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Ms. Rajinder Sahota
Deputy Executive Officer, Climate Change & Research
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Submitted electronically

Subject: SDG&E Comments on the February 25, 2025 Workshop on the SB 1075 Report

Dear Deputy Executive Officer Sahota:

San Diego Gas & Electric (SDG&E) appreciates the opportunity to comment on the California Air Resources Board's (CARB) February 25, 2025 Senate Bill (SB) 1075 Report Workshop. The preliminary analysis provided by CARB and Energy and Environmental Economics (E3) shows that hydrogen will be produced, transported, and used in multiple ways across the industrial, transportation, and electric generation sectors, which makes hydrogen a crucial component of achieving California's decarbonization goals.

SDG&E values CARB and E3's efforts to solicit public feedback in developing the final SB 1075 analysis and report.

Key points for consideration are:

- The SB 1075 analysis surveyed a diverse set of hydrogen production pathways. California should continue to consider a diverse, technology-neutral set of low-carbon hydrogen production pathways to ensure the state's hydrogen production is low-carbon, robust, accessible, and cost-effective.
- Dedicated hydrogen pipelines will play an important role in connecting areas of scaled hydrogen production with areas of large hydrogen demand, such as Los Angeles and the Bay Area.
- Blending hydrogen into existing natural gas pipeline infrastructure is another important way to decarbonize energy delivery in the state. The Hydrogen Blending Amended Application (A.22-009-006) before the California Public Utilities Commission (Commission) must move forward to understand the feasibility of hydrogen blending in real-world conditions and inform a hydrogen injection and blending standard.
- Collocated, distributed hydrogen production at the point of end use could be a particularly cost-effective hydrogen production and distribution strategy for areas of the state with smaller commercial and industrial gas needs.

Feedback on Production Analysis

SDG&E is pleased that the production analysis covers a diverse set of hydrogen production pathways, including methane pyrolysis and gasification technologies. A broad assessment of the hydrogen production landscape is prudent, and a technology-neutral, carbon-intensity-based approach will provide the greatest benefits to Californians by ensuring the state's hydrogen production is low-carbon, robust, accessible, and cost-effective.

It was notable that the analysis found electrolysis may be more carbon-intensive and resource-intensive than other production pathways. In terms of carbon intensity, the findings on the Life Cycle Assessments (LCA) of Hydrogen Production Pathways on page 14 showed that hydrogen produced via grid electrolysis with the average grid electricity is not only currently carbon intensive, but will continue to be so through 2045, even as the grid has more renewable content.[1] Interestingly, biomass gasification and pyrolysis of various gas feedstocks have lower carbon intensities today than grid-connected electrolytic hydrogen will in 2045.[2]

In terms of resource intensity, the report highlights that extensive land and water will be needed to produce all necessary hydrogen in California via electrolysis paired with solar energy. Land and water resources are precious, limited, and expensive in California compared to other markets. For these reasons, California policy should consider a technology-neutral approach and enable multiple low-carbon hydrogen production options.

The Table *Levelized Cost of Producing Hydrogen in 2045* on p. 16 uses cost assumptions for electrolysis that are acknowledged as optimistic for the state, presumably relying on off-grid solar. It would be informative to include the levelized cost of hydrogen with grid-connected electrolysis in California using projected average grid retail rates.

Feedback on Transmission and Distribution

SDG&E appreciates the discussion of hydrogen transmission and distribution and agrees that minimizing distances between supply and demand can reduce cost. Collocated, distributed hydrogen production at the point of end use could be a particularly cost-effective strategy for parts of the state with smaller commercial and industrial footprints (i.e., outside of Los Angeles and Bay Area demand hubs). For those areas such as LA and the Bay Area, where there is very concentrated demand and industrial activity, dedicated hydrogen pipelines will play a critical role connecting production centers to use centers.

Feedback on End-Use Analysis

SDG&E is pleased that the analysis acknowledges the potential of blending hydrogen into the natural gas system as an end-use for hydrogen, which can help reduce greenhouse gas emissions while also significantly encouraging market demand. By utilizing the existing natural gas infrastructure to blend hydrogen, we can flow low-carbon fuels across the state and reduce hydrogen transportation costs.

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[1] Analysis of Hydrogen in California for Senate Bill 1075 Report, E3 presentation, February 25, 2025, p. 14, available at: https://ww2.arb.ca.gov/sites/default/files/2025-02/sb-1075-workshop-022525-presentation-e3.pdf.
[2] Ibid.

