines can safely allow for delivery of the gas blend without affecting the integrity of the natural gas pipeline network.[5] The transition to partially decarbonized pipeline gas would enable continued use of the existing natural gas pipeline distribution networks, valuable pre-existing energy infrastructure. Furthermore, much of today's infrastructure, including rights of way, can be repurposed to be dedicated to hydrogen. For example, 69% of the pipelines needed to build a European Hydrogen Backbone could come from repurposing existing natural gas pipelines.[6] Additionally, Hawaii, Canada, Germany, Austria, and other countries are already adding hydrogen to their natural

[3] Noon, Chris. "The Hydrogen Generation: These Gas Turbines Can Run on The Most Abundant Element in the Universe." General Electric, Jan. 2019, www.ge.com/news/reports/hydrogen-generation-gas-turbines-can-run-abundant-element-universe.
[4] https://www.greenhydrogenny.com/wp-content/uploads/2020/09/MHPSA-Hydrogen-Turbine Brochure.pdf
[5] Melaina, M W, et al. National Renewable Energy Laboratory, 2013, Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues
[6] Gas for Climate: A path to 2050, "Extending the European Hydrogen Backbone: A European Hydrogen Infrastructure Vision Covering 21 Countries," p. 11, April 2021, available at: https://gasforclimate2050.eu/wp-content/uploads/2021/06/European-Hydrogen-Backbone_April 2021_V3.pdf.

gas pipelines, significantly reducing greenhouse gas emissions from gas end uses. Using existing natural gas infrastructure offers a low-cost pathway that would promote the transition towards a green hydrogen economy by significantly scaling up hydrogen storage and use in power production.

For these reasons, GHC urges the CEC to develop a policy scenario that models green hydrogen for multi-day and seasonal bulk energy storage and as a zero-carbon alternative to natural gas. GHC notes that this inclusion is fundamental, as it would capture the value of maintaining natural gas infrastructure and some thermal generation assets. GHC recommends the CEC use the following questions to guide the necessary research needed to model this policy scenario:

1. How much thermal peaking capacity is needed to maintain reliability and meet climate and other policy goals?
2. What are the forecasted run times needed for future thermal generation plants?
3. How much green hydrogen storage (pipeline, tank storage, geologic storage, etc.) is needed for thermal power plant fueling and long-duration energy storage needs?
4. What are the estimated emissions reductions switching to green hydrogen based on estimated capacity needs and run times? [7]
5. What is the cost-effectiveness of green hydrogen when considering it as an energy storage resource and a replacement for natural gas? [8]
6. What are the generation and transmission supply cost differences between converting green hydrogen thermal plants and natural gas infrastructure vs. an all solar and wind approach?

[7] See Cochran et al., "LA100: The Los Angeles 100% Renewable Energy Study," National Renewable Energy Laboratory, NREL/TP-6A20-79444, See final report Chapter 10, PP. 66-69, available at: https://www.nrel.gov/docs/fy21osti/79444-10.pdf

[8] Currently, green hydrogen is only being compared to natural gas on a 1:1 basis and not considering the energy storage value attribute.

<u>The CEC Should Reference Recent Studies That Identify The Need For Zero-Carbon Fuels Such As Green Hydrogen For Reliability Needs</u>

Prominent public studies highlight the importance of green hydrogen and a supporting distribution network. The CEC should reference the below studies when developing a green hydrogen policy scenario.

1. *"The Los Angeles 100% Renewable Energy Study" by LADWP and NREL*

   This report expresses the need for "renewably produced and storable fuels" to maintain reliability in the power sector. The study shows that pathways to 100% decarbonization diverge on how to meet the last 10%-20% of energy demand that existing renewable and conventional storage technologies cannot meet. The LA 100 study further identified that the leading solution currently available to maintain a reliable system that can withstand extreme events is to store and use renewable fuels, with green hydrogen and biofuels among the leading alternatives.[9]

2. *"California needs clean firm power, and so does the rest of the world" by Environmental Defense Fund and Clean Air Task Force*

   This study concludes that affordable and reliable decarbonization in California requires "firm clean power" comprised of "carbon-free power sources that can be relied on whenever needed, for as long as they are needed." The study explains that "clean firm technologies [such as green hydrogen] complement renewable energy to ensure reliability while keeping whole system costs low." This study convened a group of energy system experts who used three different optimization models of California's electricity system to quantify the costs of several different future scenarios for new sources of clean, reliable electric power. Groups from Princeton and Stanford Universities ran the

[9] Cochran et al., "LA100: The Los Angeles 100% Renewable Energy Study," National Renewable Energy Laboratory, NREL/TP-6A20-79444, Executive Summary, p. 14, available at: https://maps.nrel.gov/la100/report

first two models; the third was by the consulting firm Energy and Environmental Economics (E3).[10]

3. CONCLUSION

GHC appreciates Commission staff's efforts in Docket Number 19-SB-100 and looks forward to further collaboration on this topic.

Respectfully submitted,

/s/ Nicholas Connell

Nicholas Connell

Policy Director

GREEN HYDROGEN COALITION

[10] Long et al., "Clean Firm Power is the Key to California's Carbon-Free Energy Future," Issues in Science and Technology, March 24, 2021, available at: https://www.edf.org/sites/default/files/documents/SB100%20clean%20firm%20power%20report%20plus%20SI.pdf