BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

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Order Instituting Rulemaking to Adopt Biomethane Standards and Requirements, Pipeline Open Access Rules, and Related Enforcement Provisions.	R.13-02-008 (Filed February 13, 2013)

PETITION FOR MODIFICATION OF DECISION 22-12-057 BY SOUTHERN CALIFORNIA GAS COMPANY, SAN DIEGO GAS & ELECTRIC COMPANY, AND SOUTHWEST GAS CORPORATION

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I. INTRODUCTION AND SUMMARY OF RELIEF REQUESTED

Pursuant to Rule 16.4 of the Rules of Practice and Procedure (Rules) of the California Public Utilities Commission (CPUC or Commission), Southern California Gas Company (SoCalGas), San Diego Gas & Electric Company (SDG&E), and Southwest Gas Corporation (Southwest Gas; together with SoCalGas and SDG&E, Joint Movants) respectfully submit this Petition for Modification (Petition) of Decision (D.) 22-12-057[1] (Decision)[2] issued in the instant Rulemaking (R.) 13-02-008. The Decision followed three requests by the Commission to the Joint Utilities[3] to propose a renewable hydrogen injection standard in order to support the State's decarbonization goals, with the Joint Utilities responding that additional demonstration was necessary before they could do so. Accordingly, the 2022 Decision requires the Joint Utilities to, *inter alia*, propose demonstrations that would evaluate hydrogen blending from 0.1% to 5% and 5% to 20% to fill then-existing knowledge gaps and obtain a fuller understanding of real-world safety and operational impacts in order to inform a proposal for a renewable hydrogen blending standard.[4] Consistent with the Decision, in

[1] D.22-12-057, Decision Directing Biomethane Reporting and Directing Pilot Projects to Further Evaluate and Establish Pipeline Injection Standards for Clean Renewable Hydrogen, December 19, 2022.

[2] Pursuant to Rule 1.8(d), SoCalGas is authorized to file this Petition on behalf of SDG&E and Southwest Gas.

[3] As used in the Decision, "Joint Utilities" refers collectively to Joint Movants and Pacific Gas & Electric Company.

[4] D.22-12-057 at 9.

2024 the Joint Utilities proposed five demonstrations that are currently being evaluated in Application (A.) 22-09-006 (Hydrogen Blending Proceeding). However, since the Decision was issued and the demonstrations were proposed, there has been significant research, study, demonstration, and operationalization both nationally and around the world that establish the safety and technical feasibility of a conservative renewable hydrogen injection standard, namely, up to 5% hydrogen by volume in the medium-pressure distribution system[5] (i.e., 60 pressure per square inch gauge (psig) or less) and fill various knowledge gaps that existed at the time the Decision was issued. Much of this information was collected in a report ordered by the Decision and filed in this proceeding. Based on the foregoing, Joint Movants respectfully request the Decision be modified to eliminate the requirement for the Joint Utilities to demonstrate hydrogen blending from 0.1% to 5% in the medium-pressure distribution system which is 60 psig or less (5% Demonstration Requirement) prior to proposing a renewable hydrogen injection standard for the Commission's consideration.

The impacts of granting the narrow request in this Petition would be as follows:

- New Phase of This Proceeding or New Proceeding to Evaluate a Proposed Renewable Hydrogen Injection Standard. The Joint Movants would propose a renewable hydrogen injection standard specifically for their medium-pressure distribution systems not to exceed 5% hydrogen by volume (Maximum 5% Injection Standard) through a process prescribed by the Commission in a decision on this Petition (e.g., a new phase of this proceeding or by an application). In that venue, the new research, study, demonstration, and operationalization that support a Maximum 5% Injection Standard could be evaluated as appropriate. Joint Movants would also present an execution plan, which may include system evaluation, area of influence, maximum and minimum flow rates, etc., as provided for in the Joint Movants' Standard Renewable Gas Interconnection Tariff (SRGIT). In other words, the proposal would be evaluated just as the SRGIT was in an earlier phase of this proceeding.

[5] The Pipeline and Hazardous Materials and Safety Administration (PHMSA) defines distribution and transmission systems based on a pipeline's operating pressure compared to its Specified Minimum Yield Strength (SMYS). Distribution pipelines are those operating at less than 20% SMYS, while transmission pipelines are those operating at or above 20% SMYS. The term "medium-pressure" further clarifies the operating pressure range of the pipeline system, which in this case is 60 psig or less. Because these pipelines are operating at lower % SMYS and generally lower pressures, the pipe materials experience lower stress levels.

- Opportunity for Ratepayer Savings. If the Commission were to determine it remains prudent to demonstrate blending from 0.1 to 5% hydrogen in the medium-pressure distribution system, consistent with the Decision and Rule 16.4(h), SoCalGas would proceed with completing design of and executing the Orange Cove demonstration project currently under consideration in the Hydrogen Blending Proceeding. However, Commission recognition now of the significant work that has occurred on hydrogen blending since the Decision was issued and has resulted in an existing body of work that supports low-level blending would dispense with the 5% Demonstration Requirement and translate to significant ratepayer savings given that SoCalGas's Orange Cove demonstration is forecasted to cost over $50 million.[6] Foregoing a project that is no longer necessary in order to propose a Maximum 5% Injection Standard is also consistent with the Decision's acknowledgement that the purpose of the demonstration projects it ordered was to "address knowledge gaps."[7]

This Petition is supported by the Declaration of Katrina Regan, provided at Attachment A hereto, and its Attachment A-1, which summarizes research, study, demonstration, and operationalization regarding hydrogen blending that have occurred since the Decision was issued and, collectively with prior bodies of work, demonstrate the safety and technical feasibility of a Maximum 5% Injection Standard. The specific modifications requested to the Decision are identified in Attachment B hereto. This Petition is timely filed pursuant to Rule 16.4 because of the comprehensive information described in Attachment A that has become available in the nearly 3 years since the Decision was issued which, collectively, fill previously existing knowledge gaps and support the proposal and consideration of a Maximum 5% Injection Standard without additional demonstration.

For avoidance of doubt, granting this Petition will not result in operationalization of any renewable hydrogen injection standard, nor will it obviate the need to conduct the other demonstrations proposed in the Hydrogen Blending Proceeding.[8] Rather, granting this Petition will allow California to

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[6] A.22-09-006, Prepared Testimony of Nasim Ahmed and Marjorie Schmidt-Pines on behalf of Southern California Gas Company (Chapter 6-Regulatory Accounting, Cost Recovery, Revenue Requirement, and Rates) at 2.

[7] *Id.* at 56 (Finding of Fact (FOF) 14).

[8] There would be no changes to the blending schedule in Southwest Gas's proposed demonstration project in A.22-09-006, including a period where testing of less than a 5% blend is implemented and analyzed.

advance its decarbonization goals affordably and promptly— years before the projects proposed in the Hydrogen Blending Proceeding are completed—consistent with the Commission's three prior requests to the utilities to propose a renewable hydrogen injection standard. Recognizing the collective knowledge and experience that has been developed in the last few years and acting on it will put California back on track as a leader in advancing hydrogen blending as a decarbonization strategy.

II. BACKGROUND

A. Procedural History

This proceeding was opened in 2013 to, *inter alia*, evaluate and consider implementing safety and testing standards for biomethane injection into natural gas pipelines.[9] On September 4, 2020, the Commission issued D.20-08-0035 adopting the SRGIT for the Joint Utilities. The Commission has been engaged in a multi-year effort to establish a system-wide renewable hydrogen injection standard. In the July 5, 2018 *Assigned Commissioner's Amended Scoping Memo and Ruling* in this proceeding, Commissioner Clifford Rechtschaffen announced: "In accordance with Section 399.24 and with Executive Order B-48-18 issued on January 26, 2018, it is my future intention to consider issues within this, or a successor proceeding, that pertain to the safe, cost-effective development of other renewable gases, such as renewable hydrogen."[10] Thereafter, on November 21, 2019, in the *Assigned Commissioner's Scoping Memo and Ruling Opening Phase 4 of Rulemaking 13-02-008* (Phase 4 Scoping Ruling), Commissioner Rechtschaffen recounted the reasons why "[t]his proceeding will provide the opportunity to expand hydrogen use to offset the use of fossil fuels by establishing standards and interconnection protocols for injecting renewable hydrogen into natural gas pipelines,"[11] including that "California has been advancing the deployment of hydrogen throughout the state as a zero-emission fuel."[12] Since that time, the 2022 *California Air Resources Board Scoping Plan for Achieving Carbon Neutrality* (CARB Scoping Plan), which serves as the State's comprehensive strategy for achieving its greenhouse gas emissions reduction goals, echoed the

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[9] R.13-02-008 at 2, *available at*: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M050/K674/50674934.PDF.

[10] Assigned Commissioner's Amended Scoping Memo and Ruling (July 5, 2018) at 7.

[11] Assigned Commissioner's Scoping Memo and Ruling Opening Phase 4 of Rulemaking 13-02-008 (Phase 4 Scoping Ruling) (November 21, 2019) at 1.