CARB's 2022 Scoping Plan calls for 20% hydrogen blending by volume starting in 2030 to meet California's greenhouse gas reduction goals.[3] However, that cannot be achieved without action from the Commission. The Hydrogen Blending Amended Application (A.22-09-006) before the Commission is a critical proceeding that will inform the state on decarbonizing the gas system with hydrogen, but it has faced a delay.[4] This amended application was submitted over one year ago, on March 1, 2024, and a Scoping Memo has not been issued. The five projects in the application seek to advance the creation of a statewide hydrogen injection standard and are a critical step toward achieving our ambitious climate commitments. SDG&E is requesting a speedy approval and implementation of hydrogen blending projects as proposed; additional support from other agencies would be welcome. The CARB 2022 Scoping Plan adopted in its reference scenario renewable hydrogen blended in fossil gas pipeline at 7% energy (~20% by volume), ramping up between 2030 and 2040.[5] At a 20% hydrogen blend by volume, hydrogen's typical carbon dioxide (CO_2) reduction potential is 6.3%. Given the scale of the gas system today, a 6.3% CO_2 reduction would be significant- the equivalent to removing ~1.5 million gasoline-powered passenger vehicles from the road.[6]

Additional Feedback

SDG&E provides the following answers to the questions posed by CARB and E3 at the workshop:

CARB Questions

- *Please provide information on promising end uses for hydrogen that contribute to California's climate goals beyond those identified in the Scoping Plan.*

SDG&E supports further analysis of hydrogen demand for power generation. Clean dispatchable fuels, like clean hydrogen, enhance the reliability of a carbon-free electric supply and complement increasing electrification of vehicles and appliances. Hydrogen can support the electric system at times of low renewable production and high demand, making it crucial for both power generation and long-duration energy storage. While CARB's 2022 Scoping Plan includes approximately 9 gigawatts (GW) of hydrogen power generation capacity, various resource

[3] California Air Resources Board, 2022 Scoping Plan for Achieving Carbon Neutrality, https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp.pdf,

[4] A.22-09-006, Joint Amended Application of Southern California Gas Company, San Diego Gas & Electric, Company, Pacifica Gas & electric Company, and Southwest Gas Corporate to Establish Hydrogen Blending Demonstration Projects; https://www.socalgas.com/sites/default/files/2024-03/A.22-09-006JointAmendedApplicationforH2BlendingDemonstrationProjects.pdf

[5] CARB's 2022 Scoping Plan for Achieving Carbon Neutrality (Nov. 16, 2022), available at https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp_1.pdf.

[6] U.S. Energy Information Administration, Natural Gas Delivered to Consumers in California, *available at:* https://www.eia.gov/dnav/ng/hist/n3060ca2m.htm; U.S. Environmental Protection Agency, Greenhouse Gas Emissions from a Typical Passenger Vehicle, available at: https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle; California Department of Motor Vehicles, Estimated Vehicles Registered by County for the Period of January 1 through December 31, 2020, available at: https://www.dmv.ca.gov/portal/uploads/2021/02/estimated_fee_paid_by_county_report.pdf; Calculation: (2,019 BCF of natural gas consumed in CA 2020)*(0.0552 kg CO2/CF) produces 112.16 MMT CO2/year from natural gas system. If 20% of the natural gas by volume had been replaced by hydrogen: 6.3%*111MMT CO2 = 7.0 MMT of CO2 emissions could have been avoided. In passenger vehicle equivalency, (7.0 MMT of CO2*10^6)/4.5 MT CO2/car/year (per EPA average) = 1,524,280 cars removed from the road. As there were 25,507,660 registered cars in California in 2020, this is equivalent to removing 6% of all cars from the road in California.

planning scenarios suggest many potential volumes of demand.[7] The California Energy Commission (CEC) states in the 2023 Integrated Energy Policy Report (IEPR) that 2045 hydrogen demand for the electric power sector may range from 350,000 to nearly 1.9 million metric tons based on a University of California, Irvine report and analysis of the 2022 Scoping Plan, respectively.[8] SDG&E's Path to Net Zero: A Decarbonization Roadmap for California found a need for up to 20 GW of hydrogen-based power generation in California and large volumes of hydrogen for transportation and blending with natural gas.[9]

In 2023, SDG&E installed a renewable hydrogen pilot project at its 588 MW combined cycle natural gas plant in Escondido, CA, known as Palomar Energy Center. The project includes an onsite electrolyzer and solar panels that produce hydrogen for use as a cooling gas in the combined cycle process, for blending in the turbine with natural gas for electric generation and fueling the first hydrogen fuel cell vehicles in the SDG&E fleet.[10] This essential pilot demonstrates multiple uses of hydrogen to support decarbonizing natural gas-powered plant operations. The goal was to start with a small, prudent pilot to understand hydrogen's behavior and impact on turbines, the impact on various emissions, how to design, operate, and maintain hydrogen equipment, and how to reduce the unit cost of hydrogen. The volumetric blending ratio of hydrogen to natural gas at this facility is currently relatively low at up to two percent and can increase and scale over time.

