

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**



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Application of Southern California Gas Company (U904G), San Diego Gas & Electric Company (U902), Pacific Gas and Electric Company (U39G) and Southwest Gas Corporation (U905G) to Establish Hydrogen Blending Demonstration Projects.

Application 22-09-006
(Filed September 8, 2022)

OPENING BRIEF OF ENVIRONMENTAL DEFENSE FUND

May 4, 2026

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SUMMARY OF ENVIRONMENTAL DEFENSE FUND’S RECOMMENDATIONS

EDF recommends that the Commission deny these costly and uninformative pilot proposals.

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(Filed September 8, 2022)

OPENING BRIEF OF ENVIRONMENTAL DEFENSE FUND

In accordance with Rule 13.12 of the California Public Utilities Commission (“Commission”) Rules of Practice and Procedure and Administrative Law Judge (“ALJ”) Ferguson’s March 9, 2026 Email Ruling providing Directives and Guidance for Final Briefing, Environmental Defense Fund (“EDF”) respectfully submits its opening brief in this proceeding.¹

As detailed below, EDF recommends that the Commission deny the proposed pilot proposals.

I. Introduction

Four California gas utilities, Southern California Gas Company (“SoCalGas”), San Diego Gas & Electric Company (“SDG&E”), Southwest Gas Corporation (“SW Gas”) and Pacific Gas and Electric Company (“PG&E”) have submitted an Amended Joint Application seeking Commission authorization for five pilot projects to “test the ability

¹ EDF is one of the world’s largest environmental advocacy organizations, with more than 2.5 million members worldwide and more than 500,000 supporters in California, including members located within each of the applicants’ service territories.

of the existing statewide gas infrastructure to store and transport safely natural gas blended with hydrogen above the currently allowable level of 0.1 percent.”² The gas utilities submitted this Amended Application in response to Decision (“D.”) 22-12-057, in which the Commission ordered the utilities to submit pilot *proposals* and established criteria for those proposals after recognizing that preliminary proposals had already been submitted in this proceeding.³ That decision did not commit to approving the proposed pilots, and EDF notes that the intent of that decision was to start a conversation about whether blending hydrogen into the existing gas pipeline could have merit, taking into consideration issues including cost/benefit and safety. Based on EDF’s assessment of the voluminous record developed since September 2022, the answer to that question is clearly “no.”

In accordance with the Assigned Commissioner’s Scoping Ruling, each of the pilot proposals must be evaluated to determine that it conforms to regulatory requirements, is useful and well designed, prudent, safe and equitable.⁴ For the reasons discussed herein, EDF urges the Commission to deny authorization of all five pilots proposed in the Amended Joint Application. The applicants have not established that the proposed pilots are useful, prudent, safe and equitable. Spending more than \$200 million ratepayer dollars, in the absence of any legislative mandate or authorization, on these

² Assigned Commissioner’s Scoping Memo and Ruling (June 12, 2025) (“Scoping Ruling”) pp. 3-4.

³ See D.22-12-057 at 51 and Ordering Paragraph 7.

⁴ Scoping Ruling pp.11-13.

unnecessary, costly and unsafe pilot projects would not result in just and reasonable rates, particularly at a time when many customers are already facing unaffordable utility bills.

As instructed by ALJ Ferguson and consistent with the Scoping Ruling, EDF addresses the specific shortcomings of the five proposed pilot projects. In particular, EDF expresses concerns regarding the cost of the pilots and the impact of the pilots on public safety, including physical pipeline safety and environmental harm. EDF also questions whether the pilots are designed to provide sufficient ratepayer benefits to justify the proposed expenditures, and whether the pilots advance California's clean energy and climate goals. All of the applicants seek to recover all of the costs of their projects from natural gas customers. The applicants rely on general claims regarding the potential of hydrogen as a decarbonization strategy for California. However, a meaningful demonstration that these blending demonstration pilots will benefit all ratepayers is lacking.

EDF is concerned that the contribution to decarbonization (if any) of the pilots proposed here would be minimal and not cost-effective compared with alternatives. The benefits are naturally capped because there is only so much hydrogen that can be safely transported in the natural gas pipeline. This limitation results in a relatively low decarbonization potential and the lack of scale makes it hard to justify any major investment. As a result, the pilots will not serve as a meaningful step toward hydrogen pipeline development. Further, the proposed pilots are not focused on the right customer sectors, since residential and commercial customers are able to more cost-effectively decarbonize through electrification, using commercially available technologies.

The Commission can and should acknowledge that implementation of these pilots would be significantly more costly on a \$/GHG reduction basis compared to technologies currently available for residential and other small core gas customers. The applicants have provided no showing of a connection between these pilots and advancing the use of hydrogen to serve non-core customers (which tend to be the harder-to-electrify end users of gas), which should be the focus of the Commission’s hydrogen research and development efforts. These pilots appear to be a wasteful “bridge to nowhere” and should be rejected.

As instructed in the ALJ’s March 9, 2026 Ruling, the argument below relates only to the five pilot project proposals under consideration in this proceeding, or where specified, to an individual project. The argument below is organized around the issues identified in the Scoping Ruling.

II. The proposed pilots are not useful or well designed.

A fundamental question identified as Issue 2 in the Assigned Commissioner’s Scoping Ruling is whether the proposed pilots are “useful and well designed.”⁵ Issue 2.b is more specific, asking “[h]ow will the additional knowledge, contributed by each project, be useful to utility operators and state policy makers?”⁶ Underlying this question is the Commission’s finding that the pilot projects “should produce important information about the potential for significant carbon reductions if a system-wide hydrogen injection

⁵ Scoping Ruling p.11.