[12] *Id.* at 66.

role that renewable hydrogen could play in decarbonization.[13, 14] And just late last year, Governor Newsom reinforced California's commitment to clean renewable hydrogen:

> *Clean renewable hydrogen deserves to be part of California's energy future—creating hundreds of thousands of new jobs and saving billions in health costs. We'll continue to pursue an all-of-the-above clean energy strategy that powers our future and cleans the air….*[15]

The Phase 4 Scoping Ruling also acknowledged Joint Utilities' recommendation at that time[16] that "more technical expertise is needed to determine the maximum safe level of hydrogen blend in pipelines" and, accordingly, ordered the Commission's Energy Division to "arrange, and oversee an independent technical study to address the potential impacts of increased hydrogen concentration in California's natural gas storage and delivery system"[17]—which resulted in commissioning U.C. Riverside's Hydrogen Blending Impacts Study (U.C. Riverside Study).[18] Nevertheless, recognizing the urgency of advancing the appropriate use of renewable hydrogen while the study was underway, Commissioner Rechtschaffen again afforded the utilities the opportunity to propose a preliminary hydrogen injection standard using available

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13 California Air Resources Board (CARB), 2022 Scoping Plan for Achieving Carbon Neutrality (December 2022) at 78 ("Injecting up to 20 percent hydrogen into the existing natural gas system is being explored as a transitional strategy to reduce the carbon intensity of gas used in buildings and industry.").

14 The Decision also found that, pursuant to Senate Bill 1075 (Skinner, 2022), CARB, in conjunction with the CPUC and the CEC, was required to provide policy recommendations regarding the use of hydrogen to help achieve California's climate, clean energy, and clean air objectives. *See* D.22-12-057 at 60 (FOF 45).

15 State of California – Office of Governor Gavin Newsom, *Governor Newsom Statement on Trump Administration's Decision to Cut Hydrogen Hub Funding* (October 1, 2025), *available at:* https://www.gov.ca.gov/2025/10/01/governor-newsom-statement-on-trump-administrations-decision-to-cut-hydrogen-hub-funding/.

16 "SoCalGas and SDG&E requested that the Commission administer an independent third-party study to provide recommendations for hydrogen injection standards." Phase 4 Scoping Ruling at 7 (citing SoCalGas and SDG&E Comments on Amended Scoping Memo (July 27, 2018) at 12).

17 Phase 4 Scoping Ruling at 13. The Joint IOUs were also ordered to submit an application that included, among other things, a preliminary renewable hydrogen injection standard; however, the Joint IOUs did not believe they had sufficient information at the time to do so.

18 The Administrative Law Judge's Ruling Seeking Comments Regarding Continued Biomethane Procurement Reporting and Regarding U.C. Riverside Safe Hydrogen Injection Study states that the U.C. Riverside Study was also produced in compliance with Senate Bill 1369 and sponsored by the Commission. *See id*. at 3.

information within 12 months of the ruling.[19] None of the utilities proposed a preliminary hydrogen injection standard at that time.[20]

Following completion of the U.C. Riverside Study, in a July 18, 2022 ruling, Commissioner Rechtschaffen invited interested parties to comment on the study, including responding to the question, "Does the U.C. Riverside Study provide enough information for the Commission to consider adopting a safe injection standard for hydrogen in the common carrier pipeline system? If so, what should that standard be, and why do you think that standard is appropriate?"[21] At that time, based on the findings in, and recommendations of, the U.C. Riverside Study, the Joint Utilities (among others) indicated their intention "to develop live hydrogen blending demonstration projects to collect the necessary operational data to support the development of a safe injection standard for hydrogen."[22] In responding to other parties' comments, the Joint Utilities reasoned, "While the Joint Utilities share the enthusiasm for adopting a hydrogen injection standard and recognize the timing urgency, operational data should first be collected from real-world demonstration projects to inform such a standard."[23]

Accordingly, among other things, the Decision recognized the importance of continued pursuit of a renewable hydrogen injection standard and defined the path forward:

- Senate Bill "1075 requires the evaluation of the role of green hydrogen in achieving California's climate objectives;"[24]

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19 Phase 4 Scoping Ruling at 8.

20 Instead of proposing a preliminary hydrogen injection standard, the Joint Utilities proposed demonstration projects which would help inform proposal of a hydrogen injection standard. *See* A.20-11-004, available at https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M351/K622/351622423.PDF. The Joint Utilities emphasized that due to "current knowledge and testing limitations," they could not "recommend a hydrogen injection standard with sufficient confidence that public safety, pipeline integrity, and reliability will not be compromised." *Id.* at 2.

21 *Id.* at 4.

22 Comments of Southern California Gas Company, San Diego Gas & Electric Company, Southwest Gas Corporation, and Pacific Gas and Electric Company on Administrative Lae Judge Ruling Seeking Comments Regarding UC Riverside Safe Hydrogen Injection Study (August 19, 2022) at 2.

23 Reply Comments of Southern California Gas Company, San Diego Gas & Electric Company, Southwest Gas Corporation, and Pacific Gas and Electric Company on Administrative Law Judge Ruling Seeking Comments Regarding UC Riverside Safe Hydrogen Injection Study (September 2, 2022) at 2.

24 D.22-12-057 at 45 (FOF 3).

- "The UC Riverside Study provides support for pursuing blending as part of a decarbonization strategy, while at the same time, outlining thoughtful and prudent steps before establishing a system wide injection standard;"[25]
- "To address knowledge gaps in several areas, the UC Riverside Study emphasizes the need to conduct real world demonstrations of hydrogen blending under safe and controlled conditions;"[26]
- "Additional testing through pilot hydrogen blending projects is needed, as discussed in this decision, to continue the process that began in D.14-02-034 to establish safe injection standards for all identified constituents of concern using best scientific data;"[27] and
- "The Joint Utilities should propose hydrogen blending pilot projects, taking into account the findings and recommendations of the UC Riverside Study, existing and ongoing hydrogen research, development, and demonstration activities, and stakeholder feedback as well as guidance set forth in this decision."[28]

The Decision also required the Joint Utilities to "monitor the national and international ongoing research and to jointly file a Hydrogen Blending Compendium Report within two years from the issuance date of this decision."[29] The stated purpose of the Hydrogen Compendium Report was to continue to gather research and findings, including those related to safety performance, leakage rates, permeation rates, equipment, etc.; accordingly, it would be logical for the Hydrogen Compendium Report to inform the need for demonstration.[30]

B. Proposed Demonstration Projects

On March 11, 2024, the Joint Utilities filed an amended application in A.22-09-006 proposing five demonstration projects consistent with the requirements set forth in the

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[25] *Id.* at 57 (FOF 19).

[26] *Id.* at 56 (FOF 14).

[27] *Id.* at 59 (FOF 36).

[28] *Id.* at 61 (Conclusion of Law (COL) 7).

[29] *Id.* at 63 (COL 22).

[30] *Id.* at 63-64 (COL 22-24).

Decision.[31] Relevant here, SoCalGas's Orange Cove demonstration project proposes to gradually blend hydrogen from 0.1% up to 5% by volume into the City of Orange Cove's medium-pressure distribution system, a closed system, to serve existing natural gas-powered appliances found in residences and businesses.[32] This demonstration meets the Decision's 5% Demonstration Requirement, namely, to evaluate "hydrogen injection at blends between [0.1] and five percent," as it pertains to the natural gas medium-pressure distribution system.[33]

C. New Research, Study, Demonstration, and Operationalization

Consistent with the Decision's requirement to commission an independent assessment,[34] the Joint Utilities commissioned the Hydrogen Compendium Report from U.C. Riverside to augment the effort of the U.C. Riverside Study with updates regarding hydrogen blending occurring from July 2022 through August 2024. The Hydrogen Compendium Report was filed in this proceeding on February 14, 2025, bringing to light numerous new studies and demonstration projects around the world. Unlike with the U.C. Riverside Study, the Commission did not invite parties to comment on the report, nor were the utilities asked whether the report provided sufficient information and closed sufficient knowledge gaps to enable the proposal of a hydrogen blending injection standard. The Hydrogen Compendium Report remains filed in this proceeding without action.

Additionally, there have been updates even since the Hydrogen Compendium Report was

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31 *Id.* at 68-69 (Ordering Paragraph (OP) 7).

32 A.22-09-006, Joint Amended Application of Southern California Gas Company, San Diego Gas & Electric Company, Pacific Gas and Electric Company, and Southwest Gas Corporation to Establish Hydrogen Blending Demonstration Projects (Amended Application), Prepared Direct Testimony of Blaine Waymire (Chap. 2) at 1; *available at*: https://www.socalgas.com/sites/default/files/2024-03/Chapter2_TechnicalPresentation_SoCalGasOpenSystem.pdf.

33 D.22-12-057 at 69 (OP 7(d)). The same ordering paragraph also requires evaluation of hydrogen injection at blends between five to twenty percent. This requirement is satisfied by other projects proposed: for example, SoCalGas's U.C. Irvine project proposes to blend hydrogen incrementally from 5 to 20% in the medium pressure distribution system; SDG&E's project proposes to blend hydrogen incrementally from 5 to 20% volume in a natural gas medium-pressure distribution system for delivery to a hydrogen fuel cell; Southwest Gas's project proposes to blend hydrogen incrementally up to 20% by volume in the medium-pressure distribution system in alpine conditions; and PG&E's project proposes to blend concentrations of 5% hydrogen by volume up to 20%, with the potential for higher concentrations in the future, in a test loop representing the natural gas high-pressure transmission system. *See* A.22-09-006, Amended Application.

34 *Id.* at 70-71 (OPs 8-10).

completed and filed, which are also reflected in Attachment A-1. As Attachment A-1 describes, significant information about hydrogen blending has been developed through both literature and global real-world demonstrations and operationalization since the Decision. The further research, study, demonstration, and operationalization address the use of hydrogen blending at various different percentages by volume, in varying materials, and at varying pressures. They are conducted by various organizations, such as utilities, national labs, and research institutions. Relevant here, together, the studies and research fill knowledge gaps and expound on the knowledge from the time the Decision was issued to the point that Joint Movants believe it is possible now to propose a Maximum 5% Injection Standard.

