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## SoCalGas Comments on the IEPR Commissioner Workshop on Hydrogen to Support Californiaâ€™s Clean Energy Transition

*Additional submitted attachment is included below.*

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August 11, 2021

The Honorable J. Andrew McAllister
California Energy Commission
Docket Unit, MS-4
Docket No. 21-IEPR-06
1516 Ninth Street
Sacramento, CA 95814-5512

**Subject: Comments on the IEPR Commissioner Workshop on Hydrogen to Support California's Clean Energy Transition**

Dear Commissioner McAllister:

Southern California Gas Company (SoCalGas) appreciates the opportunity to provide comments on the California Energy Commission (CEC) 2021 Integrated Energy Policy Report (2021 IEPR) Workshop held on July 28, 2021, to examine the important role that hydrogen can play to support California's clean energy transition. SoCalGas commends and supports the CEC's work in exploring how hydrogen as well as hydrogen blending can be crucial tools in enabling California's ambitious decarbonization goals. We also acknowledge and appreciate the CEC's efforts to gather the input of a diverse set of viewpoints from national and international researchers, businesses, and government organizations. Such an approach contributes to the quality and breadth of the CEC's resulting policymaking s and SoCalGas continues to look forward to collaborating with stakeholders in these efforts.

A foundational point in the consideration on the potential future role of hydrogen is captured in the California Governor's 2021 report on California's Electricity System of the Future, which asserts, "[t]he technology exists today to achieve California's clean energy goals, but we need to build new resources at an unprecedented pace and scale, and we need to start now."[1] We strongly agree with the Governor's statement. SoCalGas submits that one such primary technology is hydrogen and its potential to offer increasingly important capabilities in supporting a reliable and increasingly decarbonized energy system. Similarly, the gas system infrastructure has the potential to facilitate the integration of hydrogen molecules as a resource in California's energy infrastructure. To that end, SoCalGas offers the following viewpoint on key aspects of hydrogen policy and infrastructure planning for the consideration of the CEC, California Public Utilities Commission (CPUC), and California Natural Resources Agency (CNRA).

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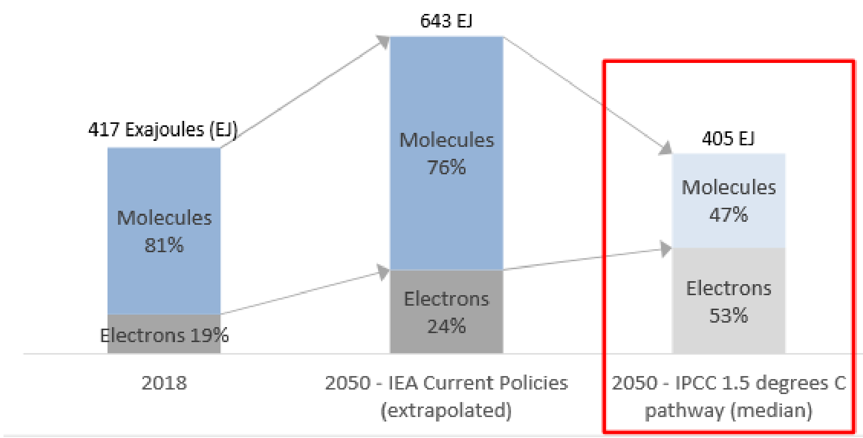
[1] "California's Electricity System of the Future", Filsinger Energy Partners, https://www.gov.ca.gov/wp-content/uploads/2021/07/Electricity-System-of-the-Future-7.30.21.pdf, p.6

Our comments focus on four areas: **(1)** Developing a State-sponsored hydrogen roadmap, policy, and infrastructure investment plan with specific targets and milestones can provide a critical framework that supports rapidly scaling the hydrogen market. **(2)** California's gas system is uniquely positioned to lead the hydrogen transition production, transport, storage, and end uses. **(3)** Unlocking California's energy policy, technical, and cost-economic barriers for hydrogen will help accelerate the growth and adoption at scale. **(4)** Supporting hydrogen demonstrations on the gas grid today to achieve a hydrogen injection standard is a critical next step.