⁶ Id.

standard is adopted.”⁷ It is with respect to this metric that that the five proposed pilots fail.

Three of the five pilots have been designed to deliver natural gas blended with hydrogen to residential and commercial customers. The SoCalGas Orange Cove Distribution Project (“Orange Cove project”) is specifically designed to replace natural gas deliveries with blended hydrogen/gas deliveries to thousands of residential and commercial locations.⁸ As discussed further below, this project raises many questions regarding safety, cost and community impact. But as a threshold matter, it also does not pass the usefulness test because apparently in designing this complex large-scale pilot the applicant did not take into consideration the fact that demonstrating delivery of blended hydrogen to the selected classes of customers is objectively not “useful” and will not under any circumstance produce important information about the potential for significant carbon reductions.

There is ample evidence in the record, and it is widely accepted by California policy makers that electrification is the most efficient and cost-effective route to decarbonization for residential customers and commercial and institutional buildings.⁹ For example, a recent Switchbox study sponsored by EDF, evaluating the efficacy of hydrogen blending in the building sector in New York, found that supplying electricity directly to heat pumps and appliances is a more efficient and effective method of

⁷ Decision 22-12-057 at 37 and Finding of Fact 38.

⁸ Amended Application p. 13.

⁹ See Exh. EDF-01 pp. 11.

decarbonization than hydrogen blending.¹⁰ Another recent peer-reviewed article found that:

Considering its physical and chemical properties, hydrogen is not an effective decarbonization tool for use in homes and buildings. For any decarbonization strategy, it is critical to determine if a fuel is in fact needed, and to compare with potentially more effective options such as direct electrification using renewably generated electricity.¹¹

Any outcome of the proposed Orange Cove project will not change the fact that hydrogen blending cannot compete with electrification to decarbonize residential and commercial end users. EDF's assessment is that this project would be a waste of ratepayer money and time. It would also likely delay or obstruct projects aimed at decarbonization through electrification and expansion of distributed renewable energy and storage facilities for the customers in Orange Cove.

The SW Gas Cold Climate Distribution Project ("SW Gas project") and UC Irvine Distribution Project ("UC Irvine project") likewise should be rejected on grounds that they do not pass the "usefulness" test. The SW Gas Project is designed to serve three comparatively large buildings located in Truckee's business district: a SW Gas building, a California Highway Patrol office building, and a newly constructed multi-use commercial/residential building in Truckee.¹² The UC Irvine project similarly is designed

¹⁰ Exh. EDF-01 Att B-4, Max Shron, et al., *Blending Hydrogen & Natural Gas: A Road to Nowhere for New Yorkers* (Environmental Defense Fund and Switchbox, 2024) ("Switchbox Report"). Comparing the energy intensities and emissions impacts of green hydrogen and heat pumps, the report demonstrates "the inefficiency and ineffectiveness of hydrogen/natural gas blending, either as an interim solution or as a stepping stone to a fully decarbonized building sector." Id. p. 9.

¹¹ Exh. EDF-01 Att B-1, Martin P., Ocko I.B., Equivel-Elizondo S., et al. A review of challenges with using the natural gas system for hydrogen. *Energy Sci. Eng.* 2024; 12: 3995-4009 ("Martin et al. (2024)") pp. 4006-07.

¹² Scoping Ruling p. 9.

around the delivery of blended gas to institutional buildings, including to furnaces, water heaters and stovetops, located on the UC Irvine campus.¹³

Again, the design is a fatal flaw in these two proposed pilots because they will not contribute useful, actionable knowledge to the utilities, their customers or policy makers, nor demonstrate the potential for providing “significant” carbon reduction. Rather the two pilots are designed around delivery of blended hydrogen to buildings and institutional appliances and heating systems that would most effectively be decarbonized by the well-established means of electrification and/or addition of distributed energy and storage. If the applicants’ intent was to test hydrogen blending under specific conditions that they claim had not been tested elsewhere (e.g. SW Gas’s focus on “high altitude/cold climate” environmental conditions), it plainly is not necessary to involve delivery of blended gas to commercial and institutional buildings that, by definition, do not fall within the category of “hard-to-electrify” locations that could potentially benefit from the introduction of hydrogen as a replacement fuel source.

Neither SoCalGas nor SW Gas offer a convincing explanation of why the proposed pilots need to be designed to deliver blended gas to the targeted appliances. The record further suggests that this aspect of the project designs for three of the five pilots is simply duplicative of other projects.¹⁴

Turning to the PG&E Gas Transmission project, the concern is different. On the surface, this project may appear to be potentially useful, since most of the hard-to-

¹³ Id. p. 10.

¹⁴ See, e.g., Exh. SCG-01R at pp. 17, 21.

decarbonize customers that are the appropriate target for hydrogen project development efforts are directly connected at the natural gas transmission level (as opposed to the distribution system). The problem is that this very expensive project for testing hydrogen blending in a closed loop pipe is not going to provide data that could subsequently be used to develop a useful hydrogen solution for these targeted hard-to-decarbonize industrial customers.