As described in the Declaration of Katrina Regan and Attachment A-1 thereto, research has addressed critical technical questions related to safety, system integrity, operations, and appliance performance. The U.S. Department of Energy's HyBlend Cooperative Research and Development Agreement has advanced understanding of material compatibility, pipeline integrity, techno-economic feasibility, and regulatory gaps.[35] Other projects have developed operating procedures, evaluated odorant performance, assessed flow meter accuracy, and established Consensus Engineering Requirements for hydrogen pipeline design and integrity management.[36] Technical input is now available for updates to relevant American Society of Mechanical Engineers (ASME) standards. As to the critical issue of appliance performance, additional testing shows that residential and commercial appliances operate safely with blends up to 20% hydrogen by volume. Vitally, research and demonstration is still underway and will help support potential future proposals for an injection standard above 5% hydrogen by volume, and possibly even for the natural gas high-pressure transmission system.

Across Europe, regulatory frameworks permit hydrogen blends ranging from 1-10%.[37]

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[35] HyBlend Collaborative Research Partnership; available at: HyBlend Collaborative Research Partnership: Cooperative Research and Development Final Report, CRADA Number CRD-21-17525

[36] PRCI PR337-23115-R01 Consensus Engineering Requirements for Pipelines in Hydrogen and Hydrogen Blend Service; available for download at https://www.prci.org/Research/JEFI/222296/JEFI-04-11/260693/294770.aspx; *see also* PRCI Provides Guidance for the Addition of Hydrogen Pipeline Requirements to ASME B31.8 Gas Transmission and Distribution Piping Systems Standard - ASME

[37] Zhang, Y., Wang, Y., Zhang, X., et al., "Techno-economic analysis of hydrogen blending into natural gas pipeline networks: A case study in China" (*International Journal of Hydrogen Energy*, Vol. 50, Issue 45, 2023), available at https://www.sciencedirect.com/science/article/pii/S0360319923030203.

And in North America, utilities such as CenterPoint Energy, NW Natural, ATCO, and Enbridge have integrated hydrogen blends into natural gas distribution networks, reinforcing the technical feasibility of blending at scale while collecting informative operational data.[38] Oregon does not have a maximum allowed limit for hydrogen blend percentage in its natural gas system, but requires advance notice to customers and the Oregon Public Utility Commission if blends will exceed 2.5% by volume.[39] Of course, Hawai'i Gas has numerous decades of experience blending hydrogen up to 15% by volume, and it is now seeking to increase that blend to up to 20%.[40]

III. THIS PETITION MEETS THE PROCEDURAL REQUIREMENTS OF RULE 16.4

Joint Movants file this Petition more than one year following the effective date of D.22-12-057 under Rule 16.4(d) of the Commission's Rules of Practice and Procedure.[41] Accordingly, this Petition is supported by the Declaration of Katrina Regan.

The Decision relied on the U.C. Riverside Study issued in July 2022 and ordered that the U.C. Riverside Study be updated with a follow-on study to capture relevant advances in hydrogen blending. As anticipated by the Decision, there have been subsequent studies and

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[38] CenterPoint Energy, "Renewable Hydrogen" (Report No. 201229-02, Dec. 29, 2020), available at https://www.centerpointenergy.com/en-us/InYourCommunity/Documents/201229-02_Renewable%20Hydrogen.pdf.; NW Natural: "NW Natural and Modern Hydrogen Unveil Clean Hydrogen Production, Carbon Capture Project in Portland"; 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; ATCO Fort Saskatchewan Hydrogen Blending Project; available at: https://gas.atco.com/content/dam/web/projects/projects-overview/fort-sask-hydrogen-blending-info-sheet-december2021.pdf; *See*, Therm H2- Hydrogen Blending Project; available at: https://www.enbridgegas.com/about-enbridge-gas/projects/hydrogen-blending-in-delta-utah.

[39] Oregon State Legislature, "Senate Bill 685 – Relating to Hydrogen; and Declaring an Emergency" (Chapter 328, Enrolled, 2025 Regular Session) (Oregon Senate Bill 685), available at https://olis.oregonlegislature.gov/liz/2025R1/Downloads/MeasureDocument/SB685.

[40] Hawai'i Gas, "Hawai'i Gas Selects Eurus Energy America and Bana Pacific for Hydrogen and Renewable Natural Gas Projects" (May 20, 2024), available at: https://www.hawaiigas.com/posts/eurus-energy-america-and-bana-pacific-for-hydrogen-and-renewable-natural-gas-projects#:~:text=Hawai%CA%BBi%20Gas'%20synthetic%20natural%20gas,Wastewater%20Treatment%20Plant%20since%202018.

[41] Joint Movants filed this Petition in this proceeding with service to the service lists of R.13-02-008 and A.22-09-006.

global real-world demonstrations regarding the feasibility of blending up to 5% hydrogen in natural gas distribution systems. Attached to the Declaration of Katrina Regan as Attachment A-1 is a summary of these studies and demonstrations, including those memorialized in the Hydrogen Compendium Report filed in this proceeding.[42] While there is no single study or demonstration that prompts this Petition—rather, it is the confluence of all the developments combined with the knowledge existing at the time the Decision was issued that results in a tipping point—the currently existing body of information confirms that hydrogen blending at low levels, such as up to 5% by volume, can be performed safely and effectively within existing natural gas distribution systems, with minimal or no modifications to the pipeline infrastructure and end-user equipment.

Based on these changed facts and circumstances since the issuance of the Decision, it is appropriate to seek modification of the Decision to eliminate the requirement to evaluate hydrogen blending from 0.1 to 5% in the medium-pressure (i.e., 60 psig or less) distribution system prior to proposing a Maximum 5% Injection Standard. This Petition could not have been presented within one year of the effective date of D.22-12-057 because, at a minimum, the Hydrogen Compendium Report which elaborates on the U.C. Riverside Study had not yet been completed. Moreover, even after the Hydrogen Compendium Report was filed in this proceeding, there was no opportunity for parties to comment on its impact.

IV. THERE IS NOW SUFFICIENT INFORMATION TO PROPOSE A MAXIMUM 5% INJECTION STANDARD FOR THE COMMISSION'S CONSIDERATION

On three separate occasions, the Commission asked the utilities to propose a renewable hydrogen injection standard.[43] In response to each Commission request, Joint Movants responded that they did not have sufficient information to do so.[44] Joint Movants appropriately adopted a conservative approach then and continue to maintain one today. Now, based on the comprehensiveness of the existing body of work regarding hydrogen blending, Joint Movants currently believe there is sufficient data and information to propose for the Commission's consideration of a Maximum 5% Injection Standard for their medium-pressure systems with only minimal or no modifications.

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42 Attachment A (Regan Decl.), Attachment A-1.

43 *Supra*, II.A.

44 *Id*.

The Decision cites the U.C. Riverside Study in finding a "need to conduct real world demonstrations of hydrogen blending under safe and controlled conditions."[45] As reflected in Attachment A-1, real world demonstrations deploying hydrogen into natural gas systems have occurred in the almost three years since the Decision was issued with respect to a Maximum 5% Injection Standard. The Hydrogen Compendium Report would provide a foundation for the Joint Utilities to propose a system-wide renewable hydrogen injection standard. There, relevant literature is catalogued by implications to pipeline operators, such as materials compatibility, metering/quality, leak detection choices, etc. Each study in Attachment A-1 focuses on different aspects of blending hydrogen into natural gas systems, such as system integrity, safety, operational practices, end-user equipment compatibility, and regulatory frameworks. Most studies concentrate on blend levels up to 20%, and their findings consistently report no major safety or performance issues at those concentrations. This suggests that lower blend ratios—such as 5% in medium-pressure distribution systems—are likely to remain well within established safety and feasibility thresholds. The demonstration and operationalization described in Attachment A-1 show that blending can work system-wide and/or at scale. In essence, the demonstration and operationalization prove that the findings of the various studies hold true when all different aspects of blending into a system are operationalized.

The following table summarizes the many notable demonstration projects that support proposing a conservative renewable hydrogen injection standard without further demonstration in Orange Cove:[46]

Utility / Demonstration	Year	Location	% Blend	Status	Makeup
United States					
Center Point Energy- Blending Demonstration[47]	2022	Minnesota, United States of America	Up to 5%	In operation	Natural gas distribution system; residential and commercial customers
Enbridge-ThermH2[48]	2023	Utah, United States of America	Up to 5%	Completed; 22-month demonstration	Natural gas distribution system; residential and commercial customers

Hawai'i Gas[49]	1974	Hawai'i, United States of America	15% to 20%	In operation; Additional blending planned[50]	Natural gas distribution system; residential and commercial customers
International					
Engie-GRHYD[51]	2014-2020	Cappelle-la-Grande, France	Up to 20%	Completed	Natural gas distribution system; residential and commercial customers
Cadent-HyDeploy Phase 1[52]	2019-2021	University Keele, United Kingdom	Up to 20%	Completed; 18-month demonstration	Natural gas distribution system; residential and commercial customers
Cadent-Hydeploy Phase 2[53]	2021-2022	Winlaton, United Kingdom	Up to 20%	Completed; 10-month demonstration	Natural gas distribution system; residential and commercial customers

45 D.22-12-057 at 56 (FOF 14).

46 Attachment A (Regan Decl.), Attachment A-1 at 5-6.

47 CenterPoint Energy, "Renewable Hydrogen" (Report No. 201229-02, Dec. 29, 2020), available at https://www.centerpointenergy.com/en-us/InYourCommunity/Documents/201229-02_Renewable%20Hydrogen.pdf.