1. **Developing a State-sponsored hydrogen roadmap, policy, and infrastructure investment plan with specific targets and milestones can provide a critical framework that supports rapidly scaling the hydrogen market.**

To fully implement California's vision of a carbon neutral energy future, including a reliable and resilient integrated gas and electric grid, both clean electrons (through renewable electricity) and clean molecules (through renewable gases like hydrogen) will be required. According to Bloomberg New Energy Finance (BNEF), to achieve the Intergovernmental Panel for Climate Change's (IPCC)[2] global warming reduction target of 1.5-degrees (centigrade) by 2050, global energy consumption would need to decrease, and technological changes would need to occur.[3] BNEF analysis suggests there is a role for both clean molecules and clean electrons by 2050 (as shown in Figure 1 below) and that the contribution of these two energy sources to global energy consumption under the IPCC 1.5-degree scenario is about equal (53 percent clean electrons and 47 percent clean molecules). The 47 percent or 190 exajoules of energy consumed in the form of molecule-based fuels would need to have a very low carbon intensity. Therefore, as a scalable energy carrier with a broad range of end uses, hydrogen has the potential to be an essential energy carrier to meet California's carbon neutrality goals.[4]

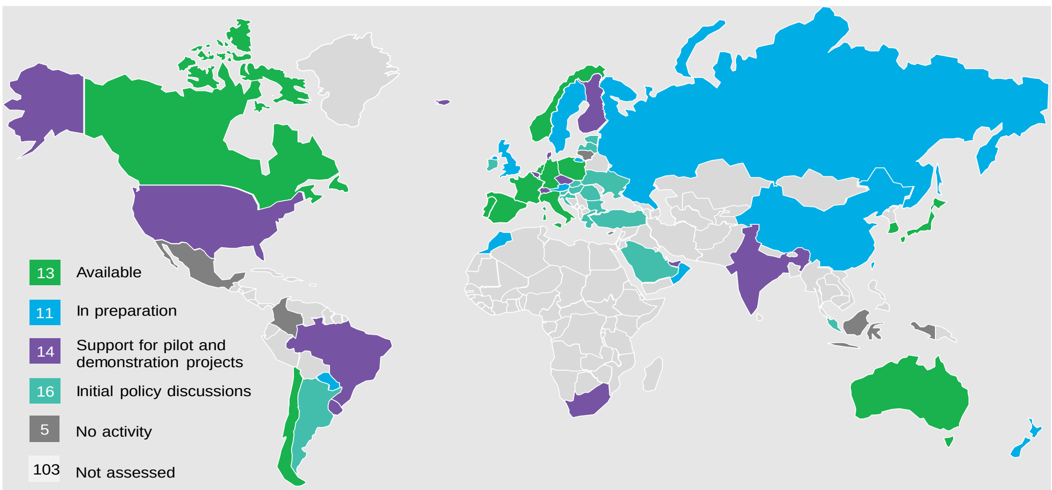
**Figure 1: Projections for Global Final Energy Consumption in 2050 (source: BNEF)**




[2] "IPCC Special Report: Global Warming of 1.5 ºC", last modified August 6, 2021, https://www.ipcc.ch/sr15/.
[3] "Extract from the prepared direct testimony of Yuri Freedman, Austin Hastings, and Joseph C. Varela on behalf of Southern California Gas Company, San Diego Gas & Electric Company, Pacific Gas and Electric Company, and Southwest Gas Corporation, Joint Utility Preliminary Hydrogen Injection Standard Application, A.20-11-004", SoCalGas, November 2020, p. 13.
[4] Ibid.

Strong government commitment to deep decarbonization, backed by financial support, regulation and clear hydrogen strategies and targets, has triggered unprecedented momentum in the hydrogen industry globally. In many nations, hydrogen has been increasingly seen as a driving force in the fight against climate change. Many utilities, energy companies, and nations are prioritizing the development of hydrogen infrastructure as an integral component of large scale decarbonization. There is a growing interest to include hydrogen as part of the energy transition and infrastructure investments in the United States (U.S.) with particular focus on developing regional hydrogen hubs to demonstrate the production, processing, delivery, storage, and end-uses of hydrogen.[5]

**Figure 2: National Hydrogen Strategies (status as of January 2021)[6]**




As reflected in Figure 2 above, 13 countries have already developed comprehensive hydrogen strategies with 11 others preparing their strategies as of January 2021.[7] The European Union (EU) alone aims to install 40 Gigawatts (GW) of renewable hydrogen electrolyzers by 2030 plus an additional 40 GW in neighboring countries to import hydrogen into the EU with a goal to accelerate the development of clean hydrogen.[8] Almost all EU member states recognize the important role of hydrogen in their national energy and climate plans. About half have explicit hydrogen-related objectives, focused primarily on transport and industry sectors.[9]

