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August 30, 2023

Advice No. 6182-G
(U 904 G)

Public Utilities Commission of the State of California

Subject: Southern California Gas Company 2024 Research Development and Demonstration Plan in Compliance with Ordering Paragraph 30 of Decision 19-09-051

Purpose

Southern California Gas Company (SoCalGas) hereby submits this Tier 3 Advice Letter pursuant to Ordering Paragraph (OP) 30 of Decision (D.) 19-09-051 requesting approval from the California Public Utilities Commission (Commission or CPUC) to record 2024 Research Development and Demonstration (RD&D) expenses to the Research, Development, and Demonstration Expense Account (RDDEA).[1]

Background

California Public Utilities Code Section 740.1 provides for the Commission to authorize utility RD&D activities that benefit ratepayers through improved reliability and safety, environmental benefits, or operational efficiencies provided that achieving those benefits is reasonably probable and the focus is not unnecessarily duplicative of efforts by other research organizations. In Application (A.) 17-10-008, SoCalGas requested to continue its RD&D program for the 2019 GRC cycle, forecasted an average annual funding level of $14.329 million, and proposed to continue to record RD&D expenses in a one-way balancing account.[2]

In the 2019 GRC Decision, the Commission found that SoCalGas's RD&D programs were not duplicative and both complementary and supplementary to other natural gas research and development programs[3] and authorized continuing the program through the TY 2019

[1] D.19-09-051 (2019 GRC Decision), addresses the Test Year (TY) 2019 General Rate Cases (GRC) of San Diego Gas & Electric Company and SoCalGas.
[2] A.17-10-008, Application of Southern California Gas Company for Authority, Among Other Things, to Update its Gas Revenue Requirement and Base Rates Effective on January 1, 2019 (October 6, 2017), Exhibit (Ex.) SCG-21 Direct Testimony of Lisa L. Alexander at LLA-9 - LLA-20.
[3] D.19-09-051 at 745-746 (Findings of Fact (FOF) 169-171).

GRC cycle at the average annual funding level requested by SoCalGas.[4] In addition, the 2019 GRC Decision ordered that:

> *SoCalGas shall host an annual workshop during the second quarter of 2020 and 2021 under supervision of the Commission's Energy Division. At these workshops, SoCalGas shall present the result of the previous year's Research, Development, and Demonstration (RD&D) program and obtain input regarding its intended spending for the following calendar year. Prior to the workshop, SoCalGas shall:*
>
> a. *Submit a report to Energy Division staff describing prior years' RD&D program including a summary of ongoing and completed projects; funds expended, funding recipients, and leveraged funding; and an explanation of the process used for selecting RD&D project areas as well as the structure of SoCalGas' RD&D portfolio;*
> b. *Provide Energy Division staff with the workshop presentation materials as well as documentation of stakeholders consulted in the development of RD&D projects, both at least one week before the workshop; and*
> c. *Engage relevant stakeholders to encourage their attendance at the workshop, such as the California Energy Commission, Gas Technology Institute, the U.S. Department of Energy, and other organizations engaged in gas research and development.*
>
> *SoCalGas must also present its budget broken down by research projects, request for proposals, and funding amounts. Other specific details concerning the workshops must be coordinated with the Commission's Energy Division staff.*[5]

The Commission also required that prior to SoCalGas recording 2021 RD&D expenses to the RDDEA memorandum account, it should submit a Tier 3 Advice Letter and include a Research Plan for the following calendar year that would:

> *(1) detail budgets broken down by research sub-program area,*
>
> *(2) explain how the projects help improve reliability, safety, environmental benefits, or operational efficiencies, and*
>
> *(3) discuss how SoCalGas incorporated feedback from workshop stakeholders and Commission staff.*[6]

In addition to the requirements outlined in the 2019 GRC Decision, the Commission provided guidance for future RD&D Research Plans in OP 5 of Resolution (Res.) G-3586. In developing subsequent Research Plans, SoCalGas was requested to:

[4] *Id.* at 381, 775 (OP 2).
[5] *Id.* at 783 (OP 30).
[6] *Id.* at 379.

- Describe how SoCalGas is engaging with diverse academic populations at universities and colleges to foster new researchers.
- Explain how SoCalGas incorporates into its Research Plan feedback received in pre-workshop stakeholder interviews with community-based organizations (CBOs).
- Describe, with Energy Division staff guidance, how to ensure energy efficiency RD&D projects for gas-powered appliances align with the State's transportation and building decarbonization goals.
- Provide detail quantifying the amount of program funds already committed and the quantity of program funds that are for projects under development in following years.
- Provide project-level detail about Research Plans with the 16 data fields described in the Discussion sub-section titled *Detailed budgets broken down by research subprogram.*
- Provide detail about how research projects supplement and coordinate with similar projects conducted by the CEC and the other IOUs.
- Provide detail about administrative budgets using allowable cost categories that will be developed in a process launched by D.21-11-028 defining allowable EPIC administrative costs.
- Develop sufficient quantitative estimates of potential safety, reliability, operational efficiency, improved affordability, and environmental-related benefits or numeric targets, or a specified numeric range of potential benefits for projects.
- Provide detail quantifying research funding allocations by research consortium, as well as project costs related to each consortium.
- Provide quantitative detail, in consultation with Energy Division staff, measuring the impact of RD&D projects on disadvantaged and low-income communities in terms of job creation and other economic development impacts and in terms of energy cost, greenhouse gas emissions, and energy reliability.
- Provide specific rather than general detail in subprogram equity descriptions about how the research areas benefit underserved communities.