48 Dominion Energy, "Dominion Energy Utah Starts Hydrogen Blending" (Oct. 10, 2023), available at https://investors.dominionenergy.com/news/press-release-details/2023/Dominion-Energy-Utah-Starts-Hydrogen-Blending/default.aspx.

49 Hawai'i Gas, "Hydrogen"; available at https://www.hawaiigas.com/sustainability/hydrogen.

50 Hawai'i Gas, "Eurus Energy America and BANA Pacific for Hydrogen and Renewable Natural Gas Projects" (Aug. 1, 2023), available at https://www.hawaiigas.com/posts/eurus-energy-america-and-bana-pacific-for-hydrogen-and-renewable-natural-gas-projects.

51 ENGIE, "The GRHYD Demonstration Project", available at https://www.engie.com/en/businesses/gas/hydrogen/power-to-gas/the-grhyd-demonstration-project.

52 HyDeploy, "HyDeploy at Keele: Live Pilot Demonstration Project", available at https://hydeploy.co.uk/hydrogen/hydeploy-at-keele-live-pilot/.

53 HyDeploy, "Green Light for First Hydrogen Blending on a Public Gas Network" (July 27, 2021), available at https://hydeploy.co.uk/about/news/green-light-for-first-hydrogen-blending-on-a-public-gas-network/.

ATCO Australia Hydrogen Blending Demonstration[54]	2022-2024	Cockburn Australia	Up to 10%	Completed; 1-year demonstration	Natural gas distribution system; residential and commercial customers
Firstgas- Te Horo Hydrogen Blending Pilot[55]	2025	Te Horo, New Zealand	Up to 15%	Completed; 4-month demonstration	Natural gas distribution system; residential customers
Australian Gas Infrastructure Group-Hydrogen Park South Australia: HyP SA[56]	2021	Marion, Australia	Up to 10%	In operation	Natural gas distribution system; residential and commercial customers
ATCO Fort Saskatchewan Distribution Demonstration[57]	2022	Fort Saskatchewan, AB, CAN	Up to 5%	In operation	Natural gas distribution system; residential and commercial customers

The Decision also found that further study was necessary because "the current understanding of the real-world implications of the use of hydrogen in California's gas system is limited."[58] That, too, has changed. For example, in 2023 SoCalGas commissioned its [H2] Innovation Experience, which showcases a clean, renewable hydrogen microgrid, along with hydrogen blending into common infrastructure and appliances in a home setting.[59] SDG&E also introduced hydrogen into the natural gas stream, feeding it into its Palomar Energy Center for

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54 CSIRO, "ATCO Hydrogen Blending Project – HyResource" (reviewed Mar. 2025), available at https://research.csiro.au/hyresource/atco-hydrogen-blending-project/.

55 Firstgas, "Inside New Zealand's First Hydrogen Blend Pilot" (Sept. 15, 2025), available at https://firstgas.co.nz/content-hub/inside-new-zealands-first-hydrogen-blend-pilot.

56 Australian Gas Infrastructure Group (AGIG), "Hydrogen Park South Australia", available at https://www.agig.com.au/hydrogen-park-south-australia.

57 ATCO, "Fort Saskatchewan Hydrogen Blending Project," available at https://gas.atco.com/en-ca/community/projects/fort- saskatchewan-hydrogen-blending-project.html.

58 *Id.* at 56 (FOF 16).

59 *See* "Lieutenant Governor Kounalakis Joins SoCalGas to Unveil First-of-its-Kind [H2] Innovation Experience"; available at: https://www.socalgas.com/newsroom/press-release/lieutenant-governor-kounalakis-joins-socalgas-to-unveil-first-of-its-kind-h2.

electric generation.[60] Southwest Gas has also explored the safety and viability of hydrogen blending outside of these proceedings.

Additional data would inform any system-wide injection standard that is ultimately proposed for the Commission's consideration (for example, system evaluation, area of influence, maximum and minimum flow rates, etc.)--just as provided for in considering and authorizing the SRGIT. The Joint Movants continue to maintain a conservative approach and would not propose an injection standard above 5% volume at this time for the natural gas medium-pressure distribution system (i.e., those operating at 60 psig or less). Such a conservative proposal aligns with the Decision's directive to establish a unified systemwide approach that accounts for the most vulnerable conditions across all infrastructure components.

V. CONCLUSION

Based on the significant information that has been developed regarding hydrogen blending in the years succeeding the issuance of the Decision, in combination with the data already known, Joint Movants respectfully request the Commission to grant this Petition and modify D.22-12-057 to eliminate the 5% Demonstration Requirement. Doing so will advance California's decarbonization goals promptly by allowing Joint Movants to propose a Maximum 5% Injection Standard for the Commission's consideration while promoting affordability for ratepayers by avoiding costs that no longer are needed to advance the Commission's stated goals.

Respectfully submitted,

By: */s/ Avisha A. Patel*
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February 3, 2026

[60] *See* Hydrogen at SDG&E; available at https://www.sdge.com/more-information/environment/sustainability-approach/hydrogen-innovation.

ATTACHMENT A

DECLARATION OF KATRINA REGAN

I, Katrina Regan, declare and state as follows:

1. I submit this declaration in support of the Petition for Modification of Decision 22-12-057 by Southern California Gas Company (SoCalGas) Regarding No Longer Requiring Hydrogen Blending Demonstration Project in Distribution System at 5% or Less (Petition).

2. I am currently employed at SoCalGas to lead the Engineering Development & Technology team. My business address is 555 West Fifth Street, Los Angeles, CA 90013. Currently, I lead the team's planning for live hydrogen blending demonstrations and regulatory applications. Prior to this, I held numerous positions within SoCalGas with increasing levels of responsibility including Associate Region Engineer, Lead Technical Supervisor, Field Project Advisor, Gas Control Outage Coordination Lead, and Business Development Project Manager. I have been employed at SoCalGas since 2011. I hold a Bachelor of Science degree in Civil Engineering from Loyola Marymount University. I have a Master's degree in Business Administration in Infrastructure Technology and Finance as well as a Graduate Certificate in Renewable Energy Engineering from the University of Massachusetts, Lowell. As a result of my position, experience, and expertise, I have personal knowledge of the facts and representations herein and, if called upon to testify, could and would do so, except for those facts expressly stated to be based upon information and belief, and to those matters, I believe them to be true.

3. Attached hereto as Attachment A-1 is a true and correct copy of a summary of research, study, demonstration, and operationalization both nationally and globally regarding hydrogen blending into natural gas. This summary was prepared at my direction and, upon information and belief, the matters stated therein are true and correct representations regarding reports of research, study, demonstration, and operationalization conducted nationally and around the world of which I am aware.

I declare under penalty of perjury under the laws of the State of California that the

foregoing is true and correct to the best of my knowledge, except as to those matters stated to be on information and belief and as to those matters, I believe them to be true and correct.

Executed this 3rd day of February 2026, at Los Angeles, California.

Katrina Regan

Katrina Regan

ATTACHMENT A-1

Summary of Research, Study, Demonstration, and Operationalization Regarding Hydrogen Blending into Natural Gas

I. Executive Summary

Since the California Public Utilities Commission (CPUC) issued Decision (D.) 22-12-057 in December 2022 directing the investor-owned gas utilities to propose hydrogen blending demonstrations,[1] significant information about hydrogen blending has been developed through both literature and global real-world demonstrations. In compliance with Ordering Paragraph (OP) 10 of that decision, the Joint Utilities filed the Hydrogen Blending Compendium Report on February 14, 2025, which expands upon the Hydrogen Blending Impact Report commissioned by the CPUC from UC Riverside (UCR) (UCR Study). This updated compilation of findings, combined with real-world blending projects and operationalization of hydrogen blending across the world, confirm that low-level hydrogen blending—particularly at concentrations up to five percent by volume—can be performed safely and effectively within existing natural gas distribution systems, with minimal or no modifications.

Natural gas pipeline systems in California are generally composed of two main classes of materials: metals and plastics. Each system is segmented into two subsystems: transmission and distribution. These systems are defined by the Pipeline and Hazardous Materials and Safety Administration (PHMSA) based on a pipeline's operating pressure compared to its Specified Minimum Yield Strength (SMYS). PHMSA defines distribution pipelines as operating below 20% SMYS, with transmission lines operating at above 20% SMYS. The transmission system has higher operating pressures and typically uses metal (steel) pipeline materials while the distribution system generally has lower operating pressures and is typically composed of a combination of steel and plastic pipeline materials. For the purposes of this summary, we are focused on the medium-pressure distribution system, which operates at less than 60 pounds per square inch gauge (psig). SoCalGas's and SDG&E's medium-pressure distribution systems use carbon steel with a range of American Petroleum Institute (API) grades for the metal materials, and medium-density polyethylene (MDPE) for the plastic materials. While SoCalGas and SDG&E operate mainly MDPE for its plastic material, some utilities in California, such as Southwest Gas, operate high-density polyethylene (HDPE). The impact of hydrogen blends on natural gas system components is driven by the partial pressure of hydrogen. Partial pressure refers to the pressure exerted by a gas alone (in this case, hydrogen) in a mixture of gases, essentially representing its contribution to the total pressure of the mixture.[2] Given the pressure observed in medium-pressure distribution systems (≤60 psig)) and the modest blend percentage (up to 5% hydrogen), the partial pressure of hydrogen experienced in the medium pressure

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[1] Among other things, the Decision found: "To address knowledge gaps, the UC Riverside Study emphasizes the need to conduct real world demonstrations of hydrogen blending under safe and controlled conditions." D.22-12-057 at 56 (FOF 14).