The capital investment plans to implement hydrogen infrastructure for some countries are substantial. Germany has allocated 10 billion euros and plans to develop up to 5 GW of hydrogen capacity by 2030, and an additional 5 GW by 2040. Germany has ambitious plans to develop 3,600 miles of hydrogen

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[5] "Senate Infrastructure Deal Has $114 Billion for Energy", BloombergNEF, https://www.bnef.com/insights/26955/view?e=Analyst%20Reaction:sailthru.
[6] "1H 2021 Hydrogen Market Outlook: A Defining Year Ahead", BloombergNEF, https://www.bnef.com/insights/25185
[7] Ibid.
[8] European Commission, Communication from the Commission to the European Parliament, the Council the European Economic and Social Committee and the Committee of the Regions: a hydrogen strategy for a climate-neutral Europe. (Aug. 7, 2020), https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf
[9] "EU hydrogen policy: Hydrogen as an energy carrier for a climate-neutral economy", European Parliament Think Tank, April 2021, p. 1.

pipelines of which about 90 percent is repurposing existing gas pipes.[10] France has set $8.3 billion in investments by 2030, with a target to build 6.5 GW of electrolysis for hydrogen production.[11] The Netherlands aims to produce renewable hydrogen using renewable electricity, generated by a 3 to 4 GW offshore wind farm in 2030 and expanded to 10 GW by 2040, as part of the objectives of the Dutch Climate Accord.[12] The United Kingdom's (U.K.) goal is 5 GW of low-carbon or renewable hydrogen production capacity by 2030 in a 10-point plan for a "green industrial revolution."[13] East Asian hydrogen policy targets are driven by mobility and hydrogen fueling targets. China has set a target of 1 million FCEVs and 1,000 hydrogen refueling stations by 2030.[14] South Korea's hydrogen roadmap targets 5.9 million fuel cell vehicles and 1,200 hydrogen refueling stations by 2040.[15] Japan plans to deploy 5.3 million residential fuel cell units (up to 5kW) by 2030.[16]

According to the Hydrogen Council, 228 hydrogen projects were announced globally (as of 2021) and 17 of these projects are at Giga scale with a total production capacity of 200,000 tons a year spread across Australia, Europe, the Middle East, and Chile. [17]

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[10] Bernd Radowitz, "German pipeline operators present plan for world's largest hydrogen grid," Recharge, May, 18, 2020, https://www.rechargenews.com/transition/german-pipeline-operators-present-plan-for-world-s-largest-hydrogen-grid/2-1-810731.

[11] Andreas Franke, "France cranks up hydrogen plans with 6.5-GW, 2030 target, plays down new nuclear," S&P Global Platts, September 8, 2020, https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/090820-france-cranks-up-hydrogen-plans-with-65-gw-2030-target-plays-down-new-nuclear#:~:text=London-,France%20cranks%20up%20hydrogen%20plans%20with%206.5%2DGW%2C%202030,target%2C%20plays%20down%20new%20nuclear&text=London%20%E2%80%94%20France%20plans%20to%20spend,to%20a%20strategy%20presented%20Sept.

[12] "Dutch trio plans 10-GW offshore wind hub for green hydrogen," RenewablesNow, February 28, 2020, https://renewablesnow.com/news/dutch-trio-plans-10-gw-offshore-wind-hub-for-green-hydrogen-688947/.

[13] "UK government misses latest hydrogen strategy deadline," S&P Global Platts, July 23, 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/072321-uk-government-misses-latest-hydrogen-strategy-deadline.