SoCalGas is currently in the TY2024 General Rate Case process.[7] As part of the 2024 GRC process, SoCalGas RD&D has proposed several modifications to both existing programs and subprograms. More detail about those changes can be found in Section 1.1. The estimated authorized funding for 2024 for SoCalGas RD&D is taken from the TY2024 GRC request. For 2024, the escalated, authorized funding amount proposed is $23.249 million. A proposed decision is expected in the second quarter of 2024. SoCalGas requests the opportunity to file a Tier 2 AL to reconcile any differences in authorized funding from the TY 2024 GRC Decision and the proposed budget provided herein.

Discussion

Summary of 2024 Research Plan

The 2024 Research Plan provides an overview of SoCalGas RD&D and its goals, key regulatory and policy drivers, stakeholder engagement process, and commitment to equity. The plan then summarizes the proposed 2024 allocation of funding across the four programs

[7] *See* A.22-05-015.

and administration and describes each program and its subprograms in detail, including funding by subprogram. In developing the proposed funding allocations, RD&D staff relied in part upon input obtained via multiple channels, including the 2023 Annual Outreach Program, comments and survey responses from the 2023 Annual Workshop, and follow-up emails sent by workshop attendees. Section 3.6 of the Research Plan summarizes key input received in preparation for developing the 2024 Research Plan, with standout items including the need for more study and testing on the impact of blending hydrogen into the gas pipeline; the importance of educating policy makers, legislators, and the environmental community about hydrogen and providing hard evidence to support the case for it; the need to design projects with equity in mind from the start; and the continuing need for investment in technologies that advance pipeline integrity, leak detection, and system inspection and monitoring. See Section 3.1 of the Research Plan for more information.

For the 2024 Research Plan, SoCalGas RD&D is divided into four programs:

- Clean & Renewable Energy Resources: The primary goal of the Clean & Renewable Energy Resources (C&RER) program is to advance decarbonization of the gas supply while maintaining its affordability and reliability. To achieve this goal, program staff members develop, support, and advance new technologies aimed at increasing and expanding the production of renewable gas to displace conventionally sourced pipeline gas, while reducing GHG emissions or capturing them for utilization or sequestration.

- Gas Operations: This program supports pipeline and storage operations through innovations that enhance public and employee safety, maintain system reliability, increase operational efficiency, minimize criteria pollutants, and reduce GHG emissions and operational impacts to the environment. The program also facilitates technology development driven by emerging regulatory requirements. Its primary goal is to develop, test, and introduce new gas operations technologies that are beneficial to ratepayers, public safety, and the environment.

- Clean Transportation: This program supports activities that minimize environmental impacts related to the transportation sector through the development of zero-emissions vehicles, hydrogen fueling infrastructure, and advanced on-board hydrogen storage technologies.

- Clean Energy Applications: The Clean Energy Applications RD&D program supports the development and demonstration of highly efficient, low-emission technologies associated with the stationary utilization of gaseous fuels for power generation and thermal applications.

Each program is further divided into multiple subprograms. The 2024 Research Plan describes how projects in each subprogram help improve reliability, safety, environmental benefits, and/or operational efficiencies. A description of how RD&D proposals “align with the State's transportation and building decarbonization goals” is identified generally in the key

policy drivers for the RD&D program,[8] and specifically with respect to energy efficiency projects for gas-powered appliances.[9]

RD&D Program staff consider a variety of factors in determining how to allocate funding, including regulatory and policy drivers and input from stakeholders, CPUC Energy Division staff, and other interested parties at an annual workshop.

To allocate the proposed 2024 budget of $23.249 million, SoCalGas RD&D staff first forecast that Program Administration costs would account for 10% of total funding. Activities in the Program Administration Budget were organized to align with allowable EPIC administration cost categories developed in the process launched by D.21-11-028. Next, Program staff determined 2024 spending by subprogram, taking into consideration projects that are currently under contract, projects that are under development for 2024, and stakeholder input. Descriptions of key research areas associated with each subprogram and examples of potential projects associated with each research area are provided. Program staff may also direct funding to new research areas developed during the plan year or to projects that align with program goals but do not fit into any of the existing research areas. Table A provides a summary of the 2024 RD&D budget by research subprogram.