[2] Science Direct. "Dalton's law of partial pressure." Available at https://www.sciencedirect.com/topics/engineering/daltons-law-of-partial-pressure

distribution system would not exceed 3 psig, providing negligible impacts to system components.[3]

Real-world demonstrations of hydrogen blending – on both steel and plastic pipelines – have been successfully conducted, and hydrogen blending is even part of normal operations in some systems in the U.S. today. These efforts add to a growing body of information that, collectively, is sufficient to propose a conservative hydrogen injection standard (i.e., one that is no greater than 5% hydrogen by volume) for the medium-pressure distribution system, i.e., those operating at less 60 psig or less, that is both technically sound and operationally feasible. Such a standard would be consistent with the Decision's requirement that a single systemwide standard consider the most susceptible conditions observed throughout all infrastructure components.[4] Operational readiness adjustments can be addressed and incorporated in the development of an execution and implementation plan through the development of an interconnection tariff, as was done for the Standard Renewable Gas Interconnection Tariff in R.13-02-008.

Demonstrated Success in North America and Internationally

Multiple North American utilities in the United States and Canada have executed controlled hydrogen blending operations – including up to 15%.[5] Hydrogen blending projects have also been successfully executed beyond North America, including in Australia, the U.K., France, and New Zealand. These projects—many operating at blends of 5–20%—have served thousands of residential and commercial customers without adverse impacts on safety or reliability. In North America, utilities such as CenterPoint Energy, NW Natural, ATCO, and Enbridge have already integrated hydrogen blends into distribution networks, reinforcing the technical feasibility of blending at scale. Adoption of an initial 5% injection standard would be based on proven success, and continuing demonstrations for blends above 5% would inform future increases to an adopted low-level injection standard.

Additional Comprehensive Research Confirms Safety and Compatibility Sufficient to Propose a Hydrogen Injection Standard Up to 5% in the Medium-Pressure Distribution System

Post-2022 studies—including the Hydrogen Blending Compendium Report, HyBlend CRADA Phase I, and multiple industry-led projects—have addressed critical technical questions related to system integrity, safety, operations, and appliance performance:

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[3] See Hydrogen Blending Compendium Report, Literature Review at 4, which states: "Fatigue crack growth rate can be accelerated even at small partial pressures of hydrogen such as 1 bar (14.5 psig); however, it generally increases with increasing hydrogen concentration and it is more pronounced at higher stress levels." Partial Pressure of 3 psig is even smaller than the small partial pressure of 1 bar noted in the literature. Available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M556/K896/556896659.PDF.

[4] D.22-12-057 at 55 (FOF 12).

[5] *See* Appendix Table 1: *Relevant Utility Hydrogen Blending Demonstration Projects, US and Canada***.**

- Hydrogen Blending Compendium Report filed in R.13-02-008 on February 14, 2025 consolidates findings from numerous projects, and updates the record with research published July 2022 – August 2024. It specifically provides a more granular basis than the 2022 UCR Study to set numeric conditions and operator requirements, concluding that blends up to 20% hydrogen do not pose immediate safety or performance concerns for common appliances and distribution infrastructure. Odorants remain effective, polyethylene pipes are compatible, and leak rates do not significantly increase. The report also provides technical input for updates to American Society of Mechanical Engineers (ASME) B31.8 and B31.8S standards and includes chapter summaries which translate the literature into pipeline-operator implications (regarding materials compatibility, metering/quality, leak detection choices, etc.) that would inform conditions proposed in an injection standard.

- HyBlend Cooperative Research and Development Agreement (CRADA) is a U.S. Department of Energy (DOE) initiative focused on exploring the blending of hydrogen into natural gas pipelines to support decarbonization goals and the broader H2@Scale vision. This initiative has advanced understanding of material compatibility, pipeline integrity, techno-economic feasibility, and regulatory gaps. Phase II of the initiative is expanding into aging-related risks and safety assessments and will help inform potential future proposals for an injection standard above 5%.

- Additional projects have developed operating procedures, evaluated odorant performance, assessed flow meter accuracy, and established Consensus Engineering Requirements for hydrogen pipeline design and integrity management—informing future ASME standards.

- Appliance testing initiatives such as Hy4Homes and Future Fuels Cooperative Research Centre (CRC) confirm that residential and commercial appliances operate safely with blends up to 20% hydrogen, with no significant performance or safety issues observed.

Further study has already occurred since the Decision was issued that is sufficient to inform a conservative proposal of blending up to 5% hydrogen into the medium-pressure distribution system. The Hydrogen Blending Compendium Report includes an independent and comprehensive evaluation of research published between July 2022 through August 2024 and ongoing proceedings, exactly as required by OP 10 of D.22-12-057, and it catalogues both U.S. and Canadian utility pilots and the state of detection/materials science – substantially reducing uncertainty with regard to a conservative initial standard. The literature review does not identify significant increase in risk factors for low-level hydrogen blending (≤5%) for pipeline integrity or end-use appliances. Globally, hydrogen blending into natural gas networks is already being set within standards. Across Europe, regulatory frameworks permit blends ranging from 1% to 10%; in the U.S., in September 2025, Oregon standardized that hydrogen blends of up to 2.5% may proceed without notification, with disclosure required for higher levels.[6] Further, SoCalGas and SDG&E have performed hydrogen blending demonstrations at their own facilities. For example, in 2023 SoCalGas commissioned its [H2] Innovation

[6] *See* Oregon Senate Bill 685; available at https://olis.oregonlegislature.gov/liz/2025R1/Measures/Overview/SB685.

Experience, which showcases a clean, renewable hydrogen microgrid, along with hydrogen blending into common infrastructure and appliances in a home.[7] This work has built upon SoCalGas's demonstration project at its centralized training facility in 2021, when it evaluated the performance of household appliances and real-world infrastructure.[8] SDG&E also introduced hydrogen into its Palomar Energy Center for electric generation.[9] Southwest Gas has also explored the safety and viability of hydrogen blending outside of these proceedings.

Critically, both domestic and international standards organizations are actively incorporating hydrogen considerations into pipeline and appliance standards. Bodies such as ASME and the CSA Group have updated their frameworks to reflect hydrogen-natural gas blends. Notably, CSA Group has confirmed that existing appliance certifications remain valid for blends up to 5%, as these concentrations fall within parameters used during appliance testing. Similarly, UL Solutions now offers certification pathways for appliances as "H2-Compatible," including verification for existing equipment.

II. Blending Demonstrations in Operating Distribution Systems

The following table provides an overview of some of the hydrogen blending operations and demonstration projects across the U.S. and world that occurred in live, operational distribution pipelines. It highlights key details such as project timelines, geographic locations, hydrogen blend percentages, operational status, and system makeup. ATCO Gas and Pipelines has performed two separate demonstrations of hydrogen blending in Australia and in Canada, blending 10% and 5%, respectively, into their existing infrastructure with no infrastructure modifications—and no malfunctions were reported. Cadent's HyDeploy 2 project demonstrated the blending of 20% hydrogen in a portion of the natural gas distribution system serving more than 600 homes and small businesses in Winlaton, England with no reported impacts to plastic materials, steel materials, or leakage. In the United States, Enbridge is blending up to 5% hydrogen by volume into a live distribution system serving approximately 1,800 customers in the Delta, Utah vicinity.[10]

Tables included in this Appendix, sourced from the Hydrogen Blending Compendium Report, detail 19 demonstrations in the U.S. and Canada, as well as 39 other demonstrations internationally. These demonstrations reflect a growing global knowledge base on cautiously integrating hydrogen into existing natural gas distribution networks, with a focus on residential and commercial applications.

Table 1 – Notable Hydrogen Blending Demonstrations

Utility/ Demonstration	Year	Location	% Blend	Status (Duration)	Makeup
United States					
Center Point Energy-Blending Demonstration[11]	2022	Minnesota	Up to 5%	In operation	Natural gas distribution system; residential and commercial customers

Utility/ Demonstration	Year	Location	% Blend	Status (Duration)	Makeup
Enbridge-ThermH2[12]	2023	Utah	Up to 5%	Completed (22 months)	Natural gas distribution system; residential and commercial customers
Hawai'i Gas[13]	1974	Hawai'i	15% to 20% (increase planned14)	In operation	Natural gas distribution system; residential and commercial customers
International					
Engie-GRHYD[15]	2014-2020	Cappelle-la-Grande, France	Up to 20%	Completed	Natural gas distribution system; residential and commercial customers
Cadent-HyDeploy Phase 1[16]	2019-2021	University Keele, United Kingdom	Up to 20%	Completed (18 months)	Natural gas distribution system; residential and commercial customers

7 *See* "Lieutenant Governor Kounalakis Joins SoCalGas to Unveil First-of-its-Kind [H2] Innovation Experience"; available at: https://www.socalgas.com/newsroom/press-release/lieutenant-governor-kounalakis-joins-socalgas-to-unveil-first-of-its-kind-h2.

8 *See* SoCalGas Among First in the Nation to Test Hydrogen Blending in Real-World Infrastructure and Appliances in Closed Loop System; available at: https://www.socalgas.com/newsroom/press-release/socalgas-among-first-in-the-nation-to-test-hydrogen-blending-in-real-world.

9 *See* Hydrogen at SDG&E; available at https://www.sdge.com/more-information/environment/sustainability-approach/hydrogen-innovation.

10 *See* Therm H2- Hydrogen Blending Project; available at: https://www.enbridgegas.com/about-enbridge-gas/projects/hydrogen-blending-in-delta-utah.

