CALIFORNIA HYDROGEN BUSINESS COUNCIL

Hydrogen Means Business in California!

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Jared Blumenfeld
Secretary of CalEPA
1001 I St
Sacramento, CA 95814

November 21, 2019

Dear Secretary Blumenfeld:

The California Hydrogen Business Council (CHBC)[1] appreciates this opportunity to comment on the September 24, 2019 workshop hosted by CalEPA on *AB 74 Studies on Vehicle Emissions and Fossil Fuel Demand and Supply.* We strongly support the state's goal of achieving carbon neutrality by 2045 and believe that including hydrogen related issues among the priorities of the two studies is essential. It is also aligned with state and federal policy (See Appendix 1), as well as a growing global consensus that hydrogen is a key enabler of transitioning to carbon neutrality in industrialized societies, both in the transportation sector and economy wide, and that now is the time for policy makers to act (See Appendix 2). We have outlined below key research topics that we urge you to consider within the scope of the AB 74 studies.

For Study 1 (*Identify strategies to significantly reduce emissions from vehicles and to achieve carbon neutrality in that sector*), we urge you pursue the research and development recommendations set forth in UC Irvine's Renewable Hydrogen Roadmap, which was funded by the Energy Commission and undertaken with a transportation sector emphasis.[2] These recommendations are:

[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 are listed here: www.californiahydrogen.org/aboutus/chbc-members/

[2] See pp. 75-76, Project Results Webinar Slides, Jeffrey Reed/UC Irvine https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=17-HYD-01

- Renewable Hydrogen Production Technology and Feedstock Supply
    - As-built and operational data collection and analysis
    - Assessment of the potential role of energy crops for the California renewable fuels sector
    - Potential impact of emerging renewable hydrogen production technologies
    - Potential role of carbon capture, utilization and storage in the renewable hydrogen production sector
    - Organic feedstock allocation based on fuel pathways cost and carbon intensity forecasting
- Demand, Adoption and Impacts Analysis
    - Analysis of global market growth in RH2 to support learning curve analysis
    - Economic adoption modeling for renewable hydrogen solutions
    - Public and key stakeholder perceptions
    - Continuity of Supply and Supply-chain Reliability
    - Air Emissions and other Community Impacts Analysis
- Supply-chain Forecasting and Optimization (Plant Gate to Point of Use)
    - Rigorous design basis and footprint analysis for on-site solutions
    - Down-scaling liquefaction and reformation
    - Mixed gas-liquid supply chain integration and optimization
    - Transition to dedicated pipeline transport for renewable hydrogen
- Renewable Hydrogen Fuel Production and Electric Grid Integration and Joint Optimization ("Sector Coupling")

For Study 2 (*Strategies to decrease demand and supply of fossil fuels, while managing the decline of fossil fuel use in a way that is economically responsible and sustainable*), we recommend agencies additionally include as topic areas the following, most of which are aligned with International Energy Agency recommendations[3] and efforts being undertaken by the European Commission's Fuel Cell and Hydrogen Joint Undertaking.[4]

- Development of appliances that use up to 100% hydrogen[5]
- Research for underground storage and distribution of hydrogen in existing gas infrastructure, as well as depleted oil and gas fields.[6]
- Use of hydrogen and fuel cells for marine and rail applications.[7]

[3] See p. 185, *Future of Hydrogen*, IEA, June 2019 https://www.iea.org/hydrogen2019/
[4] https://www.fch.europa.eu/publications
[5] See pp. 7, 13, 34 of *Hydrogen Roadmap Europe,* published by the European Commission's Fuel Cells and Hydrogen Joint Undertaking, which discuss the EU's vision for 100% hydrogen blending and impacts on appliances. https://fch.europa.eu/sites/default/files/Hydrogen%20Roadmap%20Europe_Report.pdf; See this report by UK's Frazer-Nash consultancy, which states that "Engagement with domestic gas appliance manufacturers has suggested that new appliances could be made to run on 100% hydrogen. By designing with hydrogen in mind from the outset, manufacturers see no reason why they couldn't offer similar performance, lifetime and reliability as current natural gas appliances" https://www.theengineer.co.uk/domestic-hydrogen-appliances/: The HyDeploy project in the UK is examining 100% hydrogen pipeline injection, including appliance impacts – see e.g. https://academic.oup.com/ce/article/3/2/114/5487479
[6] See, e.g. p. 69 of *Future of Hydrogen*, IEA and pp 7,13,19,21-24 in *Hydrogen Roadmap Europe,* published by the European Commission's Fuel Cells and Hydrogen Joint Undertaking (see footnotes above for links).
[7] See, e.g. pp. 138-143 in *Future of Hydrogen,* IEA; pp. 30-31 in *Hydrogen Roadmap Europe,* published by the European Commission's Fuel Cells and Hydrogen Joint Undertaking (see footnotes above for links).