Table A: 2024 RD&D Research Plan Budget Summary

Programs	Program Funding	Subprograms	Subprogram Funding
Clean & Renewable Energy Resources	$7,504,000	Carbon Management	$3,752,000
		Renewable Gas Production	$3,752,000
Gas Operations	$3,973,000	Environmental & Safety	$794,600
		Operations Technology	$595,950
		System Design & Materials	$1,589,200
		System Inspection & Monitoring	$993,250
Clean Transportation	$4,470,000	Off-Road	$1,698,600
		On-Road	$1,698,600
		Refueling Infrastructure	$1,072,800
Clean Energy Applications	$4,977,000	Energy Reliability	$1,493,100
		Industrial Operations	$1,990,800
		Residential & Commercial	$1,493,100
Program Administration	$2,324,900		
Total	**$23,248,900**		

[8] *Id.* at Section 2: Regulatory and Policy Drivers.
[9] *Id.* at Section 5.2: Alignment with California's Decarbonization Goals.

Consistency with D.19-09-051 Annual Workshop and Report Requirements

In accordance with the 2019 GRC Decision and Res. G-3586, SoCalGas's RD&D staff completed the below activities to develop the 2022 Annual Report and 2024 Research Plan.

- *Submit a report to Energy Division staff describing prior years' RD&D program including a summary of ongoing and completed projects; funds expended, funding recipients, and leveraged funding; and an explanation of the process used for selecting RD&D project areas as well as the structure of SoCalGas' RD&D portfolio;* [10]

On April 10, 2023, SoCalGas submitted its 2022 RD&D Annual Report (2022 Annual Report) to CPUC Energy Division staff for review.[11] The report includes a summary of ongoing and completed projects;[12] funds expended,[13] funding recipients,[14] and leveraged funding;[15] and an explanation of the process used for selecting RD&D project areas,[16] as well as the structure of SoCalGas's RD&D portfolio.[17]

- *Provide Energy Division staff with the workshop presentation materials as well as documentation of stakeholders consulted in the development of RD&D projects, both at least one week before the workshop;* [18]

  Engage relevant stakeholders to encourage their attendance at the workshop, such as the California Energy Commission, Gas Technology Institute, the U.S. Department of Energy, and other organizations engaged in gas research and development.[19]

On April 18, 2023, SoCalGas submitted its workshop presentation materials to CPUC Energy Division staff for review. The presentation included documentation of the stakeholders consulted in the development of the workshop presentation.[20]

In the first quarter of 2023, RD&D Program staff conducted a series of targeted interviews with 16 people from 13 different organizations, including California Energy Commission (CEC), GTI Energy (formerly Gas Technology Institute), and the U.S. Department of Energy (DOE). During these interviews, these subject matter experts (SMEs) and industry

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[10] D.19-09-051 at 783 (OP 30).

[11] SoCalGas*, Research and Development, Renewal: Research, Development, and Demonstration Program 2022 Annual Report*, *available at:* https://www.socalgas.com/sustainability/research-development-demonstration-rdd-annual-report.

[12] *Id.* at 67 (Appendix: 2021 Summary of Ongoing and Completed Projects).

[13] *Id*. at 11.

[14] *Id.* at 42 (Appendix: 2021 Funding Recipients).

[15] *Id.* at 11.

[16] *Id.* at 49 (Appendix: Project Selection Process and Evaluation Criteria).

[17] *Id.* at 20.

[18] D.19-09-051 at 783 (OP 30).

[19] *Id.*

[20] SoCalGas reached out to various stakeholders, including CEC, U.S. DOE, GTI, Stanford Natural Gas Initiative, Cal State LA, Cal State Long Beach, Pipeline Research Council Int., NYSEARCH, Bakersfield College, Kern Oil, and National Renewable Energy Laboratory.

stakeholders were asked a series of standard questions and then engaged in a freeform discussion about the industry and its RD&D needs.[21] See Section 3.1 for more information.

- *[ ] host an annual workshop during the second quarter of 2020 and 2021 under supervision of the Commission's Energy Division. At these workshops, SoCalGas shall present the result of the previous year's Research, Development, and Demonstration (RD&D) program and obtain input regarding its intended spending for the following calendar year.*[22]

The language in D.19-09-051 addressed requirements for SoCalGas to hold a workshop in the second quarter of 2020 and 2021 only. SoCalGas is also currently in the TY2024 General Rate Case process.[23] Notwithstanding, SoCalGas conducted a workshop for the 2024 Plan Year as well to promote transparency and continue collaborating with the Commission, our research stakeholders, and the public.

On April 25, 2023, RD&D staff hosted a public workshop via an online platform.[24] In consultation with Energy Division staff, SoCalGas extended invitations to and encouraged participation from 170 stakeholders representing disadvantaged communities (DACs) within SoCalGas's service territory. SoCalGas also sent notification of the workshop to several relevant Service Lists.[25] A total of 238 individuals attended the workshop. representing more than 80 research organizations, including the CPUC, CEC, GTI Energy, Electric Power Research Institute (EPRI), DOE National Labs, and California State University, Los Angeles, and a number of community based organizations including East Los Angeles College, Tulare County Economic Development Corporation, Los Angeles Valley College Foundation, and Bays & Girls Clubs of the Los Angeles Harbor.

During the five-hour workshop, RD&D team members presented results from the 2022 RD&D activities and proposed spending and activities for 2024. At the end of each section of the presentation, the RD&D team accepted questions and comments. SoCalGas encouraged attendees to submit written comments after the workshop regarding the proposed spending and activities for 2024. See Section 3.2 for more information.