11 CenterPoint Energy, "Renewable Hydrogen" (Report No. 201229-02, Dec. 29, 2020), available at https://www.centerpointenergy.com/en-us/InYourCommunity/Documents/201229-02_Renewable%20Hydrogen.pdf.

12 Dominion Energy, "Dominion Energy Utah Starts Hydrogen Blending" (Oct. 10, 2023), available at https://investors.dominionenergy.com/news/press-release-details/2023/Dominion-Energy-Utah-Starts-Hydrogen-Blending/default.aspx.

13 Hawai'i Gas, "Hydrogen"; available at https://www.hawaiigas.com/sustainability/hydrogen.

14 Hawai'i Gas, "Eurus Energy America and BANA Pacific for Hydrogen and Renewable Natural Gas Projects" (Aug. 1, 2023), available at https://www.hawaiigas.com/posts/eurus-energy-america-and-bana-pacific-for-hydrogen-and-renewable-natural-gas-projects.

15 ENGIE, "The GRHYD Demonstration Project", available at https://www.engie.com/en/businesses/gas/hydrogen/power-to-gas/the-grhyd-demonstration-project.

16 HyDeploy, "HyDeploy at Keele: Live Pilot Demonstration Project", available at https://hydeploy.co.uk/hydrogen/hydeploy-at-keele-live-pilot/.

Utility/ Demonstration	Year	Location	% Blend	Status (Duration)	Makeup
Cadent-Hydeploy Phase 2[17]	2021-2022	Winlaton, United Kingdom	Up to 20%	Completed (10 months)	Natural gas distribution system; residential and commercial customers
ATCO Australia Hydrogen Blending Demonstration[18]	2022-2024	Cockburn, Australia	Up to 10%	Completed (2 years)	Natural gas distribution system; residential and commercial customers
Firstgas- Te Horo Hydrogen Blending Pilot[19]	2025	Te Horo, New Zealand	Up to 15%	Completed (4 months)	Natural gas distribution system; residential customers
Australian Gas Infrastructure Group-Hydrogen Park South Australia: HyP SA[20]	2021	Marion, Australia	Up to 10%	In operation	Natural gas distribution system; residential and commercial customers
ATCO Fort Saskatchewan Distribution Demonstration21	2022	Fort Saskatchewan, AB, Canada	Up to 5%	In operation	Natural gas distribution system; residential and commercial customers

III. New Literature Published After D.22-12-057

The following table summarizes key hydrogen blending studies conducted or completed to date by various organizations, including utilities, national labs, and research institutions. Each study addresses different aspects of hydrogen integration into natural gas systems, ranging from system integrity and safety to operational practices, appliance compatibility, and regulatory frameworks. This overview highlights the breadth of research supporting hydrogen blending and identifies the specific focus areas covered by each project. The majority of these studies focus on

[17] HyDeploy, "Green Light for First Hydrogen Blending on a Public Gas Network" (July 27, 2021), available at https://hydeploy.co.uk/about/news/green-light-for-first-hydrogen-blending-on-a-public-gas-network/.

[18] CSIRO, "ATCO Hydrogen Blending Project – HyResource" (reviewed Mar. 2025), available at https://research.csiro.au/hyresource/atco-hydrogen-blending-project/.

[19] Firstgas, "Inside New Zealand's First Hydrogen Blend Pilot" (Sept. 15, 2025), available at https://firstgas.co.nz/content-hub/inside-new-zealands-first-hydrogen-blend-pilot.

[20] Australian Gas Infrastructure Group (AGIG), "Hydrogen Park South Australia", available at https://www.agig.com.au/hydrogen-park-south-australia.

[21] ATCO, "Fort Saskatchewan Hydrogen Blending Project," available at https://gas.atco.com/en-ca/community/projects/fort-saskatchewan-hydrogen-blending-project.html.

blends up to 20%, and their findings generally indicate no significant safety or performance concerns at higher levels, suggesting that lower concentrations within lower-pressure distribution systems—such as 5%—are likely to fall well within established safety margins. Notably, the Hydrogen Blending Compendium Report reviewed several demonstration projects evaluating impacts of hydrogen blending into local natural gas infrastructure and found that none of the projects employing hydrogen percentages up to 20% reported major challenges related to safety and performance characteristics of materials or components.[22] When examining pipeline materials, the report showed no significant impacts to mechanical properties of polyethylene materials, and found that impacts to steel materials is highly dependent on hydrogen concentration, stress levels, and loading cycles.

Detailed highlights from each project or study are provided in the section following the table.

Table 2 – Hydrogen Blending Literature Published Since 2022

No.	Study	Author	Topic				
			System Integrity	Safety	Operation	End-Use Appliances	Regulatory / Codes
1	Hydrogen Blending Compendium Report[23]	UC Riverside; Joint IOUs	X	X	X	X	X
2	HyBlend CRADA Phase I[24]	US Dept. Of Energy	X		X		
3	HyBlend CRADA Phase II*	US Dep. Of Energy	X	X			X
4	H2 Blending Recommended Practice and Operating Procedures*	OTD; GTI		X	X		
5	Evaluation Odorants for Hydrogen Services*	Emerging Fuels Institute; Kiwa Expert B.V.		X			
6	Verification of Performance and Measurement Capabilities of Flow Meters in Hydrogen*	Emerging Fuels Institute; DNV	X		X		
7	Consensus Engineering Requirements for Pipelines in Hydrogen	Emerging Fuels Institute; ROSEN	X				X

[22] Joint IOUs and UC Riverside, *Hydrogen Blending Compendium Report* (2025) (File ID: 556896659.PDF), Literature Review at 3.

[23] Joint IOUs and UC Riverside, *Hydrogen Blending Compendium Report* (2025) (File ID: 556896659.PDF).

[24] U.S. Department of Energy, *HyBlend: Opportunities for Hydrogen Blending in Natural Gas Pipelines* (2021), available at https://docs.nrel.gov/docs/fy25osti/94949.pdf

No.	Study	Author	Topic				
			System Integrity	Safety	Operation	End-Use Appliances	Regulatory / Codes
	and Hydrogen Blend Service*						
8	Consensus Engineering Requirements for Integrity Management of Hydrogen Pipelines*	Emerging Fuels Institute; ROSEN	X				X
9	Impacts of Hydrogen Blending on Gas Piping Materials[25]	American Gas Association	X	X			X
10	Hy4Homes Joint Industry Project: Appliance Testing for Hydrogen Blended Service*	DNV		X	X	X	
11	Safety and Performance Testing of End-Use Appliances*	Future Fuels CRC; The University of Adelaide, Australia		X	X	X	

*Reports are available through organization membership; HyBlend CRADA Phase II is currently in draft form but will be published publicly upon finalization.

A. *Hydrogen Blending Compendium Report (Compendium)*

Published collaboratively by the University of Riverside (UCR) and Pacific Gas and Electric Company, Southwest Gas Corporation, San Diego Gas & Electric Company, and Southern California Gas Company (collectively, Joint IOUs) in February 2025, the Hydrogen Blending Compendium Report continues the work of the UC Riverside Study and consolidates findings from hundreds of sources on hydrogen blending research and demonstration projects, including projects from July 2022 – August 2024. Key results show that blending up to 20% hydrogen into natural gas systems does not pose immediate safety or performance concerns for common appliances and infrastructure. Odorants remain effective, polyethylene pipes are compatible, and leak rates do not significantly increase. The report also provides technical input for standards development, including updates to ASME B31.8 and B31.8S. Overall, the report finds that natural gas piping materials appear compatible with hydrogen blended natural gas, and the sources cited in the paper indicate a blend up to 20% hydrogen may be acceptable.

[25] American Gas Association, *Impacts of Hydrogen Blending on Gas Piping Materials* (2023), available at https://www.aga.org/wp-content/uploads/2023/08/Impacts-of-Hydrogen-Blending-on-Gas-Piping-Ma_.pdf

B. *HyBlend CRADA*

The HyBlend CRADA Initiative, launched by the U.S. Department of Energy in 2021, is a collaborative effort among national laboratories and industry partners to enable hydrogen blending into U.S. natural gas pipeline systems. The project addresses technical, economic, and regulatory challenges of hydrogen and natural gas mixtures.

Phase I (Oct 2021–Sep 2024) focused on:

- Structural integrity and materials compatibility;
- Techno-economic analysis;
- Life cycle assessment; and
- Development of software tools for modeling pipeline integrity, economic feasibility, and preparation costs.

Phase II, currently underway, expands the scope to include:

- Aging-related risks in polymer piping;
- Safety and risk assessments; and
- Regulatory gap analysis.

C. *OTD H2 Blending Recommended Practice and Operating Procedures*

This Operational Technology Development (OTD) project published two white papers: one provides guidance for developing operating and maintenance procedures for hydrogen blending in distribution systems, and the other presents a high-level analysis of expected capital and operating costs for such projects.

D. *Evaluation Odorants for Hydrogen Services*

This project conducted lab experiments, including human olfactory testing, to identify promising sulfur-free odorants and recommend the best options for hydrogen applications.

E. *Verification of Performance and Measurement Capabilities of Flow Meters in Hydrogen*

This project evaluated various meter types, including ultrasonic, turbine, rotary, orifice/venturi, and Coriolis meters, for hydrogen readiness. It assessed calibration needs, performance impacts, and material compatibility, as well as flow-induced pulsations and the accuracy of hydrogen equations of state. The report also offers recommendations for designing and repurposing metering stations for hydrogen service.

F. *Consensus Engineering Requirements for Pipelines in Hydrogen and Hydrogen Blend Service*

This project developed Consensus Engineering Requirements (CERs) for hydrogen pipeline design and reuse. These CERs will serve as a foundation for discussions within the

ASME B31.8 Hydrogen Task Group, which is responsible for drafting a new exception chapter in the ASME B31.8 Gas Transmission and Distribution Piping Systems standard.