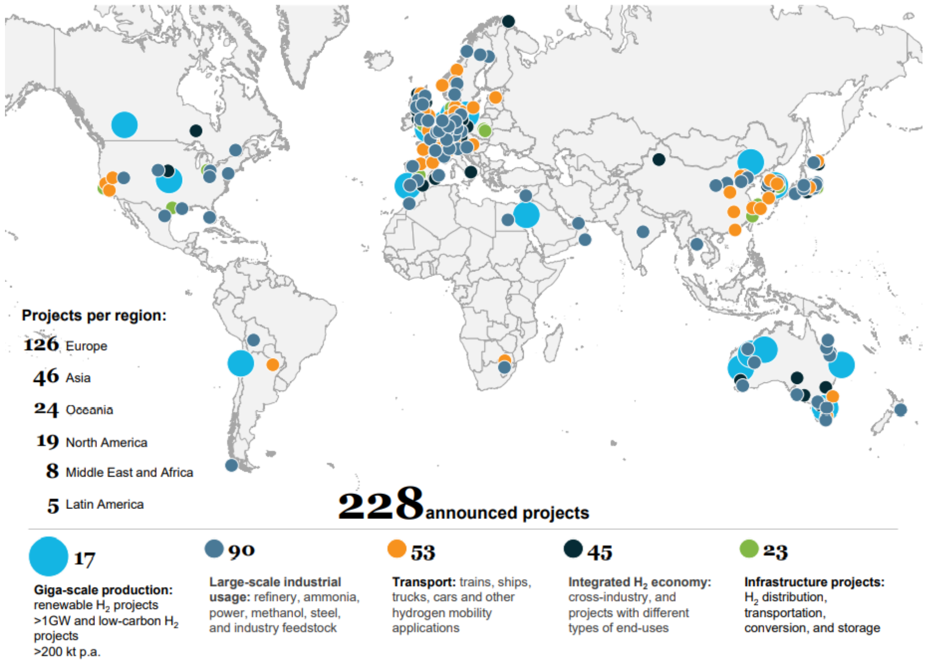
[14] Michael Meidan, "China's Emerging Hydrogen Strategy," May 21, 2021, https://www.ispionline.it/en/pubblicazione/chinas-emerging-hydrogen-strategy-30431.

[15] "Korean Hydrogen Economy Market Intelligence Report", Intralink Group, January 2021, p. 2.

[16] Jack Chaben, "Japan Fuel Cell Developments," Fuel Cell & Hydrogen Energy Association, March 11, 2019, https://www.fchea.org/in-transition/2019/3/11/japan-fuel-cell-developments#:~:text=Japan%20plans%20to%20deploy%205.3,a%20self%2Dsustaining%20energy%20future.&text=Japan%27s%20commitment%20to%20fuel%20cells,clean%20and%20sustainable%20energy%20future.

[17] "Hydrogen Insights: A perspective on hydrogen investment, market development, and cost competitiveness", McKinsey & Company, February 2021, p. 5.

**Figure 3: Global hydrogen projects across the value chain** [18]




In addition to capital hydrogen infrastructure investments, global momentum is also building to reduce the cost of hydrogen. In addition to the Department of Energy's (DOE) Earthshot-Hydrogen Shot program which seeks to reduce the cost of clean hydrogen by 80 percent to $1 per 1 kilogram (kg) in 1 decade ("1 1 1") by 2030.[19] Australia's national hydrogen strategy has launched the "H2 under 2" target, which sets a production cost of below AU $2/kg (approximately USD $1.50) for green hydrogen sourced from solar and wind.[20] As discussed during the workshop, the HyDeal LA initiative is aiming to achieve $1.5/kg of delivered green hydrogen to off-takers in the LA basin.[21] Even electrolyzer OEMs like NEL are targeting $1.5/kg of green hydrogen production by 2025.[22] Countries have also been announcing additional support mechanisms, including hydrogen-related government funding opportunities, R&D programs, and policies supporting the development of the hydrogen economy.

California can follow many global economies at the forefront of hydrogen development by implementing a comprehensive hydrogen roadmap, policy, and infrastructure plan. This would align with the Governor's recent assertion that, "investments in green hydrogen could lead to rapid decline in production costs similar to the experience seen with solar production and battery energy storage technologies as technologies are scaled up and commercialized."[23] As the CEC considers how to manage and guide California's energy transition, thoughtful analysis should be given to take advantage of the entire hydrogen value chain[24] as part of such a hydrogen roadmap including to strategically leverage the existing gas system to the greatest

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[18] Ibid.
[19] "Hydrogen Shot," last modified August 6, 2021, https://www.energy.gov/eere/fuelcells/hydrogen-shot.
[20] Sambit Mohnaty, "Analysis: Asia's 'H2 at $2' green hydrogen target is a mission not impossible", S&P Global Platts, January 14, 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/011421-analysis-asias-h2-at-2-green-hydrogen-target-is-a-mission-not-impossible.
[21] "HyDeal LA: Architecting a Scalable Model for Green Hydrogen Hubs, Starting with Los Angeles", Green Hydrogen Coalition, July 7, 2021, p. 5.
[22] "NEL presentation at the IEPR Hydrogen workshop", NEL, July 28, 2021, p. 12.
[23] Filsinger Energy, "California's Electricity System of the Future," p.27.
[24] Hydrogen value chain includes production, distribution, storage, and end-uses across all hydrogen applications.