- *detail budgets broken down by research sub-program area,*

A detailed budget for 2024 RD&D activities broken down by subprogram is included in section 5 of the Research Plan, "Proposed 2024 Funding Allocations."

- *explain how the projects help improve reliability, safety, environmental benefits, or operational efficiencies, and*

[21] SoCalGas Research Development and Demonstration 2024 Research Plan (2024 Research Plan) which is attached to this Advice Letter as Attachment A, Section 3.1 Stakeholder Outreach.
[22] D.19-09-051 at 783 (OP 30).
[23] *See* A.22-05-015.
[24] *SoCalGas RD&D 2023 Research Plan – Public Workshop* (April 27, 2022), *available at:* https://www.youtube.com/watch?v=KNx1GEpYpG8.
[25] A.17-10-008, R.19-10-005, R.20-01-007, R.19-01-011, and R.13-11-005.

SoCalGas RD&D tracks six standard ratepayer benefits: (1) Reliability, (2) Safety, (3) Operational Efficiency, (4) Improved Affordability, (5) Environmental: Reduced Greenhouse gas (GHG) Emissions, and (6) Environmental: Improved Air Quality. Each subprogram section in the 2024 Research Plan explains how projects within that subprogram help provide ratepayer benefits. For example, section 6.4.3 describes the benefits associated with projects in the Clean & Renewable Energy Resources Program, Carbon Management subprogram.

On May 5, 2023, the CPUC's Energy Division requested more data from SoCalGas RD&D about how SoCalGas residential ratepayers directly benefit from hydrogen-related research, the clean transportation program, the commercial food service subprogram, and the carbon capture, utilization, and sequestration (CCUS) subprogram. On May 19, 2023, SoCalGas RD&D staff submitted a response to the CPUC, parts of which are summarized in the 2024 Research Plan in sections describing subprogram benefits.

- *discuss how SoCalGas incorporated feedback from workshop stakeholders and Commission staff.*[26]

RD&D staff incorporated feedback from workshop stakeholders and Commission staff by (1) reviewing all questions and comments that arose during the 2023 public workshop conducted on April 25, 2023; (2) combining this input with input received in stakeholder interviews and post-workshop emails; (3) evaluating how the new input aligned with program and subprogram goals and objectives, the evolving policy and technology landscape, and CPUC guidance, and (4) incorporating that input into the design of the subprogram budgets as well as areas of research focus in those subprograms.

Consistency with Resolution G-3586 Requirements

- *Describe how SoCalGas is engaging with diverse academic populations at universities and colleges to foster new researchers.*[27]

Included as Attachment B, the SoCalGas Research, Development, & Demonstration Equity Engagement Roadmap (EER) describes a multi-year vision for improving equity engagement within SoCalGas RD&D. The EER is meant to serve as an operating framework that integrates equity considerations throughout SoCalGas' RD&D Plan. It is based on extensive literature review and consultation with numerous internal SoCalGas stakeholders and representatives of disadvantaged communities. It also includes key definitions and a set of action items to improve engagement with the community. Tasks 3 and 4 of the EER are directly related to engagement with diverse academic populations at universities to foster new researchers. Based on previous guidance from the Commission,[28] Task 3 continues implementation of a stipend program, that supports the participation of diverse researchers and advocates for Environmental & Social Justice (ESJ) communities to participate and provide input through the annual RD&D public workshop, advisory committees, or interviews. Details regarding implementation of the CBO stipend program can be found in Appendix B of

[26] D. 19-09-051 at 379.

[27] Res. G-3586 at 25 (OP 5).

[28] Resolution G-3573, issued March 18, 2021, page 9.

the EER. Task 4 seeks to encourage and inspire the next generation of diverse researchers by providing funding and mentoring to student engineers and scientists from Hispanic- and Minority-Serving Institutions throughout the SoCalGas service territory. See Section 4.1 for more information.

- *Explain how SoCalGas incorporates into its Research Plan feedback received in pre-workshop stakeholder interviews with community-based organizations (CBOs).*[29]

In the attached EER and summarized in Section 4.1 of the Research Plan, SoCalGas RD&D staff describe how they solicited input from 14 CBOs on the draft EER. These included the Community Action Partnership of Kern, FIND Food Bank, Tulare Kings Hispanic Chamber of Commerce, DIY Girls, and Mar Vista Family Center. SoCalGas RD&D uses the ERR to guide its ongoing engagement efforts. RD&D staff also use it to develop, update, and track equity engagement metrics that serve as a way to evaluate program success, inform research priorities in the annual Research Plan, and select projects.

- *Describe, with Energy Division staff guidance, how to ensure energy efficiency RD&D projects for gas-powered appliances align with the State's transportation and building decarbonization goals.*[30]

Section 9.2 of the 2024 Research Plan, Clean Energy Applications Policy Considerations, describes how a diversified decarbonization pathway that includes improved energy efficiency, building retrofits, and fuel-switching will enable California to achieve its short- and long-term transportation and building decarbonization goals more cost-effectively and expeditiously.