The natural gas transmission system is not isolated from the natural gas distribution system. In fact, per a PG&E data request response, there are no locations on PG&E's gas system where blending hydrogen into the transmission level pipe does not then flow into the distribution pipe:

[PG&E] cannot currently deliver hydrogen blends to customers (of which there are 469 in the classes EDF identified) that are supplied natural gas from our existing transmission pipeline without the hydrogen blends flowing downstream into the distribution pipeline. This is because our current transmission system is fully interconnected with the distribution system. Even if hydrogen were to be injected on the service line to the customer (at the terminus of a transmission line), there is the potential for the hydrogen blend to flow backwards, unless system modifications are made to prevent such backflow. Such modifications would depend on the situation at hand, but would include one-way check valves, specialized meters, specialized monitoring equipment, compatible seals and gaskets, and potential pipe replacements.¹⁵

What the above means is that PG&E's proposed Gas Transmission Project is not designed to serve as a useful step toward developing a hydrogen solution for hard-to-decarbonize industrial natural gas customers. It is a dead-end project that will cost \$92

¹⁵ Exh. EDF-01 p.15, citing Exh. EDF-01 Att B-13, PG&E Data Response to Environmental Defense Fund Request EDF-PG&E-01, Answer to Question 001.

million dollars and entail risk of leakage and other safety risks in the disadvantaged community of Lodi, while not leading to a sustainable, scalable application for target customers.

The SDG&E Isolated Distribution Project (“SDG&E project”) design raises many questions. The project proposes to blend hydrogen in polyethylene pipe and deliver it to a fuel cell. The pilot design is represented as being “aligned with” the United Kingdom HyDeploy project, which also tested hydrogen blending in polyethylene pipe, but does not adequately explain why millions of California ratepayer dollars need to be spent on what appears to be a duplicative project.¹⁶ The project design includes a fuel cell, but one that has, according to SDG&E, already been manufacturer approved to accept at least twenty percent hydrogen by volume, suggesting there is no need for this pilot.¹⁷ SDG&E’s vague response, that it “must connect an end use appliance application to its test loop” and that it is “doing so safely and also creating a useful product and demonstrating an important use of hydrogen— generating electricity for the grid,” is nonresponsive and begs the question.¹⁸

¹⁶ Exh. SDGE-03 p. 17.

¹⁷ Id. p. 16.

¹⁸ Exh. SDGE-05 p. KP-15.

III. The proposed pilots are not a prudent use of ratepayer funds.

A. Reviewing the prudence of the proposed pilots.

While the applicants were instructed in Decision 22-12-057 to submit hydrogen blending proposals, the Commission's order did not guarantee the approval of any proposal. In Decision 21-07-005, which initially rejected three phased hydrogen blending proposals, the Commission instructed that if the utilities were to again seek funds to examine hydrogen blending they must "present a program to address necessary research and demonstration that is *just and reasonable, efficient, and cost effective*."¹⁹ In Decision 22-12-057 the Commission again clarified that "[t]he projected costs of the proposed pilots will be considered as part of the Commission's evaluation of the utility applications."²⁰ For purposes of conducting this evaluation of the prudence of the proposed pilot projects, the Scoping Order identified as relevant questions, *inter alia*:

- What specific benefits will gas customers receive from investment in these pilot projects?
- What cost-sharing arrangements have been made or pursued with potential non-ratepayer beneficiaries of this research?²¹

Each applicant has the burden of addressing these questions and justifying the prudence of its proposed pilot(s).

Context is important in considering whether investment of ratepayer funding of the proposed pilots is prudent. The economic and regulatory environment in 2026 is different from when the Commission originally authorized the utilities to propose

¹⁹ D.21-07-005 p. 22 (emphasis added).

²⁰ D.22-12-057 p. 37 and Conclusion of Law 10.

²¹ Scoping Ruling p. 12.

hydrogen blending pilots in 2022. Several factors are relevant here as the Commission considers whether the proposed pilots are cost-justified at this point.

Ratepayers are recently facing serious affordability challenges and will be for the foreseeable future.²² Natural gas rates are expected to increase in coming years. The California Energy Commission projects that a decade from now, natural gas prices will be double what they were in 2025.²³ These rate increases will eliminate the potential cost effectiveness of blending hydrogen in the natural gas system. At the same time, electricity rates are going up too, making it harder for ratepayers to manage utility costs day-to-day and increasing the importance of ensuring that every ratepayer dollar invested into research and development is cost justified.

Another recent development is the loss of some sources of federal assistance to help fund California utility research and development projects. This has apparently affected the pilot projects proposed in this proceeding, in that the Amended Application does not identify any source of federal support. In denying funding for a \$16 million SDG&E hydrogen pilot in the most recent SoCalGas/SDG&E general rate case, the Commission noted its responsibility to carefully weigh costs and benefits:

We are currently facing a unique situation where we must balance affordability in rates, achieve our decarbonization goals, and test technological advancements for regulated monopolies. To navigate this complex situation, we need to come up with creative solutions, such as leveraging public-private investments or federal funding. Currently, SDG&E earns a rate of return on its capital costs paid by

²² Decision 24-12-074 at 2 (“California ratepayers are facing an affordability crisis with record-high arrearages and utility bills.”)

²³ Exh. EDF-01 pp.16-18, citing Exh. EDF-01 Att B-12, CEC Staff, “Presentation – Gas End-Use Rates” Docket 25-IEPR-03, June 6, 2025.

the ratepayers. However, a triad partnership, which can include private investments from businesses interested in promoting and testing their technology, may provide a more reasonable and cost-effective approach for ratepayers. SDG&E should reconsider this proposal with a fresh perspective to take advantage of private institutions that want to test their technology and other public funding sources to help reduce costs to ratepayers. A public-private partnership or an additional funding stream may help move these capital-intensive pilot projects forward.²⁴

The Commission has recognized that ratepayers should not be burdened with the cost of utility projects that primarily benefit non-ratepayer parties, or that could benefit from financial support from public or private research institutions.