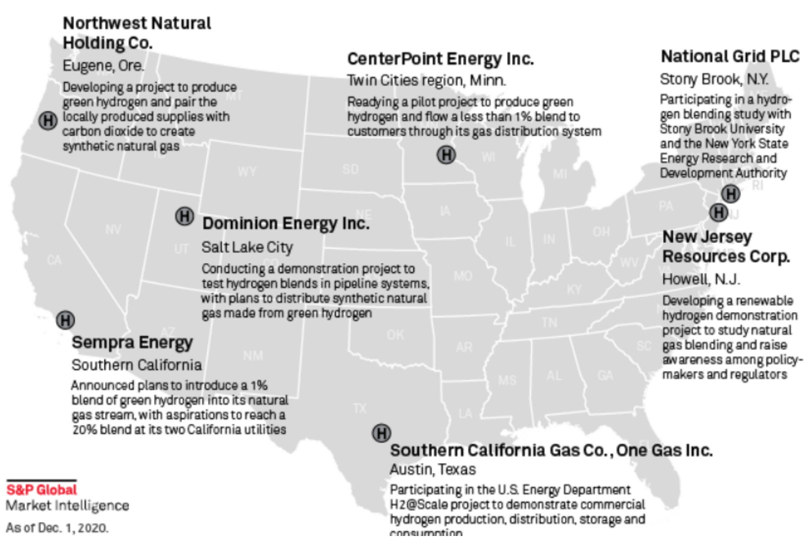
extent possible.

2. **California's gas system is uniquely positioned to lead the hydrogen transition to scale hydrogen production, transport, storage, and end uses.**

Governments and utilities around the world are increasingly looking to inject hydrogen into the gas grid as a means of displacing conventional gas consumption and thus reducing emissions. Both the Australian national hydrogen and the Dutch national hydrogen strategies are considering hydrogen blending as part of their energy ecosystem, in addition to a host of small-scale pilot projects.[25,26,27]

Hydrogen blending is already a reality in the United Kingdom (U.K.). Zero-carbon hydrogen was injected into a U.K. gas network for the first time this year in a groundbreaking trial. The 20 percent hydrogen blend is being used to heat 100 homes and 30 faculty buildings at Keele University in Staffordshire.[28] For this pilot, the hydrogen gas is created using an electrolyzer powered by electricity. The resulting hydrogen is then injected into the existing gas system, with no need for end-users to change appliances or pipelines. If the pilot is successful, it will be expanded to deliver the 20 percent hydrogen blend to 670 nearby domestic and commercial buildings. Domestically, hydrogen blending pilots are well underway across the U.S. Figure 4 (below) highlights several hydrogen initiatives at various gas utilities in the U.S.

**Figure 4: Select early-stage hydrogen initiatives at US gas utilities [29]**

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[25] "Australia's National Hydrogen Strategy", COAG Energy Council, November 2019, p.41.
[26] Kevin Morrison, "East Australia pipelines start blending hydrogen", Argus, March 3, 2021, https://www.argusmedia.com/en/news/2192241-east-australia-gas-pipelines-start-blending-hydrogen.
[27] Davine Janssen, "Dutch outline clean hydrogen 'vision', aim at global market", EURACTIV, April 1, 2020, https://www.euractiv.com/section/energy-environment/news/dutch-outline-clean-hydrogen-vision-aim-at-global-market/.
[28] "UK's first grid-injected hydrogen pilot gets underway at Keele", Keele University, January 2, 2020, .
[29] Tom DiChristopher, "MI: How National Grid plans to advance US renewable gas, hydrogen deployment", S&P Global Market Intelligence, January 21, 2021, https://platform.marketintelligence.spglobal.com/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=62227805.