- *How do you expect the hydrogen supply and end use demand to change over the next decade?*

Hydrogen market demand and supply need to increase over the next decade for California to meet its ambitious decarbonization goals by 2045. However, hydrogen producers and offtakers need clear market signals and support from regulators and lawmakers for these investments. Given recent changes in federal leadership, the market, particularly for zero-emission heavy and medium-duty vehicles, is struggling. State leadership and commitment are more important than ever. In order for the industry to grow and deliver clean energy, California must commit to supporting fleet vehicle decarbonization, approving the hydrogen blending projects at the CPUC to understand safe hydrogen blending and injection standards, support and fund hydrogen for power generation, and supporting the California Hydrogen Hub "ARCHES" with state match funds.

- *The SB 1075 Technology and State - level Assessments will evaluate environmental impacts including water consumption, land use, air quality, and safety associated with hydrogen production, distribution, storage, and end use. Can you suggest any specific metrics or analysis to consider when comparing impacts?*

The analysis should further compare the resource requirements of various production and hydrogen delivery pathways. The cost, energy intensity, and method of transporting hydrogen matters. In addition to a well-to-gate emission analysis, the study could also consider "well-to-wheel" or "well to X" analysis and incorporate energy requirements and emissions related to

[7] CARB's 2022 Scoping Plan for Achieving Carbon Neutrality (Nov. 16, 2022) at 78, available at https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp_1.pdf.
[8] Adopted 2023 Integrated Energy Policy Report with Errata, CEC, February 14, 2024, available at: https://efiling.energy.ca.gov/GetDocument.aspx?tn=254463, p 78-80.
[9] San Diego Gas & Electric. "Path to Net Zero: A Decarbonization Roadmap for California." April 2022. Available at https://www.sdge.com/netzero
[10] San Diego Gas & Electric. "Hydrogen Innovation." Available at https://www.sdge.com/more-information/environment/sustainability-approach/hydrogen-innovation.

hydrogen delivery to the end-user. For example, liquefaction of hydrogen, which enables hydrogen transport via truck, adds significant cost and energy demand compared to gaseous hydrogen delivery. NREL estimates the cost of liquefaction to add $3/kg.[11] See the National Renewable Energy Laboratory's (NREL) 2024 analysis on "Levelized Cost of Dispensed Hydrogen for Heavy-Duty Vehicles" and its 2013 analysis on Hydrogen Pathways, "Updated Cost, Well-to-Wheels Energy Use, and Emissions for the Current Technology Status of Ten Hydrogen Production, Delivery, and Distribution Scenarios."[12] Distributed production pathways that are co-located with end-use would avoid the need for trucking and therefore liquefaction, reducing the cost and potential greenhouse gas emissions of hydrogen delivery. Similarly, pipeline transportation avoids the liquefaction energy burden.

- *What methods for measuring and/or mitigating potential hydrogen leakage from production, distribution, storage, and end use should this report consider?*

The SB 1075 final report should consider the findings of the recently published *Hydrogen Blending Compendium Report* (Compendium Report) filed with the CPUC on February 14, 2025 as part of Rulemaking 13-02-008. The Compendium Report was developed by SDG&E, Southern California Gas Company, Pacific Gas and Electric Company, and Southwest Gas Corporation (collectively, the Joint Utilities), in cooperation with the University of California, Riverside. It is a comprehensive review of recent technical literature and regulatory proceedings related to hydrogen blending with natural gas. The Compendium Report evaluates many aspects of hydrogen and hydrogen blends in natural gas pipeline infrastructure. Specifically, Chapter 6 reviews the latest scientific literature on hydrogen leak detection, monitoring, and control. Recent research suggests that computational pipeline monitoring systems, existing maintenance and operation procedures, odorant, and standard repair methods can be utilized in traditional natural gas pipeline infrastructure with hydrogen blends up to 20% by volume.[13]

The hydrogen blending demonstration projects proposed by the Joint Utilities through A.22-09-006 would further this field of research by measuring and reporting on leakage from hydrogen blends in pipelines representative of the California pipeline system. The Executive Summary of the literature review within the Compendium Report, prepared by UCR, states, "there is a need for demonstration projects that can simulate the conditions and environments of California's natural gas infrastructure as knowledge gaps exist, especially under the real-world environments that systems operate under."[14]

E3 Questions

- *Are there additional infrastructure needs or impacts that should be considered in the Analysis? If so, please describe.*

See response to CARB Question 3 above.