The Commission should take all relevant factors into consideration in evaluating whether the applicants have met their burden of justifying the cost of these proposed pilots in the current economic and regulatory environment.

B. The cost of the proposed pilots has not been justified by a showing of commensurate benefits to ratepayers.

The applicants have not met their obligation to demonstrate that the proposed pilots are a prudent investment for ratepayers. The pilots are neither “just and reasonable,” “efficient,” nor “cost effective.” The total proposed budget has ballooned from the \$31.8 million requested for the projects rejected in Decision 21-07-005 to over \$200 million for the projects proposed in the Amended Application.²⁵ The utilities have also not identified outside funding sources.²⁶

²⁴ Decision 24-12-074 at 406.

²⁵ Compare D.21-07-005, Finding of Fact 5 and Amended Application pp. 16-18.

²⁶ See Amended Application pp. 22-23.

The budgets for each of the proposed pilots include the very high cost of hydrogen production and many other expenses associated with trying to mitigate the risks associated with this novel experiment. At the same time, the demonstration value of the pilots is limited because the projects cannot be cost-effectively scaled up.²⁷ The applicants offer proposals for differently configured projects, but none of the proposals identify a long-term financial benefit to all ratepayers that would justify the proposed level of expenditure for these costly projects.

For most residential customers and for commercial buildings, natural gas is used for space and water heating and for cooking. Each of these functions can be decarbonized more cost-effectively via electrification. As noted by the Public Advocates Office, the California Air Resources Board has recognized electrification as the most efficient and cost-effective method of achieving greenhouse gas (“GHG”) reductions for building decarbonization, and this Commission’s staff have deemed electrification the “*best fit for decarbonizing homes and commercial buildings*.”²⁸ The Amended Application does not make a case showing that any blend of hydrogen and gas will be cost-competitive with electrification. Thus, the foundational justification for these pilots, three of which are exclusively focused on residential, institutional and commercial uses, is missing.

²⁷ Exh. EDF-01 pp. 14-18.

²⁸ Exh. CADV-01 p. 2-2 (emphasis added), citing 2024 Joint Agency Staff Paper: Progress Towards a Gas Transition, in R.20-01-007, February 22, 2024, at 14
<https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M525/K660/525660391.PDF>.

First, there is the cost of hydrogen. Decision 22-12-057 required use of “clean renewable hydrogen.”²⁹ Recent studies have shown that green hydrogen is expensive, at \$3.50 to \$6.00 per kilogram.³⁰ Second, there is the cost of delivering blended hydrogen. Retrofitting the existing gas system to accommodate a blend level of hydrogen is costly because hydrogen presents several challenges for pipeline transmission due to its lower energy density compared to natural gas. Specifically, hydrogen has about one-third the energy per unit volume of natural gas, making it difficult to transport the same amount of energy using existing pipelines efficiently. If typical pipelines were to handle hydrogen, the energy transfer would drop to one-ninth of what natural gas pipelines can deliver if the pressure is reduced appropriately.³¹

To transmit equivalent energy levels compared to natural gas, hydrogen would need to flow at roughly three times the volume of natural gas, and compressors would have to use at least three times more energy.³² Replacing existing compressors with larger ones suitable for hydrogen would demand considerable investment. Many existing utility compressors are made of materials that may not be compatible with hydrogen, and engines that currently run on gas would need modifications or replacements to work with hydrogen. Furthermore, without replacing valves, hydrogen could leak from closed

²⁹ The definition of “clean renewable hydrogen” adopted in D.22-12-057 was “[h]ydrogen which is produced through a process that results in a lifecycle (i.e., well-to-gate) GHG emissions rate of not greater than 4 kilograms of CO₂e per kilogram of hydrogen produced and does not use fossil fuel as either a feedstock or production energy source.” D.22-12-057 at 48.

³⁰ Exh. EDF-01 p. 12, citing Exh. EDF-01 Att B-10, Curcio, E. Techno-economic analysis of hydrogen production: Costs, policies, and scalability in the transition to net-zero. *Int’l J. Hydrogen En.* 128 (2025) at p.473.

³¹ Exh. EDF-01 p. 14, citing Exh. EDF-01 Att B-01 (Martin *et al.* (2024)) p. 4000.

³² Exh. EDF-01 Att B-01 p. 3997.

components, presenting safety risks and contributing to climate change through increased emissions.³³ These cost concerns have been inadequately addressed by the applicants.

Looking at the benefit side of the equation, the applicants have not met their burden of establishing that the cost of the pilots justify the size of the proposed budgets or imposition of costs on all classes of customers. The applicants claim that pilots should be approved as an investment in advancing hydrogen as a decarbonization solution and strategy for addressing climate change.³⁴ However, such assertions need to be scrutinized carefully. The need to accelerate efforts to address climate change is pressing, and the Commission does not have unlimited resources and time to spend on research and development. Ratepayer funded R&D should focus on “least cost best fit” projects – pilots that are most likely to result in cost effective decarbonization of the most difficult to decarbonize customers.

Turning to the individual proposed pilots, it is evident that the three proposals for hydrogen blending to serve residences (Orange Cove Project) and institutional buildings (Orange Cove Project, SW Gas Project, and UC Irvine Project) cannot be found prudent in light of the simple fact that testing hydrogen blending to serve natural gas customers in these use cases is unnecessary and not a path to advancing future hydrogen solutions for decarbonization. In other words, these three projects do not offer any meaningful residential and commercial customer benefits to justify the requested investment of ratepayer dollars.