Gas system pipelines are likely to be the most cost-effective long-term choice for local hydrogen distribution with sufficiently large, sustained, and localized demand. For example, SoCalGas owns and operates over 102,000 miles of transmission, distribution, and service lines, serving 21.8 million customers over 24,000 square miles.[30,31] As a result, SoCalGas' system is uniquely positioned to scale hydrogen by blending it into the existing gas system. Blending hydrogen into the gas system could also provide a boost towards achieving gas pipeline decarbonization. Hydrogen has the potential to be integrated into the gas system as a form of larger scale energy storage and could allow for multiple locations for injection and withdrawal. SoCalGas is studying the potential of utilizing hydrogen and its pipeline system to provide a long-duration storage solution by leveraging excess renewable electricity to support a resilient energy system. California can learn from international efforts; however, the State has to consider differences in materials, operations, and system design as no two gas systems are identical. Therefore, it is crucial to collect system-specific data to mitigate public safety concerns. SoCalGas is collaborating with European companies to learn from their experiences and apply them to California to further facilitate the adoption of hydrogen into the State's energy mix.

3. **Unlocking California's energy policy, technical, and cost-economic barriers for hydrogen will help accelerate the growth and adoption at scale.**

There is an urgent need to address several key policies relating to hydrogen in California to help unlock barriers for scaling hydrogen. SoCalGas urges the CEC to evaluate and expeditiously address the high priority issues discussed below:

***Adopting Definitions of Hydrogen for different regulatory programs***

Successfully decarbonizing California's economy requires innovation, predictability, and consistent policies that provide certainty and clarity regarding the role of hydrogen in the marketplace. There are strong grounds for believing that decarbonized, renewable or green hydrogen can experience a cost decline like those of solar PV, and wind. But at this time, uncertainty regarding the definitions and the specific roles hydrogen can play, undermine the confidence that businesses and industry need to make long-term investments in the production of this fuel source. By defining the role of the various types of hydrogen production that can be used within specific regulatory programs, the state will provide suppliers and consumers with the certainty needed to spur investment, decrease costs and harness the full potential of hydrogen as tool in our decarbonization efforts.

***High electricity rates for electrolytic hydrogen production are a significant barrier***

The National Renewable Energy Lab (NREL) study titled: "An Analysis of Hydrogen Production from Renewable Electricity Sources"[32] demonstrates that regardless of any additional cost elements, electricity costs are a major price influencer on the price of electrolytic hydrogen. Electricity costs have been shown to account for 59 to 68 percent of the total electrolysis-based hydrogen production costs in the industrial and commercial sectors in the U.S.

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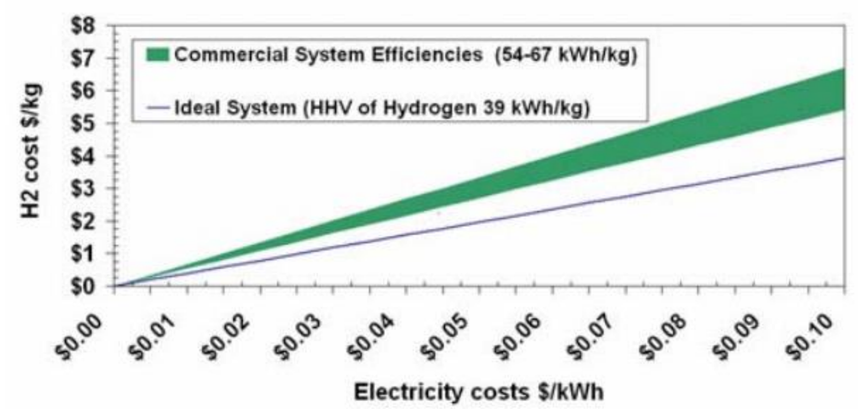
[30] "SoCalGas Service Territory", SoCalGas, https://www.socalgas.com/documents/news-room/fact-sheets/ServiceTerritory.pdf.

[31] SoCalGas, "SoCalGas Data Analytics Team Named Most Innovative in the Nation", CISION PR Newswire, January 29, 2021, https://www.prnewswire.com/news-releases/socalgas-data-analytics-team-named-most-innovative-in-the-us-301218231.html.

[32] "An Analysis of Hydrogen Production from Renewable Electricity Sources", NREL, August 6, 2005, p. 4.