- *Provide detail quantifying the amount of program funds already committed and the quantity of program funds that are for projects under development in following years.*[31]

Each subprogram section of the 2024 Research Plan includes a funding table that lists the committed funds for 2024, the funds for projects under development for 2024, the total subprogram funding for 2024, and the subprogram funding as a percentage of the Program funding. For example, section 6.3.5 includes funding detail for the Clean & Renewable Energy Resources Program, Carbon Management Subprogram.

- *Provide project-level detail about Research Plans with the 16 data fields described in the Discussion sub-section titled Detailed budgets broken down by research subprogram.*[32]

Detailed information about active, contracted projects for 2024, including the 16 data fields listed in Res. G-3586, are included as “Attachment A—Project Details” to this Advice Letter.

[29] Res. G-3586 at 25 (OP5).
[30] *Id.*
[31] *Id.*
[32] *Id.*

- *Provide detail about how research projects supplement and coordinate with similar projects conducted by the CEC and the other IOUs.*[33]

Section 3.4 of the 2024 Research Plan, "Coordination with CEC and other IOUs," describes how SoCalGas RD&D collaborates and coordinates with the CEC, California utilities, and utilities across North America. To summarize, coordination occurs through the public workshop process, participation in research consortia, and through project level collaboration. SoCalGas RD&D staff also includes representatives from the CEC and other IOUs in its annual stakeholder engagement process (Section 3.1). SoCalGas RD&D also discussed coordination with the CEC and other utilities in its May 19, 2023, response to the May 5, 2023, data request from the CPUC.

- *Provide detail about administrative budgets using allowable cost categories that will be developed in a process launched by D.21-11-028 defining allowable EPIC administrative costs.*[34]

Section 5.1 of the Research Plan, "Proposed 2024 Funding Allocations," provides a breakdown of the Program Administration budget based on categories developed for the EPIC program.

- *Develop sufficient quantitative estimates of potential safety, reliability, operational efficiency, improved affordability, and environmental-related benefits or numeric targets, or a specified numeric range of potential benefits for projects.*[35]

  Provide quantitative detail, in consultation with Energy Division staff, measuring the impact of RD&D projects on disadvantaged and low-income communities in terms of job creation and other economic development impacts and in terms of energy cost, greenhouse gas emissions, and energy reliability.[36]

In early May 2022, SoCalGas began conversations with Energy Division (ED) staff to discuss "a framework for collecting and reporting sufficient quantitative estimates of potential safety, reliability, operational efficiency, improved affordability, environmental-related benefits (including NOx and GHG emission reductions), benefits to underserved communities, and numeric targets or a specified numeric range of potential benefits for projects," also referred to as the "benefits analysis framework."

During the May meeting, ED staff informed SoCalGas that they would like to make sure the benefits analysis framework for SoCalGas's RD&D projects is consistent with work to develop similar frameworks for other R&D programs overseen by the CPUC. ED staff recommended submitting a letter requesting an extension of time to comply with Ordering Paragraph 4 to allow for further discussions with the subject matter experts on ED staff working to address benefits quantification. On May 26, 2022, SoCalGas submitted a letter to the Executive Director, formally requesting an extension of time from June 15, 2022, to July

[33] *Id.* at 26 (OP 5).
[34] *Id.*
[35] *Id.*
[36] *Id.*

29, 2022, to submit the requirements of OP 4 of Resolution (Res.) G-3586. On June 6, 2022, the Executive Director approved the extension.

On July 29, 2022, in response to Advice No. 6014 (U 904 G), SoCalGas RD&D submitted a Tier 2 Advice Letter (AL) pursuant to OP 4 of Res.G-3586, dated March 17, 2022, concerning certain additional information requested by the Commission regarding SoCalGas's Research, Development, and Demonstration (RD&D) program.[37] This letter addressed, among other things, the development, with substantial input from Energy Division staff, of a set of Foundational Guidelines that would help guide the development of a full benefits analysis framework.

- *Provide detail quantifying research funding allocations by research consortium, as well as project costs related to each consortium.*[38]

Section 5.2 of the Research Plan, "Funding Allocations by Research Consortium," provides detail regarding the allocation of funds to the various research consortia with which SoCalGas RD&D collaborates.

- *Provide specific rather than general detail in subprogram equity descriptions about how the research areas benefit underserved communities.*[39]

Each section in the 2024 Research Plan describing a specific subprogram includes information about how the research areas benefit underserved communities.

Protests

Anyone may protest this Advice Letter to the Commission. The protest must state the grounds upon which it is based, including such items as financial and service impact, and should be submitted expeditiously. The protest must be submitted electronically and must be received within 20 days after the date of this Advice Letter, which is September 19, 2023. Protests should be submitted to the attention of the Energy Division Tariff Unit at:

E-mail: EDTariffUnit@cpuc.ca.gov

In addition, protests and all other correspondence regarding this Advice Letter should also be sent electronically to the attention of:

Attn: Gary Lenart
Regulatory Tariff Manager
E-mail: GLenart@socalgas.com
E-mail: Tariffs@socalgas.com

[37] Decision 19-09-051 (September 26, 2019) (2019 GRC Decision) addresses the Test Year (TY) 2019 General Rate Cases (GRC) of San Diego Gas & Electric Company and SoCalGas.
[38] *Id.*
[39] *Id.*

Effective Date

OP 30 of D.19-09-051 directs SoCalGas to submit this Advice Letter as Tier 3 pursuant to General Order (GO) 96-B and, as such, requires a Resolution to be issued by the Commission. Accordingly, SoCalGas respectfully requests that it be approved by the Commission by December 1, 2023, to allow SoCalGas to timely provide funding.