³³ Id. p. 4002.

³⁴ Amended Application pp. 9-11.

These three projects represent a total of \$90.6 million, which the applicants propose to be funded exclusively by ratepayers.³⁵ Notably, the applicants have identified no outside funding sources for the projects, and no cost sharing arrangements with benefitting public or private parties.³⁶

The Commission did not instruct the applicants to focus their pilot projects on residential communities or institutional buildings. This was a choice made by SoCalGas and SW Gas. As discussed above, scientists, regulators and policymakers have already identified electricity as the best fit for decarbonizing homes and commercial buildings. Using blended gas to serve residential and commercial end users is demonstrably not a good investment when evaluated in terms of GHG emissions avoided per ratepayer dollar spent, even if other issues and obstacles can be resolved. As there is already a good, cost effective decarbonization solution for residential and commercial gas customers, ratepayers should not fund pilots to test other, more expensive, novel and potentially unsafe solutions such as blended hydrogen that are targeted at these customers.

The scale and associated costs of these three projects are also objectively excessive and unjustified, in light of current affordability challenges. For example, SoCalGas has not explained why it is necessary to involve 10,000 residents in a small disadvantaged community in order to conduct a test of hydrogen blending.³⁷ SoCalGas apparently deliberately chose Orange Cove in order to deliver blended gas to an “entire

³⁵ Amended Application p. 17.

³⁶ Id. pp. 22-23.

³⁷ By way of comparison, the UK project cited as a “model” for the Orange Cove project involved 100 homes and 30 buildings. Exh. SCG-012 p. 3, fn.10.

community” instead of opting for a small test population, which would have reduced the size and cost of the pilot.³⁸ SoCalGas proposes to use ratepayer money to build and operate a 1.1 megawatt solar farm to temporarily operate an electrolyzer and blending apparatus for a community that would be better served by replacing their old gas stoves and furnaces with electric appliances powered by the local solar facility.

PG&E’s ten-year Gas Transmission Project has a very expensive price tag, at \$94.2 million. PG&E justifies this cost by pointing out that it originally presented a \$400 million dollar “concept.”³⁹ PG&E further maintains that its project “is not intended to drive up rates.”⁴⁰ These justifications are beside the point. Presumably no utility proposes projects for the purpose of driving up rates, but rates will be affected by approval of a \$94 million dollar demonstration project. And that proposed ratepayer investment must be demonstrably cost beneficial to ratepayers on its own merits, not as compared to a \$400 million concept. PG&E admits that it has obtained no external funding for the proposed Gas Transmission Project.⁴¹

As for benefits, PG&E offers only vague speculation that that “if” the five utility projects demonstrate that blended hydrogen can be transported safely and reliably the joint utilities “may” be able to start injecting clean renewable hydrogen into existing

³⁸ Amended Application p. 13. SoCalGas informs the Commission that “[i]t would not be prudent nor cost effective to conduct the demonstration on a smaller sampling.” Exh. SCG-06 p. 6. This apparently means that if the Commission does not find the proposed large-scale pilot to be prudent and cost-effective, there is no smaller scale alternative to be considered.

³⁹ Exh. PG&E-003 p. 43.

⁴⁰ Id.

⁴¹ Id. pp. 47-48.

natural gas infrastructure.⁴² PG&E extrapolates that this “would help reduce California’s utilization of fossil fuels, reducing GHG emissions across the state of California while extending and enhancing the use of infrastructure in which gas ratepayers have already invested.”⁴³ This and PG&E’s further speculation that unidentified “third parties” “may” pay PG&E in the future to connect to the facility⁴⁴ is inadequate to enable the Commission to identify any ratepayer benefits at all, or to justify ratepayer investment in the costly PG&E pilot.

The SDG&E project has a budget of \$21.1 million.⁴⁵ While SDG&E discusses potential project partners and beneficiaries, including the UC San Diego Center for Energy Research,⁴⁶ national laboratories,⁴⁷ and an unidentified solid oxide fuel cell vendor, it does not appear that SDG&E has obtained governmental funding, or pursued or arranged any cost-sharing arrangements with institutions or businesses that may benefit from the pilot. In particular, the Commission should examine why a pilot that claims to provide “a unique opportunity to evaluate performance, emissions, and operational characteristics under real-world conditions” for a fuel cell product that “has not yet been commercially deployed in California”⁴⁸ should not be funded in part or in whole by the fuel cell manufacturer, which will obviously benefit.

⁴² Id. p. 45.

⁴³ Id. pp.45-46.

⁴⁴ Id. p. 46.

⁴⁵ Amended Application p. 17.

⁴⁶ Exh. SDGE-03 p. 14.

⁴⁷ Exh. SDGE-05 p. KP-9.

⁴⁸ Id. p. KP-15.

IV. The pilots present public health and safety issues.

Safety is a priority concern for Commission review of any project, but it is particularly important when considering an application involving a novel use of utility infrastructure. Pursuant to California Public Utility Code section 451, each public utility in California must “furnish and maintain such adequate, efficient, just and reasonable service, instrumentalities, equipment, and facilities...as are necessary to promote the safety, health, comfort, and convenience of its patrons, employees, and the public.”⁴⁹ Ensuring that the management of investor-owned gas utility systems fully performs its duty of safe operations is a core obligation of the Commission.⁵⁰ In the wake of the tragic San Bruno gas explosion, the Commission took aggressive steps to improve gas pipeline safety in California. But the resulting changes to General Order 112-E do not address the unique risks posed by blending hydrogen with natural gas in pipelines, pipeline facilities, and thousands of consumer appliances that were designed for natural gas. These risks – to utility infrastructure, to customers, to local communities and to the environment – must be evaluated here.

