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SoCalGas Comments on EPIC 4 Investment Plan Scoping Hydrogen Technology

Additional submitted attachment is included below.

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July 15, 2021

Mike Petouhoff, Manager of Energy Systems Research Office
California Energy Commission
Docket No. 20-EPIC-01
1516 Nineth Street
Sacramento, California 95814

Subject: Comments on the July 1, 2021 Public Workshop Electric Program Investment Charge 2021-2025 Investment Plan Scoping - Hydrogen Technology

Dear Mike Petouhoff:

Southern California Gas Company (SoCalGas) appreciates the opportunity to comment on the California Energy Commission's (CEC's) Public Workshop - Electric Program Investment Charge: 2021-2025 (EPIC 4) Investment Plan Scoping Workshop: The Role of Green Hydrogen in a Decarbonized California - A Roadmap and Strategic Plan (Workshop). The substantial role of green hydrogen to achieve decarbonization requirements is pivotal to SoCalGas's system-wide carbon neutrality (ASPIRE 2045) sustainability strategy[1] which aligns with the state's climate policy. SoCalGas, along with all of the relevant stakeholders, have a shared interest in deploying green hydrogen at scale as an indispensable tool for a decarbonized energy system.

The substance of the Workshop was highly informative for the prospective future pathways. One area of further development for getting to scale is the high delivered cost to customers for which the largest component of the cost is the delivery and storage. The major hydrogen investment areas discussed at the workshop (generation, transportation, buildings and industrial) are dependent on costs for delivery and storage. To further deployment of more affordable green hydrogen, we respectfully suggest that a priority should be on funding research for delivery and storage including hydrogen blending. As part of development of the Roadmap and Strategic Plan, it will likewise be beneficial to address policy obstacles, including both regulatory and legislative.

During the Workshop, staff posed questions to each of the three panels, and on which we are providing some additional perspectives for consideration by the CEC.

[1] SoCalGas, "Aspire 2045 Sustainability and Climate Commitment to Net Zero," March 2021. Available at https://www.socalgas.com/sites/default/files/2021-03/SoCalGas_Climate_Commitment.pdf

- In response to questions staff asked of Panel 1, there is compelling factual support that hydrogen sourced from organic sources should be considered renewable when derived from feedstock that is carbon neutral and/or has negative carbon characteristics.
- Regarding questions posed to Panel 2, discussed below are several Grant Funding Opportunities (GFO) related to hydrogen transportation research expressing that both hydrogen fuel-cell electric vehicles (FCEV) and battery electric vehicles (BEV) will be needed to decarbonize the transportation sector; however, adoption of zero emission technologies varies by vehicle weight class and is driven by multiple factors. SoCalGas suggests that FCEVs will play a large role in all types of on-road transportation and there is significant potential for hydrogen as a marine fuel and a sustainable aviation fuel.
- Finally, in response to staff questions for Panel 3, research will help address possible challenges to utilizing green hydrogen in the industrial sector and will help inform a statewide standard for blending hydrogen into existing gas infrastructure for transport to residential or commercial buildings.

Note several our responses reference the Joint Utilities' (SoCalGas, SDG&E, Pacific Gas and Electric, and Southwest Gas Corporation) Application 20-11-004 filed with the California Public Utilities Commission, which includes a specific chapter by SoCalGas and SDG&E on hydrogen blending demonstration projects.[2,3]

Panel 1 – "Should H2 sources from organic sources such as reforming Green CH4 be considered Renewable H2? Is it decarbonized?"