Notice

A copy of this Advice Letter is being sent to SoCalGas' General Order (GO) 96-B service list and the Commission's service lists in A.17-10-008, A.22-05-015 and A.22-05-016, R.19-10-005, R.20-01-007, R.19-01-011, and R.13-11-005. Address change requests to the GO 96-B service list should be directed via e-mail to Tariffs@socalgas.com or call 213-244-2424. For changes to all other service lists, please contact the Commission's Process Office at 415-703-2021 or via e-mail at Process_office@cpuc.ca.gov.

/s/ Joseph Mock
Joseph Mock
Director – Regulatory Affairs

Attachments

California Public Utilities Commission

ADVICE LETTER SUMMARY

ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No.:

Utility type:

☐ ELC ☐ GAS ☐ WATER

☐ PLC ☐ HEAT

Contact Person:
Phone #:
E-mail:
E-mail Disposition Notice to:

EXPLANATION OF UTILITY TYPE

ELC = Electric GAS = Gas WATER = Water
PLC = Pipeline HEAT = Heat

(Date Submitted / Received Stamp by CPUC)

Advice Letter (AL) #:

Tier Designation:

Subject of AL:

Keywords (choose from CPUC listing):

AL Type: ☐ Monthly ☐ Quarterly ☐ Annual ☐ One-Time ☐ Other:

If AL submitted in compliance with a Commission order, indicate relevant Decision/Resolution #:

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL:

Summarize differences between the AL and the prior withdrawn or rejected AL:

Confidential treatment requested? ☐ Yes ☐ No

If yes, specification of confidential information:
Confidential information will be made available to appropriate parties who execute a nondisclosure agreement. Name and contact information to request nondisclosure agreement/ access to confidential information:

Resolution required? ☐ Yes ☐ No

Requested effective date:

No. of tariff sheets:

Estimated system annual revenue effect (%):

Estimated system average rate effect (%):

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

Tariff schedules affected:

Service affected and changes proposed[1]:

Pending advice letters that revise the same tariff sheets:

[1]Discuss in AL if more space is needed.

Protests and all other correspondence regarding this AL are due no later than 20 days after the date of this submittal, unless otherwise authorized by the Commission, and shall be sent to:

CPUC, Energy Division Attention: Tariff Unit 505 Van Ness Avenue San Francisco, CA 94102 Email: EDTariffUnit@cpuc.ca.gov	Name: Title: Utility Name: Address: City: State: Zip: Telephone (xxx) xxx-xxxx: Facsimile (xxx) xxx-xxxx: Email:
	Name: Title: Utility Name: Address: City: State: Zip: Telephone (xxx) xxx-xxxx: Facsimile (xxx) xxx-xxxx: Email:

ATTACHMENT A

Advice No. 6182-G

SoCalGas Research, Development, & Demonstration
2024 Research Plan

2024 Research Plan

SoCalGas Research, Development and Demonstration Department

August 28, 2023

SoCalGas™

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“California is leading the planet in building a clean energy future and SoCalGas, the nation’s largest natural gas distribution utility, is collaborating with partners to innovate and deploy new energy technologies so that every Californian can have access to clean, safe, and reliable energy.”

—Maryam Brown, President, SoCalGas

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TABLE OF CONTENTS

ACRONYMS

Acronym	Description
AB	Assembly Bill
AI	Artificial Intelligence
AQMP	Air Quality Management Plan
BTU	British Thermal Unit
C&RER	Clean & Renewable Energy Resources
CARB	California Air Resources Board
CAV	Connected and Autonomous Vehicle
CBO	Community-based Organizations
CCS	Carbon Capture and Sequestration
CCST	California Council on Science and Technology
CCU	Carbon Capture and Utilization
CCUS	Carbon Capture, Utilization, and Sequestration
CDR	Carbon Dioxide Removal
CEC	California Energy Commission
CFR	Code of Federal Regulations
CFS	Commercial Food Service
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
CNTP	Catalytic Non-Thermal Plasma
CO_2	Carbon Dioxide
CPUC	California Public Utilities Commission
CSP	Concentrated Solar Power
CSU	California State University
CTP	Clean Transportation Program
DAC	Disadvantaged Community
DEI	Diversity, Equity, and Inclusion
DG	Distributed Generation
DME	Dimethyl Ether
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EER	Equity Engagement Roadmap
EERE	Energy Efficiency and Renewable Energy
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPIC	Electric Program Investment Charge
ESJ	Environmental and Social Justice
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gas
GML	Gas Mapping LiDAR™