The Scoping Ruling has specifically identified the question “Are the pilot projects safe” and included as sub-issues questions addressing risk assessment for each of the pilot projects and community outreach and informed consent.⁵¹ These questions are addressed below.

⁴⁹ Cal. Pub. Util. Code §451.

⁵⁰ D.12-04-047 at 3.

⁵¹ Scoping Ruling p. 12.

A. The proposed pilots present operational safety risks.

1. Assessing and monitoring safety in hydrogen blending pilots.

In Decision 22-12-057 the Commission specified that each of the applicants' proposed hydrogen blending pilots must ensure the long-term safety of the California pipeline and the prevention of hydrogen leakage.⁵² The decision further specified that each of the pilots should avoid end user appliance malfunctions,⁵³ and address parties' comments regarding leak issues.⁵⁴ The evidence on the record is not adequate to address these Commission mandated requirements and ensure the safety of the proposed pilots. Applicants promise to adhere to existing safety standards but have not adequately addressed and responded to evidence on the record identifying specific safety risks that are likely to affect proposed pilots.

Before discussing the proposed pilots individually, it is important to review the recent scientific literature addressing hydrogen blending technology and attendant risks. As the expert scientists in the 2024 peer-reviewed article titled "A review of challenges with using the natural gas system for hydrogen" explain, safety concerns arise at each stage of a hydrogen blending project. Hydrogen's weight and density is one-eighth that of methane and its diffusivity in the air is around three times higher, making it more likely to permeate through materials, rapidly leak from infrastructure, and accumulate and rise

⁵² D.22-12-057, Ordering Paragraphs 7.a and 7.i. At pages 22-23 of Decision 22-12-057 the Commission specified that "any proposed pilot project must demonstrate that the applicant can *reliably* detect leakage of any hydrogen, methane...." (emphasis added)

⁵³ Id. Ordering Paragraph 7.c.

⁵⁴ Id. Ordering Paragraph 7.k.

at high points in enclosed spaces.⁵⁵ The same study found that hydrogen can permeate through intact polyethylene and other soft materials (such as those used in gaskets and seals) at a significant rate, which leads to a greater leakage tendency compared to methane.⁵⁶

Hydrogen is known to diffuse into high-yield-strength steel and cause cracks, especially when combined with cyclic stress. Since high-yield-strength steel is a material commonly used in gas pipeline infrastructure, this cracking risk is a concern even in partially converting existing natural gas pipelines for hydrogen usage. Injecting hydrogen into a natural gas pipeline may cause the pipe to leak or burst. If both temperature and the partial pressure of hydrogen are high, this cracking could occur in low-yield-strength steel pipes as well.⁵⁷

Ocko and Hamburg's published study from 2022 ("Ocko and Hamburg (2022)") finds that for hydrogen emissions, "there is a paucity of quantitative data addressing in situ hydrogen leakage along the value chain, with empirical measurements to date focused on safety concerns (i.e. large leaks), primarily in confined spaces."⁵⁸ It is very likely that hydrogen emissions occur throughout the value chain, including loss rates from electrolyzers and transport.⁵⁹ While several types of hydrogen gas sensors exist, "there are currently no commercially available sensors that can detect hydrogen

⁵⁵ Exh. EDF-01 Att B-01 (Martin *et al.* (2024)) at p. 3996.

⁵⁶ Id. p. 4002.

⁵⁷ Exh. EDF-01 p. 6, citing Martin *et al.* (2024), Exh. EDF-01 Att B-01 at 4000.

⁵⁸ Exh. EDF-01 Att B-02. Ocko, I.B. and Hamburg, S.P. Climate consequences of hydrogen emissions. *Atmos. Chem. Phys.* 2022; 22: 9349-9368 p. 9355.

⁵⁹ Id.

emissions at levels well below the threshold for hydrogen gas flammability which is required to characterize emissions in the open.”⁶⁰ These issues present identifiable operational safety risks in each of the proposed pilot projects.

2. The proposed pilot projects pose unmitigated safety hazards.

The Orange Cove project will blend hydrogen into the distribution system serving thousands of residential and commercial customers. The project will limit testing to a 1-5% blend in the pipeline but will entail extensive involvement of residential gas appliances, with inadequate assurance on the record that the pilot can be completed without safety impacts on this low-income community. CalAdvocates points out that after initial inspections, SoCalGas will expect the thousands of Orange Cove residents obliged to participate in this experiment to monitor their own appliances and deal with malfunctions by contacting the utility.⁶¹

Like the Orange Cove Project, the SW Gas Project would continually expose a residential population and visitors to the risks and unknowns associated with hydrogen blending in an existing distribution pipeline and associated infrastructure. For this pilot the hydrogen blend percentage will be higher, increasing the safety risks to participants associated with leaks and appliance malfunction.⁶² SW Gas represents that its risk mitigation strategies are adequate but has not presented adequate evidence contradicting

⁶⁰ Id.

⁶¹ Exh. CADV-01 p. 1-4.

⁶² See CADV-01 p. 1-7, citing UC Riverside Study as mentioned in D.22-12-057 Finding of Fact (FOF) #31, at 58.

the evidence discussed above that hydrogen may cause cracking and leaking in pipes designed for natural gas, and that existing hydrogen detection devices are not adequate to assure that populations exposed to the project will be safe.