Yes, the California Air Resources Board (CARB) AB 32 Low-Carbon Fuel Standard program demonstrates that renewable gas is not only decarbonized but can also be carbon negative. CARB data released in May 2021, analyzed by NGVAmerica demonstrates the heavy-duty natural gas fleet in 2020 was fueled by renewable gas with an average energy weighted carbon intensity (CI) value of (-) 5.845 grams of carbon dioxide equivalent units per mega joule (gCO_2e/MJ) as compared to plug-in battery electric trucks fueled by grid electricity at a carbon intensity of 82.92 gCO2e/MJ. [4,5]

In Chapter 1 of the Joint Utilities' Application (page 9), the Joint Utilities proposed the following definition for renewable hydrogen, which includes reforming renewable gas:

> *Renewable hydrogen means hydrogen derived from one of the following: 1) Electrolysis of water using renewable electricity. In this context, renewable electricity refers to electricity produced from sources which are eligible renewable energy resources as defined in California*

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[2] *See* SoCalGas Presentation on Hydrogen Blending, 18 March 2021. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=237351.

[3] CPUC A. 20-11-004. Available at https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M351/K622/351622423.PDF.

[4] Laura Sanicola, California's renewable natural gas vehicles turn carbon negative in 2020, *Reuters,* 2 June 2021. Available at https://www.reuters.com/business/autos-transportation/californias-renewable-natural-gas-vehicles-turn-carbon-negative-2020-2021-06-02/.

[5] California Air Resources Board, Low Carbon Fuel Standard: Annual Updates to Lookup Table Pathways, 16 January 2020. Available at https://ww2.arb.ca.gov/sites/default/files/classic//fuels/lcfs/fuelpathways/comments/tier2/elec_update.pdf.

Public Utilities Code sections 399.11- 399.36.6, 2) Steam methane reforming (SMR), autothermal reforming (ATR), or methane pyrolysis of renewable gas (RG), 3) Thermochemical conversion of biomass, including the organic portion of municipal solid waste (MSW).

Panel 1 – "Can Green CH4 be used for grid support generation?"
Yes, green methane (CH4) is the same molecule of one carbon atom bonded to four hydrogen atoms as the methane currently transported and distributed in pipelines to millions of California end users today. Its source is simply not fossil methane, therefore; it will provide the same robust grid support generation.

Panel 2 – "What H2 Transportation Research has CEC done and planned in this area?"
CEC has had several GFOs related to Hydrogen Transportation Research in the last few years, primarily focusing on medium-duty and heavy-duty (to heavy-heavy-duty) drayage trucks, rail, and marine applications. Planned hydrogen research in transportation includes optimizing hydrogen refueling infrastructure and heavy-duty trucking.

Recent GFOs for Hydrogen Transportation Research includes:

1. GFO-20-604 - Hydrogen Fuel Cell Demonstrations in Rail and Marine Applications at Ports (H2RAM)[6] - SoCalGas is providing funding to the 4 awarded projects.
2. GFO-20-606 - Zero-Emission Drayage Truck and Infrastructure Pilot Project[7]
3. GFO-20-601 - Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure[8]

Panel 2 – "What is current status of FCV and BEV adoption?"
Both hydrogen FCEVs and BEVs will be needed to decarbonize the transportation sector; however, adoption of zero emission technologies varies by vehicle weight class and is driven by multiple factors.

Medium- and heavy-duty vehicles make up nearly 21 percent of the transportation greenhouse gas emissions inventory.[9] These trucks are responsible for 70 percent of smog pollution and 80 percent of diesel particulate matter (PM) emissions.[10] Alone, "heavy-duty trucks emit over 22 percent of CO2e from on-road transportation" in the State. [11] Currently, plug-in technologies cannot replace conventional fast-fuel technologies at a one-to-one ratio. In fact, a 2020 study found that 19 diesel

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[6] *See* CEC Webpage for GFO-20-604 - Hydrogen Fuel Cell Demonstrations in Rail and Marine Applications at Ports (H2RAM). Available at https://www.energy.ca.gov/solicitations/2020-07/gfo-20-604-hydrogen-fuel-cell-demonstrations-rail-and-marine-applications.

[7] *See* CEC Webpage for GFO-20-606 - Zero-Emission Drayage Truck and Infrastructure Pilot Project. Available at https://www.energy.ca.gov/solicitations/2020-11/gfo-20-606-zero-emission-drayage-truck-and-infrastructure-pilot-project.