GRC	General Rate Case
GTI	GTI Energy (formerly Gas Technology Institute)
HFCV	Hydrogen Fuel Cell Vehicle
IoT	Internet of Things
IOU	Investor-Owned Utility
IPCC	Intergovernmental Panel on Climate Change
LCFS	Low Carbon Fuel Standard
LIC	Low-Income Community
MHD	Medium- and Heavy-Duty
MIC	Microbiological Influenced Corrosion
MMTCO_2e	Million Metric Tons of Carbon Dioxide equivalents
MSI	Minority Serving Institution
MSS	Mobile and Stationary Source
NDE	Nondestructive Examination
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NGA	Northeast Gas Association
NGV	Natural Gas Vehicle
NOx	Nitrogen Oxides
NREL	National Renewable Energy Laboratory
OIR	Order Instituting Rulemaking
OTD	Operations Technology Development
PE	Polyethylene
PG&E	Pacific Gas and Electric Company
PM	Particulate Matter
PNNL	Pacific Northwest National Laboratory
PRCI	Pipeline Research Council International
PSPS	Public Safety Power Shutoff
R&D	Research and Development
RD&D Program	SoCalGas' Research, Development, and Demonstration Program
RNG	Renewable Natural Gas
ROI	Return On Investment
RPA	Regional Public Affairs
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SCF	Standard Cubic Foot
SME	Subject Matter Expert
SMP	Sustaining Membership Program
SMR	Steam Methane Reforming
SoCalGas	Southern California Gas Company
SOFCS	Solid Oxide Fuel Cells
T&D	Transmission and Distribution

TPF	Thermal Particle Fluid
TRL	Technology Readiness Level
UC	University of California
UCI	University of California, Irvine
UTD	Utilization Technology Development
VOC	Volatile Organic Compound
ZEV	Zero-Emission Vehicle

1 Overview

The SoCalGas Research, Development, and Demonstration (RD&D) department at Southern California Gas Company (SoCalGas) plays a key role in the company's commitment to achieve net zero greenhouse gas (GHG) emissions in its operations and delivery of energy by 2045. In collaboration with experts from the world's top institutions, RD&D staff work to develop and demonstrate transformational products and technologies that enable decarbonization across the gas value chain, and innovate towards a diversified portfolio of clean, safe, reliable, and resilient energy sources.

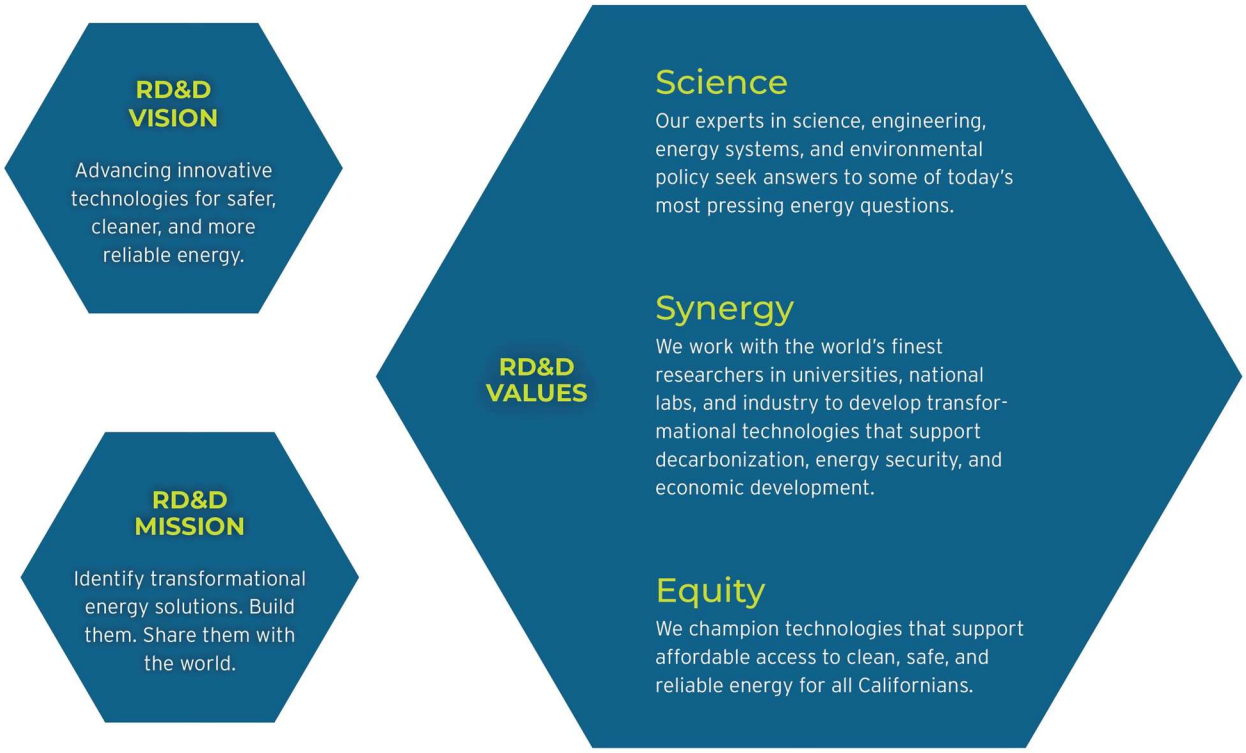


Figure 1: The vision, mission, and values of SoCalGas RD&D align with the SoCalGas mission to build the cleanest, safest, and most innovative energy infrastructure company in America.