[11] Bracci., J, Koleva, M, and Chung, M. NREL. "Levelized Cost of Dispensed Hydrogen for Heavy-Duty Vehicles." March 2024.
[12] T. Ramsden, M. Ruth, V. Diakov M. Laffen, T.A. Timbario. NREL. "Hydrogen Pathways Updated Cost, Well-to-Wheels Energy Use, and Emissions for the Current Technology Status of Ten Hydrogen Production, Delivery, and Distribution Scenarios." March 2013. Available at https://www.nrel.gov/docs/fy14osti/60528.pdf.
[13] Notice of Filing of Joint Utilities' Hydrogen Blending Compendium Report, Joint Utilities, February 14, 2025, available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M556/K896/556896659.PDF.
[14] Notice of Filing of Joint Utilities' Hydrogen Blending Compendium Report, Joint Utilities, February 14, 2025, available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M556/K896/556896659.PDF. P 59.

- *Is there any additional evidence or recent analysis that you would recommend for consideration in preparing this Analysis (e.g., recent white papers, public reports, data sources, policy recommendations developed for a different region, etc.)?*

The hydrogen landscape continues to move quickly and is driven by many countries, including Germany, Canada, South Korea, Japan, the Netherlands, the UK, Australia, and others. Recently, a German-based infrastructure operator has begun filling the initial segment of its German pipeline network with hydrogen, marking a key step in its project to repurpose approximately 400 kilometers (249 miles) of existing infrastructure by 2025. The Flow project, a 1,630-kilometer (1,013-mile) pipeline slated for inclusion in Germany's hydrogen core network, involves converting a 4.6 foot diameter former natural gas pipeline for hydrogen transport.[15] Upon full operation, the pipeline is expected to have a capacity of up to 20 gigawatts, enabling the transport of hydrogen produced offshore and onshore in northern Germany to southern Germany.

In the United States, utilities such as Puget Sound Energy[16], Northwest Natural[17], and Peoples Gas[18] are beginning to evaluate and adopt distributed methane pyrolysis to remove carbon from natural gas at the point of use for commercial and industrial operations. This hydrogen production process also generates a solid carbon byproduct that can be sold as a feedstock to other industries and enables permanent carbon sequestration, delivering "pre-combustion" solid carbon removal. As more users adopt this technology, its viability will be better understood.

Conclusion

SDG&E appreciates the invitation to engage in the development of the SB 1075 report and supports the CARB's continued focus on stakeholder engagement, which contributes to robust policy discussions and analyses. Thank you for your consideration of our comments.

Respectfully,

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/s/ Megan Silva
Megan Silva
Regulatory Affairs Manager

[15] "Gascade Begins Filling First Section of Repurposed Hydrogen Pipeline Network in German." Pipeline Technology Journal. March 13, 2025. Available at: https://pipeline-journal.net/news/gascade-begins-filling-first-section-repurposed-hydrogen-pipeline-network-germany

[16] Puget Sound Energy. "Puget Sound Energy and Modern Hydrogen forge decarbonization path with innovative hydrogen technology." January 29, 2025. Available at https://www.pse.com/en/press-release/details/PSE-and-Modern-Hydrogen-forge-decarbonization-path-with-hydrogen-technology

[17] NW Natural Holdings. "NW Natural and Modern Hydrogen Unveil Clean Hydrogen Production, Carbon Capture Project in Portland." May 16, 2024. Available at https://ir.nwnaturalholdings.com/news/news-details/2024/NW-Natural-and-Modern-Hydrogen-Unveil-Clean-Hydrogen-Production-Carbon-Capture-Project-in-Portland/default.aspx.

[18] Peoples Gas. "Peoples Natural Gas, H Quest, and University of Pittsburgh Team." June 10, 2024. Available at https://www.peoples-gas.com/news/archive/2024/06/Produce_Test_Hydrogen_Energy.php