[8] *See* CEC Webpage for GFO-20-601 - Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure. Available at https://www.energy.ca.gov/solicitations/2020-07/gfo-20-601-blueprints-medium-and-heavy-duty-zero-emission-vehicle.

[9] Austin L. Brown, Daniel Sperling, et al., Driving California's Transportation Emissions to Zero, UC Office of the President: University of California Institute of Transportation Studies, April 2021, at 8. Available at https://escholarship.org/uc/item/3np3p2t0.

[10] Ibid., at 201

[11] Ibid.

drayage trucks would have to be replaced by 36 zero emission drayage trucks.[12] This means that deploying one plug-in heavy-duty truck would not even get one full diesel truck off the road and the benefits would not be fully realized.

Hydrogen fuel is an attractive long-term option for medium- and heavy-duty trucks. Hydrogen fuel weighs much less than electric batteries, which could make trucks more efficient as they carry more cargo, refuel faster, and drive longer distances.[13] In fact, Toyota and Hino collaborated to develop a 25-ton fuel cell electric truck for the Japanese market. The companies see hydrogen fuel cell technology as a superior zero emissions alternative to battery power for large commercial vehicles.[14] Likewise, the Department of Energy (DOE) is planning to invest $100 million over the next five years into research for hydrogen powered heavy-duty trucks.[15] The DOE intends for this investment to help jump-start the American hydrogen economy. To support the beneficial private and public investments in hydrogen, we recommend that the CEC provide funding that will help to increase availability of hydrogen fueling stations for medium- and heavy-duty trucks.

Hydrogen fuel cell offers quicker refueling time and longer range between refueling, which is where range anxiety and infrastructure may be challenging to fleets operating class 2b -6 trucks. Heavier weight classes, such as Class 7 and 8, are still in demonstration phases and there are no commercially available options. Further, for these weight classes, there are no standardized charging equipment specifications and no public charging network available.

Panel 2 – "As the transportation sector decarbonizes, what volume and type of vehicles will likely be based on H2 fuel cell technology?"

We anticipate that FCEVs will play a large role in all types of on road transportation. For passenger cars, FCEVs can be the long-range option and option for drivers form multi-family housing that do not have access to residential charging. For trucks, FCEVs can play a significant role because, inherently, they do not have the same weight, range, and downtime limitations that plug-in electric technologies have.

Panel 2 – "Though it may be outside the role of EPIC-is there likely a role for hydrogen in ship and air travel-would it likely be in the form of NH_3?"

Hydrogen for aviation and Ammonia for maritime shipping are very important topics for future research to decarbonize these transportation sectors, and there is significant potential for hydrogen as a marine fuel and a sustainable aviation fuel. Several companies are looking closely as hydrogen

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[12] Genevieve Giulliano, Maged Dessouky, et al., Developing Markets for ZEVs in Short Haul Goods Movement, UC Davis: National Center for Sustainable Transportation, 2020. Available at https://escholarship.org/uc/item/0nw4q530.

[13] John Fialka, Hydrogen fuel weighs less than electric batteries, making it an attractive option for long-haul vehicles, Scientific American: E&E News, 6 November 2020. Available at https://www.scientificamerican.com/article/energy-department-looks-to-boost-hydrogen-fuel-for-big-trucks/.

[14] Paul O'Donnell, Toyota expects to roll out a fuel cell electric big rig early next year in North America, The Dallas Morning News, 5 October 2020. Available at https://www.dallasnews.com/business/localcompanies/2020/10/05/toyota-expects-to-roll-out-a-pilot-fuel-cell-electric-big-rig-early-next-year-in-north-america/.