G. *Consensus Engineering Requirements for Integrity Management of Hydrogen Pipelines*

This project developed CERs for managing the integrity of hydrogen pipelines. These CERs will inform updates to ASME B31.8S to include hydrogen and hydrogen blends. The findings will be submitted to the ASME B31.8 hydrogen task group for inclusion in future editions.

H. *Hy4Homes Joint Industry Project: Appliance Testing for Hydrogen Blended Service*

This project, commissioned by ATCO and the Hy4Homes Joint Industry Project, tested 18 residential and commercial appliances to evaluate the effects of hydrogen blending. It focused on safety and performance, including flashback, overheating, emissions, and heat input, using both new and in-service appliances. Results showed no short-term issues up to 20% hydrogen blending, and all appliances tested under simulated one-year cycles performed without problems.

I. *Safety and Performance Testing of End-Use Appliances*

This project tested the compatibility of various appliance types with different hydrogen blend ratios. Residential appliances were evaluated with blends up to 20% hydrogen by volume using AS/NZS 5263 standards (i.e., Australian and New Zealand Standards), along with tests to identify the blend level at which safety or performance concerns arise. Results showed that blending up to 20% hydrogen does not pose immediate safety or operational issues for common appliances and burners used in Australian gas networks.

IV. Existing Blending Standards

Oregon's Senate Bill 685, signed in June 2025, marks a significant regulatory shift in the United States since the CPUC's 2022 decision. The law requires utilities to provide public notice and file with the Oregon Public Utility Commission for hydrogen blending only above 2.5% by volume in distribution systems. The transparency requirement for higher blends signals growing regulatory confidence in low-level hydrogen blending and a move toward formalizing oversight rather than mandating additional sub-5% demonstrations.

International experience with hydrogen blending provides valuable insights for shaping U.S. regulatory standards. Several countries have already established maximum allowable hydrogen concentrations in natural gas networks, typically ranging between 1% and 6%, with Germany permitting up to 10% under specific conditions. As noted above, in the U.S., the Oregon Legislature determined to allow injection of up to 2.5% hydrogen without notice to customers and, notably, did not place any upper limit on hydrogen blending. These determinations reflect a cautious approach to prioritize safety, infrastructure compatibility, and end-use performance while enabling gradual decarbonization of gas systems without unnecessary

delay. The table below summarizes current blending limits in selected countries and parts of the U.S., highlighting the diversity of regulatory frameworks and the emerging precedent for adopting hydrogen blending as a transitional strategy toward a low-carbon energy future.

Table 3 – Established Existing Hydrogen Blending Limits into Existing Infrastructure[26]

Country	Blending Limit (maximum)	Adoption Year
New Zealand[27]	10%	2025
Australia[28]	10%	2025
Austria[29]	10%	2023
Germany[30]	10%*	2021
France[31]	6%	2019
Spain[32]	5%	2024
United States - Oregon[33]	2.5%**	2025

[26] Zhang, Y., Wang, Y., Zhang, X., et al., "Techno-economic analysis of hydrogen blending into natural gas pipeline networks: A case study in China" (*International Journal of Hydrogen Energy*, Vol. 50, Issue 45, 2023), available at https://www.sciencedirect.com/science/article/pii/S0360319923030203.

[27] Standards New Zealand (NZS) 5442 – Specification for Reticulated Gas, revised October 2025 to explicitly allow hydrogen blending in distribution and align with Australia's AS 4564; available at: https://www.standards.govt.nz/news-and-updates/paving-the-way-for-renewable-gas-integration-a-new-chapter-in-nzs-reticulated-gas-standard.

[28] Australian Standard (AS 4564)- Specification for General Purpose Natural Gas revised to introduce a specific hydrogen limit of 10% by volume; available at https://apga.org.au/submissions/draft-as45642025-general-purpose-natural-gas#:~:text=Introducing%20a%20specific%20hydrogen%20limit,including%20specific%20contaminants%20for%20biomethane.

[29] The ÖVGW H E510 guideline (issued by the Austrian Gas and Water Association) allows up to 10% hydrogen by volume; available at: https://www.isinnova.org/Regatrace/austrian-gas-grid-allows-for-higher-hydrogen-share/#:~:text=The%20present%20guideline%20G%20B210,it%20will%20be%20ten%20percent.

[30] DVGW (German Technical and Scientific Associated for Gas and Water) Standard G 260.

[31] No single binding law that sets a hydrogen blending limit; however, the technical and regulatory framework is codified through gas quality specifications and operator guidelines with the primary reference being the French gas quality specification (NF EN 16726 and GRDF technical rules).

[32] Hydrogen Blending in Natural Gas Grid: Energy, Environmental, and Economic Implications in the Residential Sector.

[33] *See* Oregon Senate Bill 685 available at https://olis.oregonlegislature.gov/liz/2025R1/Downloads/MeasureDocument/SB685.

*Higher limit for Germany applies if there are no CNG filling stations connected to the network[34]

**Threshold for notice; higher concentration hydrogen injection may be allowed with notice.

V. End-Use Appliance Certification

As a practical matter, every single make and model of appliance that is currently in service today cannot be tested for compatibility with various blend percentages of hydrogen; as a consequence, the lack of absolute certainty about appliance performance with hydrogen blending is often heard as a concern. While each and every single appliance has not been tested, there is an existing certification framework that provides assurance for appliances at low blends. The CSA Group (formerly known as the Canadian Standards Association) is a global organization and leader in North American Standards, Testing, Inspection and Certification around the world. Their focus is to provide expert testing, inspection, and certification services that enable manufacturers to demonstrate that their products are in compliance with applicable safety, environmental, and operating performance standards for markets around the world.[35] They confirmed in 2022 that appliance certifications remain valid for natural gas containing up to 5% hydrogen by volume.[36]

Similarly, UL Solutions Group is another leading certification organization for appliances in North America who delivers testing, inspection, and certification services, plus software and advisory offerings that support utility customers' product innovation and business growth. UL Solutions Group has begun offering services for verification of equipment with hydrogen blends as "H2Ready" or "H2Compatible"[37] UL has the ability to test and certify vintage appliances as well, which may occur *in situ*. Further, UL 795 offers a certification path for boilers, furnaces, and air heaters for hydrogen blends up to 25% hydrogen by volume. These standards and certification practices indicate that hydrogen blends up to 5% do not pose a risk to appliance safety or performance.

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[34] International Energy Agency (IEA), "Limits on Hydrogen Blending in Natural Gas Networks, 2018" (last updated June 14, 2019), available at https://www.iea.org/data-and-statistics/charts/limits-on-hydrogen-blending-in-natural-gas-networks-2018.

[35] *CSA Group.* "About CSA Group." Available at: https://www.csagroup.org/about-csa-group/?srsltid=AfmBOorh-Ko-4tf4macRQ2HjBG-NcKSCCZr-xoZez-6x0n2miUTSbthQ.

[36] *American Society of Gas Engineers (ASGE).* "Update on End Use Codes & Standards." April 28, 2022. Available at: https://asge-national.org/agaupdate-20230428/.

[37] *See* UL Solutions H2 Compatible and H2 Ready Offerings; *available at*: https://verify.ul.com/verifications/1213.

VI. Appendix

The following tables are based on information in the Hydrogen Blending Compendium Report.

Table 4: Relevant Utility Hydrogen Blending Demonstration Projects, U.S. and Canada[38]

No.	Gas Utility	Location	Project	Sector	% Blend	Status as of 11/1/2024	Proceeding/ Docket
1	ATCO	AB,CAN	Distribution demonstration	Distribution	5%	Operational	Proceeding 27256 (Alberta Utility Commission)
2	ATCO	AB, CAN	Edmonton Convention Centre Hydrogen Blending	Distribution	20%	Completed	Proceeding 27256 (Alberta Utility Commission)
3	Calgary District Heating	AB, CAN	Hydrogen Blending District Heating	Distribution	20%	In Progress	Proceeding 27256 (Alberta Utility Commission)
4	CenterPoint Energy	MN, US	Renewable hydrogen distribution demo	Distribution	0.5% - 5%	Operational	Docket No. G-008/M-23-215 (Minnesota Public Utilities Commission)
5	Enbridge Gas Ohio (Dominion Energy Ohio)	OH, US	Hydrogen Heights Pilot Program	Operations and Training Facility; Distribution	5%	Launched pilot	23-0894-GA-AIR (Public Utilities Commission of Ohio)
6	Dominion Energy	VA, US	Dominion Energy H2 Blending Pilot Projects	Distribution	up to 5%	Pilot Phase	Not Applicable (N/A)
7	Enbridge	ON, CAN	Green hydrogen distribution demonstration	Distribution	2%	Operational	EB-2019-0294 (Ontario Energy Board)
8	Enbridge Energy (previously called	UT, US	ThermH2 Project Phase 2 - Delta	Distribution	5%	Operational	N/A

[38] *See Hydrogen Blending Compendium Report*, Summary of Regulatory Proceedings at 2-5; available at https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M556/K896/556896659.PDF.