NREL's analysis shows that with "electrolyzer energy requirements from 54 to 67 kWh/kg, electricity costs must be lower than $0.04 - $0.055/kWh respectively to produce hydrogen at lower than $3.00/kg. [33] For an ideal system operating at 100 percent efficiency (39 kWh/kg), electricity costs must be less than $0.075/kWh to produce hydrogen at lower than $3.00/kg".[34] According to a recent IHS Markit study, each additional dollar per megawatt-hour increases the cost of electrolytic hydrogen by $0.16/kg.[35] The high cost of retail electricity in California (average retail price: $0.168/kWh) acts as a potential barrier for the distributed grid-connected electrolyzers. [36]

**Figure 5: Hydrogen costs via electrolysis with electricity costs [37]**




**4. Gas utility hydrogen demonstration programs are needed today to advance hydrogen injection standards**

As discussed above and during the workshop, hydrogen blending demonstrations are in progress across the globe and are a critical step towards engaging end-use customers and developing systemwide injection standards. Further, earlier this year, the DOE released its Hydrogen Program Plan where it emphasizes that "realizing the true potential for hydrogen requires a commitment to continued research and development as well as ramping up demonstrations and deployments with the private sector to achieve scale." [38] SoCalGas concurs with the workshop panelists that demonstrations of hydrogen blending are critical next steps to safely move from laboratory research to a systemwide injection standard.

To this end, SoCalGas and San Diego Gas and Electric Company proposed, in CPUC Application (A.) 20-11-004, three hydrogen blending demonstration projects with the objectives of (1) establishing hydrogen blending demonstration workflow, including data acquisition to set integrity management approach, (2) setting standards for polyethylene (PE) plastic and mixed material distribution networks, and (3) data acquisition on steel that would feed into integrity management analysis to set a standard for a transmission

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[33] Ibid.
[34] Ibid.
[35] "Hydrogen and Renewable Gas Forum", IHS Markit, December 2020.
[36] "Energy Information Administration (EIA) State Electricity Profiles", last modified August 6, 2021, https://www.eia.gov/electricity/state/.
[37] NREL, "An Analysis of Hydrogen Production from Renewable Electricity Sources", p. 4.
[38] "Hydrogen Program Plan", U.S. Department of Energy, November 2020, p. 8.

network. The field experience gained from the demonstrations would have corroborated and assessed hydrogen blending literature and laboratory testing as applied to the SoCalGas and SDG&E gas systems. The CPUC denied the Application and recommended that SoCalGas, SDG&E, PG&E, and Southwest Gas (Joint IOUs) "improve collaboration with stakeholders including the California Energy Commission, University of California, Riverside; and parties in this proceeding" to develop and submit a demonstration plan and program for consideration in a future Application. [39] Consistent with this direction, SoCalGas suggests the CEC target its upcoming Grant Funding Opportunity for a pilot project to demonstrate hydrogen blending in the existing gas system towards projects that include a private sector and California gas utility partnership where preferably high-pressure steel. Such a project would allow the utility to collect foundational operational information, share resulting operational and inspection data on its pipeline with state agencies and provide insights on how the blended fuel interacts with the customer's end use operations and/or processes. [40] SoCalGas looks forward to continuing collaborating with the CEC and other stakeholders as recommended in the CPUC's decision to A.20-11-004 to quickly and effectively develop a demonstration program for the CPUC's consideration in a future Application.

**Conclusion**

As we collectively pursue California's energy system decarbonization, it is imperative that we consider public interest; policymakers, market participants, and stakeholders should collaboratively prioritize and help scale clean hydrogen as part of a balanced portfolio of clean energy resources in California. SoCalGas looks forward to contributing and advancing those efforts by working with the CEC, the CPUC, and sister agencies to define solutions for leveraging the fuel system and enabling the future decarbonized energy system for all Californians.

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[39] "Decision Dismissing Application (A.) 20-11-004", California Public Utilities Commission, July 15, 2021, p. 2.
[40] "Extract from the prepared direct testimony of Hilary Strong Petrizzo on behalf of Southern California Gas Company and San Diego Gas & Electric Company, A.20-11-004", SoCalGas, November 2020, https://www.socalgas.com/sites/default/files/2020-11/H2_Application-Chapter_3_H2_Demonstration_Program.pdf

Respectfully,

*/s/ Kevin Barker*

Kevin Barker
Senior Manager
Energy and Environmental Policy

cc: The Honorable Karen Douglas, CEC Commissioner
The Honorable Patty Monahan, CEC Commissioner
The Honorable Siva Gunda, CEC Commissioner
The Honorable Darcie Houck, CPUC Commissioner
The Honorable Matt Baker, CNRA Deputy Secretary for Energy