- Creating a cross sectoral roadmap for adopting large scale, sustainable deployment of hydrogen and fuel cells in California, similar to what the European Commission is doing for Europe.
- Research on fuel cells and hydrogen as a green energy solution for California cities.[8]
- Opportunities and potential for hydrogen fuel cells and electrolyzers to improve distribution grid resiliency with decarbonized solutions

Please see further background regarding how advancing hydrogen research aligns with state, federal, and international efforts in Appendices I and II on the following pages.

We thank you for your consideration, welcome any questions, and look forward to working with you to reduce emissions and achieve carbon neutrality in the transportation sector and beyond, as well as to reduce dependence on fossil fuels in the most sustainable ways possible.

Regards,

Emanuel Wagner
Deputy Director
California Hydrogen Business Council

[8] Europe's Fuel Cell and Hydrogen Joint Undertaking summarizes opportunities for regions in this presentation on *Development of Business Cases for Fuel Cells and Hydrogen Applications for Regions and Cities,* Fall 2017; https://www.ctc-n.org/sites/www.ctc-n.org/files/resources/hydrogen_injection_into_the_natural_gas_grid-_development_of_business_cases_for_fuel_cells_and_hydrogen_applications_for_regions_and_cities.pdf

APPENDIX 1: Research and Development to advance hydrogen is aligned with state and federal policy.

Executive Order B-48-18 calls for the expansion of hydrogen fueling stations to enable the state's goal to put 5 million zero emissions vehicles on California roads by 2050.

AB 8 calls for funding of hydrogen fueling infrastructure for transportation.

SB 1505 mandates that a third of hydrogen for transportation fueling in California come from renewable sources, which can be produced from biogas, syngas made from bio-waste, directly with solar energy, or by electrolysis that splits water into hydrogen and oxygen. Currently, the hydrogen industry has surpassed the state's 33% renewable mandate,[9] and the first generation of renewable hydrogen production facilities are under development in the state, including a 100% renewable hydrogen production facility in Moreno Valley, Riverside County, due to come online in 2020 that is funded by the Energy Commission.[10] There are also several other projects bid in the Energy Commission solicitation, along with other projects that have not been publicly announced.

SB 1383[11] requires the Public Utilities Commission, along with other state agencies, "*to consider and, as appropriate, adopt policies and incentives to significantly increase the sustainable production and use of renewable gas."* The CHBC worked closely with the author of SB 1383 to ensure that the law explicitly does not limit the scope of the agencies' consideration to biomethane and biogas when deciding upon solutions to mitigating short lived climate pollutants, but instead to broaden it to "renewable gas," so that renewable hydrogen is included in all relevant deliberations. The Energy Commission's *2017 Integrated Energy Policy Report* reinforces this in its recommendations on implementing SB 1383, explicitly calling for inclusion of hydrogen produced via electrolysis and synthetic methane derived from this process (also often referred to as "power to gas") in the suite of solutions California deploys to mitigate short lived climate pollutants.[12]

SB 1369[13] requires the PUC, State Air Resources Board, and Energy Commission to consider green electrolytic hydrogen an eligible form of energy storage, and to consider other potential uses of green electrolytic hydrogen.

Wildfire prevention and resiliency has become an urgently needed focus in California, which will require decarbonized fuels to provide 24/7 critical energy services under all conditions. Relying on less vulnerable underground gas infrastructure is also prudent, rather than solely on

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[9] As reported by CARB Staff to CHBC and published in *Zero Emission Transportation and Power The Opportunity of Hydrogen Energy*, CHBC, January 2018 https://www.californiahydrogen.org/wp-content/uploads/2018/03/CHBC_Opportunity-of-Hydrogen-and-Fuel-Cells-January-2018.pdf

[10] This project is being developed by Hydrogenics and Stratosfuel with funding from the Energy Commission.

[11] SB 1383 text: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383

[12] See 2017 IEPR pp. 285-286. Note the IEPR uses the term "power to gas," which is hydrogen produced via electrolysis using grid electricity or dedicated renewable generation, or this hydrogen synthesized into methane.

[13] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1369

overhead power lines. The current planned power shut down policy is putting public health at risk, as air quality suffers due to rise in fossil fuel generator use,[14] as hospitals are unable to perform surgeries when relying on generators, and as Medical baseline customers risk losing power to respirators. Solar and battery storage are not enough to replace this need with clean alternatives because they cannot provide zero emissions power 24/7 under all scenarios. Fuel cells are capable of long-duration storage and generation, even under extreme conditions. They can run on hydrogen, and when this hydrogen is produced using renewable electricity, the result is electricity generation that emits zero criteria or greenhouse gas emissions over its lifecycle.