The UC Irvine Distribution project will involve injection of up to a 20% blend of hydrogen into steel and plastic distribution pipes at UC Irvine and will be delivered to heating and cooking equipment in buildings located on this large and densely populated campus. This project will also involve an electrolyzer and blending equipment, likewise located on campus. The leakage and cracking risks discussed in the studies cited above are inherent to the use of steel and plastic pipes designed for transporting natural gas. The potential health and safety risks to the students and staff at UC Irvine have not been adequately discussed or justified by the applicant.

PG&E's Gas Transmission Project will be sited in another disadvantaged community, the City of Lodi. PG&E will initially introduce up to 20% blended hydrogen into a high-pressure transmission pipe, increasing the volume of hydrogen over a period of years. PG&E may increase the amount of hydrogen to a percentage *above* 20% if the Northern California Power Agency agrees to take the blended fuel for use in its nearby electric generation facility.⁶³ Again, the leakage and cracking risks associated with this type of project have not been adequately addressed, and PG&E's request for authority to exceed 20% blended hydrogen and to deliver it to an operating generating facility only increase safety concerns related to this pilot proposal.

⁶³ Exh. PGE-001 p. 28.

The SDG&E project is smaller in scale and apparently will be sited in a more remote location, since the University of California at San Diego declined to host the project.⁶⁴ However, the project will use polyethylene pipe that is representative of the type currently in use for distributing natural gas, and only designed for that use. Again, the safety risks arising from leakage and cracking have not been adequately addressed.

B. The proposed pilots present environmental safety risks.

The above discussion is focused on operational safety hazards – the risk to public health and safety resulting from pipeline leakage and cracking. However, the Commission’s analysis of safety risks must also include consideration of how the proposed pilots could affect the environment.

This Commission has recognized climate change as a cognizable safety risk and its own responsibility to address that risk.⁶⁵ Even if the applicants were somehow able to provide adequate assurances that hydrogen blending does not risk catastrophic failure of a gas pipeline or compressor, the fact remains that all five pilots pose a risk to the environment and to undermining California’s commitment to reducing emissions of greenhouse gases. This is a critical concern, and one that cannot be adequately mitigated insofar as leakage is likely to occur, and the existing technology for detecting and preventing leakage of hydrogen from natural gas infrastructure is limited and inadequate.

⁶⁴ Scoping Memo at 9; Exh. SDGE-03 p. 2.

⁶⁵ See e.g., Order Instituting Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation, R.18-04-019, (issued May 7, 2018) at 3.

The impacts of hydrogen leakage cause immediate harm – the warming effect of hydrogen is akin to a short-lived climate pollutant, with the most harm occurring in the first five years. The extent of leakage will have significant climate impacts and the scale of leakage is likely to be significant.⁶⁶ For example, the International Energy Agency (“IEA”) has found that the “process of converting hydrogen to a carrier for transport incurs energy losses of 45-70%.”⁶⁷

Once leaked into the environment, hydrogen causes climate damage. Unlike a one-time pulse emission of a short-lived climate pollutant, a leak from a non-purpose built pipeline would result in continuous pulse emissions, compounding the environmental harm.⁶⁸ Research by Sun et al. (2022) suggests that when factoring in the impacts of these continuous pulses from the pipeline cracks, hydrogen blending might cause more climate harm than unblended natural gas (methane) and undermine climate benefits expected from hydrogen systems. The inclusion of multiple hydrogen emissions enhances the warming potential of multiple hydrogen pathways, particularly in the short to medium terms due to hydrogen’s transient warming effects.⁶⁹

Hydrogen is an indirect greenhouse gas, which has warming impacts that are underestimated and widely overlooked. Like other short-lived climate pollutants, hydrogen’s atmospheric warming effects last only a couple of decades. Methane is an

⁶⁶ Exh. EDF-01 p. 4.

⁶⁷ Id., citing IEA. GHG emissions of hydrogen and its derivatives. Available at: <https://www.iea.org/reports/global-hydrogen-review-2024/ghg-emissions-of-hydrogen-and-its-derivatives>.

⁶⁸ Exh. EDF-01 p. 6.

⁶⁹ Exh. EDF-01 Att B-03 p. 5299.

infrared-absorbing greenhouse gas, while hydrogen is not.⁷⁰ According to Ocko and Hamburg (2022) and Martin *et al.* (2024), hydrogen emissions indirectly increase methane's residence time in the atmosphere, thereby contributing to methane's warming effect.⁷¹ Current assessments of hydrogen's climate warming potential suggest that hydrogen can cause around 12 times more warming than carbon dioxide over a 100-year period following emissions of equal mass, and around 37 times more warming over a 20-year period.⁷²

The demonstration pilot proposals do not thoroughly and accurately consider how hydrogen emissions can have a warming impact. Without considering these emissions there could be a significant underestimation of the risk that the projects pose to the environment and overestimation of the decarbonization benefits that blending hydrogen into the natural gas pipeline may offer, relative to the risks.

C. A safer alternative: purpose-built hydrogen infrastructure.

As discussed above, infrastructure designed to transport and deliver natural gas is not designed for hydrogen. This is an unavoidable fact in trying to introduce blended hydrogen into existing utility gas infrastructure and appliances designed for natural gas. Experts point out that there are safe materials available for construction of new, purpose-built hydrogen pipelines. Purpose-built industrial pipelines made from mild steels, lower strength steels or high yield strength steels that were designed and fabricated for use with

⁷⁰ Exh. EDF-01 p. 7.

⁷¹ Exh. EDF-01 Att B-02 p. 9350 and EDF-01 Att B-02 p. 3998.