No.	Gas Utility	Location	Project	Sector	% Blend	Status as of 11/1/2024	Proceeding/ Docket
	Dominion Energy)						
9	Gazifère Inc	QC, CAN	Gatineau Green Hydrogen Project	Distribution	Not Specified	Not Specified	N/A
10	Hawai'i Gas	HI, US	20% Blend	Production and Distribution	15%	In Operation & Planning	Docket No. 2024-0158 (Hawaii Public Utilities Commission)
11	Liberty Utilities	NB, CAN	MOU between Nu:ionic and Liberty Utilities	Production and Distribution	Not Specified	Planning	Unknown
12	Liberty Utilities - New York Gas	NY, US	Massena Blending Test	Production and Distribution	Not Specified	Operational	N/A
13	National Grid	NY, US	HyGrid	Distribution	5%	On hold	Case 23-G-0226 §9 (New York Public Service Commission)
14	New Jersey Natural Gas	NJ, US	Green hydrogen distribution demonstration	Distribution	< 1 %	Operational	Docket GR21030679 (New Jersey Board of Public Utilities)
15	New Mexico Gas Company	NM, US	Hydrogen Blending Demonstration: Phase 1 Onsite Blending, Phase 2: Distribution Demonstration	Distribution	5%	In Planning	No. 23-00255-UT (New Mexico Public Regulation Commission)
16	Columbia Gas of Pennsylvania	PA, US	NiSource Hydrogen Blending Project	Distribution and end-use	2-10%	Pilot Phase	Docket No. R-2024-3046519 (Pennsylvania Public Utility Commission)
17	NW Natural	OR, US	Methane Pyrolysis, Hydrogen Blending in Training Facility, Blending into Distribution	Operations and Training Facility; Distribution	< 1%	In Operation	Docket UG 490 (Oregon Public Utilities Commission)

No.	Gas Utility	Location	Project	Sector	% Blend	Status as of 11/1/2024	Proceeding/ Docket
18	Puget Sound Energy	WA, US	PSE Hydrogen Blending Pilot Project	Operations and Training Facility; Distribution	Up to 15%	Pilot Phase	UE-240004 & UG-240005 (Washington Utilities and Transportation Commission)
19	Xcel Energy	CO, US	Hydrogen-Natural Gas Blending Demonstration Project	Distribution and end use	Not specified	Planning	23A-0392EG (Colorado Public Utilities Commission)

Table 5: Hydrogen Blending Demonstration Projects, Worldwide[39]

No.	Company	Country	Project	Sector	% Blend	Status	Timeline
1	Aragon Hydrogen Foundation (FHA)	Spain	HIGGS (hydrogen in gas grids) - FHA facilities	Transmission	20% & 100%	Operational	2020-2023
2	ATCO	Australia	Renewable hydrogen distribution demo	Distribution	10%	Planning	2022
3	Australian Gas Infrastructure Group	Australia	Hydrogen Park South Australia (HyP SA)	Distribution	5%	Operational	2021
4	Australian Gas Infrastructure Group	Australia	Hydrogen Park Gladstone	Distribution	10%	In Planning	2022
5	Australian Gas	Australia	Hydrogen Park Murray Valley	Distribution	10%	Construction	Construction in 2023,

[39] *Id*. at 5-10.

No.	Company	Country	Project	Sector	% Blend	Status	Timeline
	Infrastructure Group						Operational in 2025 --> 2030
6	Beijing Gas, SK E&S, Tsinghua University	China	Beijing Green Hydrogen Demonstration	Production and distribution	Unknown	In planning	2022 to present
7	Cadent	United Kingdom	HyDeploy - Keele	Distribution	20%	Complete	2019 to 2021
8	Cadent	United Kingdom	HyDeploy - Winlaton	Distribution	20%	Complete	Aug 2021 to June 2022
9	CIIEG	Colombia	Promigas H2Lab	Transmission and distribution	Various	Operational	2022 to present
10	CNPC, PetroChina, Sinopec	China	PetroChina/CNPC	Transmission	Up to 24%	Pilot	2023 to present
11	Department of Science and Innovation, Bambili Energy	South Africa	Hydrogen Valley South Africa	Distribution	Various (includes direct use)	In development	2021 to present
12	DNV, National Gas Transmission (NGT), OFGEM	United Kingdom	FutureGrid	Transmission	Various (up to 100% tested)	Operational	2021 to present
13	E.ON, Avacon, DVGW	Germany	H2-20 Hydrogen Blending Project	Distribution and end-use	Up to 20%	Operational	2021 to present
14	EDP, Galp, REN, ENGIE, Bondalti, McPhy, and others	Portugal	GreenH2Atlantic	Production and distribution	Up to 5% initially	In development	2021 to present
15	Enagás, Acciona, CEMEX, IDEA, others	Spain	Green Hysland	Production, distribution and end-use	Various (includes direct use)	Operational	2021 to present
16	Energinet	Denmark	Hydrogen Maturation Project	Transmission	Up to 15%	Demonstration	2022 to present
17	ENGIE	France	GRHYD - neighborhood	Distribution	20%	Complete	2014 to 2019

No.	Company	Country	Project	Sector	% Blend	Status	Timeline
			and NGV refueling station (distribution)				
18	EWE, GASCADE	Germany	Hy2Infra	Transmission and distribution	Up to 100%	Operational	2024
19	FGSZ Ltd., MVM Group, University of Miskolc	Hungary	GLUMEN Project	Transmission	Up to 10% proposed	Feasibility study	2023 to present
20	Firstgas Group, Hiringa Energy, Venture Taranaki, Others	New Zealand	H2 Taranaki Roadmap	Distribution	Up to 20% by 2035	In planning	2025 (planned)
21	Fluxys, Eoly, Parkwind	Belgium	HYOFFWIND	Undefined	2%	Planning	First H2 by 2026
22	Gas Networks Ireland	Ireland	HyTest (Phase 1), HyEnd (Phase 2)	Distribution	Up to 20%	In planning	2021 to present
23	GASCADE Gastransport GmbH	Germany	HH2E	Transmission	Unknown	In Development	2018 to present
24	GasTerra	Netherlands	Hydrogen in natural gas on Ameland	Distribution and end use	up to 20%	Complete	2007 - 2011
25	Gasvalpo, PietroFiorentini	Chile	Gasvalpo H2GN Project	Distribution	20%	Operational	2022
26	GNL Quintero, Acciona Energia, Enagas	Chile	Green Hydrogen Quintero Bay	Distribution	Not Specified	In Development	Not Specified
27	GRTGaz	France	Jupiter 1000	Distribution	6%	Operational	2018 to 2023
28	Jemena	Australia	Western Sydney Green Gas Project	Distribution	2%	Operational	2021 to 2026
29	Jemena, Solarig	Australia		Distribution		Planning	MOU signed 2024
30	Netze BW (EBKG.DE)	Germany	Hydrogen blends to home heating	Distribution	30%	Operational	2023

No.	Company	Country	Project	Sector	% Blend	Status	Timeline
31	New Energy Coalition, Gasunie, Groningen Seaports, Others	Netherlands	HEAVENN (H2 Energy Applications in Valley Environments for Northern Netherlands)	Production, distribution and end use	Various (includes 100% hydrogen pipelines)	In development	2020 to present
32	Nortegas	Spain	H2sArea	Distribution	10-20%	Complete	2021 to 2023
33	Petronas, Eneos Corporation	Malaysia	Hydrogen-to-MCH	Distribution and end use	Up to 5% initially	In development	2022 to present
34	Portuguese Government, OMIP	Portugal	Portugal H2 and Biomethane Blending Tender	Distribution	5-20%	Tender Open	2024
35	RAG Austria AG	Spain	EUH2STARS	Storage	Pure H2 Storage	Planning	Through 2029
36	Scottish Gas Network (SGN)	Scotland	The Aberdeen Vision	Transmission	2%	In Planning	2018-2028
37	Snam	Italy	Pasta factory and a mineral water bottling company (transmission demo)	Transmission	5 & 10%	Complete	2019 to 2020
38	ThueGA Group, Energie Suedbayern, Energienetze Bayern, H2Go Power	Germany	H2Direkt	Distribution	Up to 100%	Pilot Project Completed, in development	2021 to present
39	Uniper, Siemens, Linde	Germany	Green Hydro Chem Central Germany	Distribution	Unknown	In planning	2019 to present

ATTACHMENT B

PROPOSED MODIFICATIONS TO D.22-12-057

SoCalGas proposes the following modifications to D.22-12-057:

Decision Body

Modify Section 3.2.4.2 (p. 27):

> Consistent with the UC Riverside Study, we find that pilot projects should be used to evaluate hydrogen injection at blends ~~**between 0.1 and five percent, and**~~ between five and twenty percent, as further specified in this decision. Any proposed pilot project should be designed to avoid hydrogen from reaching natural gas storage areas and electrical switching equipment directly or through leakage. Real-world pilot projects should be performed in either a closed system or in a mock-up of a real-world system using typical equipment and materials found in California gas infrastructure. Additionally, the pilot projects must be designed to evaluate whether hydrogen blending will pose minimal risk to distribution and transmission pipeline integrity and whether blending fuel use will result in end user appliance malfunctions. Pilot projects should focus on ensuring long-term safety of the California pipeline, hydrogen leakage, and hydrogen monitoring, as well as the dilution rate and other mechanical characteristics of hydrogen blends in the natural gas pipeline stream.

Decision Conclusions of Law ("COL")

Modify COL 9 as follows:

> Proposed pilot projects should aim to evaluate hydrogen injection at blends between ~~**0.1 and five percent, and between**~~ five and twenty percent, as further specified in this decision.

Decision Ordering Paragraphs ("OP")

Modify OP 7.d:[1]

> d. Evaluates hydrogen injection at blends between ~~**0.1 and five percent and**~~ five to twenty percent; such evaluations must adhere to approved monitoring, reporting, and long-term impact study in accordance with the approval of the pilot project application, and must include validation programs to confirm performance;

[1] As corrected by D.23-02-043.