[15] Department of Energy, DOE Announces $162 Million to Decarbonize Cars and Trucks, 15 April 2021. Available at https://www.energy.gov/articles/doe-announces-162-million-decarbonize-cars-and-trucks.

in both applications. Bloom Energy has entered a partnership with Samsung Heavy Industries[16] to develop fuel cell powered ocean vessels with a target to present the design to potential customers in 2022. Additionally, Airbus, one of the largest aircraft manufacturers in the world, has announced its intent to develop the world's first zero-emission commercial aircraft by 2035.[17]

Major international companies are investing in hydrogen for these applications. Ammonia can be used as a carrier of hydrogen or as a product. It can potentially be used to transport hydrogen, but ammonia is not likely be used directly within these sectors. SoCalGas is contributing funding and partnering with the CEC on four projects awarded by the CEC under GFO-20-604 - Hydrogen Fuel Cell Demonstrations in Rail and Marine Applications at Ports. SoCalGas RD&D Clean Transportation is interested to work with the CEC to further research and to gain knowledge in these areas.

Panel 3 – "What technical or economic challenges are there to utilizing green hydrogen in this [industrial] sub-sector and how could research help address these challenges?"

The European Commission's study (2018) on its "strategic long-term vision for a prosperous, modern and competitive climate neutral economy" evaluates the importance of hydrogen in the industrial sector. [18] The study points out that steel, cement, and chemical processing dominate most of the industrial emissions in the European Union and states that "in the next 10 to 15 years, technologies that are already known will need to demonstrate that they can work at scale, and some of them are indeed already being tested at small scale, e.g., hydrogen-based primary steel production."

Many industrial-related emissions (from processing) can be challenging to eliminate. Some choices to mitigate those emissions exists such as carbon capture and utilization.[19] Carbon dioxide can be efficiently captured, stored, and used as end use materials for diverse applications. Instead of carbon intensive fuels used for industrial processing, both renewable hydrogen and sustainable biomass can be potential feedstocks for several industrial processes, including chemicals, food processing, and steel production.

Additionally, Chapter 4 of the Joint Utilities' Application (page 21) states that feedstock customers (e.g., fertilizer plants, petrochemical facilities, metal forming and working, heat treating, aerospace, defense, fuel cells, etc.) may be impacted by the addition of hydrogen to their natural gas supply (their processes, product quality, emissions). Research would help determine the need and cost for hydrogen analyzers, equipment modifications, and manufacturing method changes, and to determine a hydrogen blend limit for industrial customers and support the use of hydrogen.

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[16] Erica Osian, Samsung Heavy Industries and Bloom Energy Advance Plans for Clean Power Ships with Joint Development Agreement, *Bloomenergy,* 29 June 2020. Available at https://www.bloomenergy.com/news/samsung-heavy-industries-and-bloom-energy-advance-plans-for-clean-power-ships-with-joint-development-agreement/.

[17] *See* AIRBUS Webpage on ZEROe. Available at https://www.airbus.com/innovation/zero-emission/hydrogen/zeroe.html.

[18] European Commission. *Communication from the Commission to the European Parliament, the European Council, The Council, The European Economic and Social Committee, the Committee of the Regions and the European Investment Bank.* November 2018. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN, pg.13

[19] Carbon Capture and Utilization is a process where CO_2 can be captured and then converted into a new product like carbon black, graphite, carbon nanotubes etc.

Panel 3 – "Are there any infrastructure challenges to transport green hydrogen to residential or commercial buildings?"

Chapter 4 of the Joint Utilities' Application also describes possible safety, system integrity, and system reliability knowledge gaps (e.g., hydrogen embrittlement, measurement and regulation, welding, etc.) that should be addressed to enable the safe transport of hydrogen in existing natural gas infrastructure. Research will inform the development of a statewide standard to inject hydrogen into existing natural gas infrastructure for delivery and storage. This will not only provide resiliency for the electric system, but it also will help decarbonize the pipelines, consistent with the State's policy to decarbonize the electric grid.

In closing, we commend the CEC Energy Generation Research Office for its leadership on hydrogen innovation. SoCalGas believes that in the first instance, the best use of EPIC hydrogen research funding would be for transportation and for hydrogen injection into the pipeline system to provide resiliency for the electric system. We look forward to continuing to provide feedback on development of successful research and policies grounded in comprehensive analysis of programs and/or solutions required to achieve the State's long-term climate goals.

Respectfully,

/s/ Kevin Barker

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