⁷² Exh. EDF-01 p. 7, citing Martin *et al.* (2024) (EDF-01 Att B-02) p. 3998.

hydrogen have been operating for decades. The key is design pressure determinations, materials selection, nondestructive examinations, welding methods and testing focused on hydrogen applications.⁷³

Since the Amended Application focuses only on hydrogen blending projects, the applicants do not discuss the relative safety of purpose-built hydrogen infrastructure versus introducing blended hydrogen into infrastructure designed for natural gas. However, this subject is relevant in evaluating the merits of the applicant's projects and alternatives, particularly with respect to issues around public health and safety.

If the Commission denies any or all of the pilot proposals, it should not foreclose future research and development focused on purpose-built hydrogen infrastructure. This area of focus would avoid many of the safety and project design concerns discussed above and would enable the applicants to target the hard-to-decarbonize industrial customers that should be the main focus in future phases of this proceeding.

V. The proposed projects will disproportionately affect disadvantaged communities.

Two of the proposed projects would, if approved, be located in disadvantaged communities. According to the Senate Bill 535 CalEnviroScreen Map, which provides a relative ranking of a community's pollution burden and population vulnerability, the proposed Orange Cove and Lodi projects lie within disadvantaged communities.⁷⁴

⁷³ Martin *et al.* (2024) (EDF-01 Att B-02) p. 4002.

⁷⁴ Exh. EDF-01 Att B-06, California Environmental Protection Agency, SB 535 Disadvantaged Communities (2022 Update), last modified May 2024, <https://experience.arcgis.com/experience/1c21c53da8de48f1b946f3402fbac55c/page/SB-535-Disadvantaged-Communities>.

By definition the pollution burden is already high in these areas. Further, methane leakage disproportionately occurs in communities of color and lower median income – even after adjusting for housing age and other factors – exacerbating environmental injustice.⁷⁵ As discussed above, there are real risks of pipeline cracking and leakage associated with hydrogen blending. Siting pilots in disadvantaged communities exposes them to these risks.

Looking more closely at Orange Cove, the 2020 census reports that the population is 95 percent Hispanic or Latino. The median household income in Orange Cove is \$38,447, substantially lower than the California median of \$95,521. Approximately 39 percent of the population lives in poverty, compared to the state average of 12 percent.⁷⁶

This economic reality suggests that residents may be less likely to be able to upgrade or maintain gas appliances affected by the introduction of hydrogen blends. If the existing gas appliances in residences and commercial buildings are not up to the necessary safety standards, it could compromise not only the pilot program but also endanger the health and safety of these residents.

This outcome appears entirely possible, based on the experts’ analysis of hydrogen blending risks discussed above. And this outcome would be antithetical to the goals of the Commission’s Environmental and Social Justice Action Plan, which includes as a priority improving local air quality and public health in environmental and social justice (“ESJ”)

⁷⁵ Exh. EDF-01 Att B-07, Zachary D. Weller et al. “Environmental Injustices of Leaks from Urban Natural Gas Distribution Systems: Patterns among and within 13 U.S. Metro Areas,” *Environmental Science & Technology*, 56, no. 12 (2022): 8599-8609 pp. 8602, 8606.

⁷⁶ Exh. EDF-01 p. 10, citing Exh. EDF-01 Att B-08, U.S. Census Bureau, Decennial Census P.L. 94-171 Redistricting Data (accessed July 23, 2025).

communities, and furthering research and analytical opportunities to understand impacts in ESJ communities.⁷⁷ SoCalGas admittedly has not obtained any written or verbal agreements from the Orange Cove residents that will be affected by its pilot, and will not allow individual customers to opt out of the pilot.⁷⁸

If the pilots were cost justified and demonstrably contributed to the state's decarbonization goals, the Commission could weigh those benefits against the negative impacts they will have on ESJ communities. But here the application offers dead end projects that will contribute little or nothing to the state's pressing need to advance hydrogen as a replacement fuel for targeted hard-to-electrify industries. Thus, on this ground alone, the projects should be rejected.

VI. Recommendations

For the reasons discussed above, the Commission should deny the application in full, with prejudice.

If the Commission rejects any or all of the proposed pilots, it should explicitly acknowledge that there is an alternative to hydrogen blending that remains worthy of research and demonstration efforts. That alternative is the exploration of purpose-built infrastructure for delivering hydrogen more safely and efficiently to targeted difficult-to-electrify end users. The record in this proceeding includes evidence that can be used to guide the utilities toward a safer and more cost beneficial alternative.

⁷⁷ [CPUC Environmental and Social Justice Action Plan, Version 2.0 \(April 7, 2022\)](#), Goal 2, p. 23.

⁷⁸ Exh. SCG-06 p. 16.

VII. Conclusion

EDF appreciates the Commission's consideration of the above and urges the Commission to adopt its recommendations. The health and safety risks, excessive costs and community impacts of the five proposed pilots outweigh their very minimal benefits to ratepayers. The applicants make extensive claims that the pilots will fill research gaps and provide benefits to customers and others but have failed to identify a single public or private entity willing to share in the cost of any of the pilots. That failure is telling.

Even if infrastructure safety issues could be addressed, hydrogen blending still offers only a small reduction in GHG emissions compared to other uses of hydrogen fuel. The Commission should reject these demonstration projects and focus instead on how to encourage cost-effective development of dedicated hydrogen infrastructure projects that will enable hard to decarbonize industries to replace fossil fuels with clean hydrogen.

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Respectfully submitted,

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