SB 100 will require more than solar, wind, hydro, and batteries to reach its 100% renewable and zero carbon electricity target by 2045.[15] Gas will be needed, and hydrogen is the most viable option to develop decarbonized gas at scale.

US Department of Energy's H2@Scale[16] program explores the potential for wide-scale hydrogen production and utilization in the United States to enable resiliency of the power generation and transmission sectors, while also aligning diverse multibillion-dollar domestic industries, domestic competitiveness, and job creation. The program recently awarded $40 million in R&D funding to 29 projects to advance hydrogen storage and infrastructure technologies and identify innovative concepts for hydrogen production and utilization including grid resiliency.[17]

[14] https://www.sfchronicle.com/business/article/Demand-for-generators-lights-up-as-PG-E-power-14054242.php
[15] See, e.g. See *Optionality, Flexibility & Innovation - Pathways for Deep Decarbonization in California* TN-229819 Submitted 9/23/2019; https://ww2.energy.ca.gov/2019_energypolicy/documents/2019-09-24_workshop/2019-09-24_presentations.php; and *The Role of Electricity in Decarbonizing CA's Energy System* TN-229820 Submitted 9/23/2019. https://ww2.energy.ca.gov/2019_energypolicy/documents/2019-09-24_workshop/2019-09-24_presentations.php
[16] https://www.energy.gov/eere/fuelcells/h2scale
[17] https://www.energy.gov/articles/department-energy-announces-40-million-funding-29-projects-advance-h2scale

APPENDIX 2: Recognition of hydrogen as a necessary component of deep decarbonization and carbon neutrality strategy is rising around the world.

Europe - In addition to several national and regional initiatives focused on advancing hydrogen as part of deep decarbonization efforts, the European Commission recently found that, in fact, the only way to achieve economy-wide 90+% greenhouse gas emissions below 1990 levels by 2050 was to aggressively pursue a diversified approach that includes hydrogen, among other pathways like efficiency, electrification, and land sinks. [18] Germany's federal climate and energy research agency came to a similar conclusion.[19]

Japan laid out its strategy to become a hydrogen-based economy in 2017, [20][21] with deep greenhouse gas emissions as one of its targets, and this year committed to supporting carbon neutral living by 2050, with hydrogen as one of the key enablers of that goal.[22]

Australia[23] and **New Zealand**[24] are pursuing hydrogen to decarbonize their energy systems.

Here in **California**, the Energy Futures Initiative, led by former US Department of Energy Secretary Ernest Moniz, recently identified electrolytic hydrogen as one of eleven breakthrough technologies that stand to be "major potential contributors to California's deep decarbonization over the long-term" and concludes that "work must pick up the pace today and be sustained to support…development."[25] UC Irvine additionally concludes that advancing hydrogen and fuel cell technology is a "scientific imperative," in order to have adequate clean energy storage, essential energy services, and energy to supply the most challenging applications like shipping, aviation, rail, and heavy duty vehicles.[26]

Further research and development is needed to ensure cost effective, clean hydrogen is available in adequate supply, as the need for it increases across sectors throughout the state.

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[18] *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 https://ec.europa.eu/knowledge4policy/publication/depth-analysis-support-com2018-773-clean-planet-all-european-strategic-long-term-vision_en

[19] https://www.umweltbundesamt.de/en/press/pressinformation/a-greenhouse-gas-neutral-germany-is-almost-possible

[20] https://www.meti.go.jp/english/press/2017/pdf/1226_003a.pdf

[21] https://www.ifri.org/en/publications/etudes-de-lifri/japans-hydrogen-strategy-and-its-economic-and-geopolitical-implications

[22] http://sdg.iisd.org/news/japans-long-term-strategy-pledges-emission-reductions-through-virtuous-cycle-of-environment-and-growth/

[23] See, e.g. *Hydrogen for Australia's Future,* Hydrogen Strategy Group (Chaired by Australia Chief Scientist, Dr. Alan Finkel); August 2018 https://www.chiefscientist.gov.au/wp-content/uploads/HydrogenCOAGWhitePaper_WEB.pdf http://www.renewablessa.sa.gov.au/content/uploads/2019/09/south-australias-hydrogen-action-plan-online.pdf

[24] https://www.mbie.govt.nz/dmsdocument/6798-a-vision-for-hydrogen-in-new-zealand-green-paper

[25] p. xi, *Optionality, Flexibility & Innovation - Pathways for Deep Decarbonization in California, Summary for Policymakers,* Energy Futures Initiative, April 2019 https://static1.squarespace.com/static/58ec123cb3db2bd94e057628/t/5d4c4c012023770001582b2f/1565281308104/EFI+CA+Decarbonization+SFPM

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