SoCalGas RD&D staff is comprised of subject matter experts (SME) in science, engineering, industrial process technology, and environmental policy. Every year, RD&D staff support hundreds of projects along the commercialization pathway—from lab-scale research and development (R&D) to multi-year precommercial demonstrations—with the ultimate goals of saving energy, reducing GHG emissions, improving air quality, and increasing the safety, reliability, and affordability of energy.

In 2022, SoCalGas RD&D provided technical assistance, outreach, strategic guidance, and more than $13 million in funding to 339 projects throughout California and around the nation. In 2023, SoCalGas RD&D staff anticipate spending a total of $16,874,000 supporting hundreds of projects.[1]

[1] Subject to the approval of the 2023 RD&D Research Plan submitted under Advice No. 5991 on June 15, 2022.

1.1 SoCalGas RD&D Goals and Structure

The goals of SoCalGas RD&D are to identify, test, and commercialize transformational new energy technologies that have the potential to reduce GHG and criteria air pollutant emissions, maintain the energy affordability that gaseous resources have historically provided, and/or advance the safety and reliability of California's gas delivery networks and systems in an ever-changing operational environment.

SoCalGas RD&D is divided into programs, each of which is focused on products and technologies united by a broad theme such as clean transportation or gas operations. Each program is, in turn, broken into multiple subprograms. Each subprogram focuses on a subset of the program theme. Generally, directional programs and subprograms remain relatively constant from year to year. There can be changes in response to industry developments, guidance from the California Public Utilities Commission (CPUC), or stakeholder input.

Each subprogram includes several research areas. These forward-looking categories suggest the types of projects RD&D hopes to fund. Staff evaluate research areas annually. Research areas are non-exhaustive; RD&D can and does fund or otherwise support projects that do not fall within a defined research area. RD&D presents each program's research areas as part of the Annual Public workshop and in the Research Plan in order to guide researchers to identify potential technologies and projects for funding. After the Research Plan is approved by the Commission, RD&D staff will continue to work to determine which, if any, technologies in the research area are appropriate for RD&D funding and how best to advance these technologies toward commercialization. Furthermore, any proposed research projects will also be reviewed to make sure they meet the RD&D project selection criteria as described Appendix A of the 2024 Research Plan.

For the 2024 research plan, SoCalGas RD&D proposes several modifications to current programs and subprograms:[2]

Proposed 2023 Program	Proposed 2024 Program Changes
Low Carbon Resources	1. Change program name to Clean & Renewable Energy Resources (C&RER) 2. Change "Carbon Capture, Utilization, & Sequestration" subprogram to "Carbon Management"
Gas Operations	1. No changes.
Clean Transportation	1. Consolidate the existing "Onboard Storage" and "Refueling Stations" subprograms into the "Refueling Infrastructure" subprogram

[2] Subject to the approval of the 2023 RD&D Research Plan submitted under Advice No. 5991 on June 15, 2022.

Clean Generation	1. Consolidate the "Clean Generation" and "Customer End-Use Applications" programs into the "Clean Energy Applications" program 2. Consolidate the "Distributed Generation" and "Integration & Controls" subprograms from "Clean Generation" into the "Energy Reliability" subprogram 3. Eliminate the "Advanced Innovation" subprogram from the "Customer End-Use Applications" program 4. Consolidate the "Commercial Applications," Commercial Food Service," and "Residential Appliances" subprograms into the "Residential & Commercial" subprogram 5. Change the name of the "Industrial Process Heat" subprogram in the "Customer End-Use Applications" subprogram to the "Industrial Operations" subprogram
Customer End-Use Applications	

Following these modifications, SoCalGas RD&D would be structured into four programs and 12 subprograms in 2024 as follows:

Table 1: Proposed 2024 SoCalGas RD&D Structure.

Proposed 2024 Programs	Subprograms
Clean & Renewable Energy Resources	Carbon Management
	Renewable Gas Production
Gas Operations	Environmental & Safety
	Operations Technology
	System Design & Materials
	System Inspection & Monitoring
Clean Transportation	Off-Road
	On-Road
	Refueling Infrastructure
Clean Energy Applications	Energy Reliability
	Industrial Operations
	Residential & Commercial

2 SoCalGas RD&D Research Plan Development

RD&D staff broadly consider a variety of factors in determining how to allocate funding. These factors include regulatory and policy drivers, input from stakeholders, the California Public Utilities Commission (CPUC) Energy Division staff and other interested parties at our annual workshop, and the potential impact our research has on environmental and social justice (ESJ) communities. The process is designed to optimize subprogram-level funding allocations, to provide an opportunity for stakeholder input, and to maximize progress toward overarching program goals and objectives.

2.1 Regulatory and Policy Drivers

Table 2: Key state and federal policies and regulations impacting SoCalGas RD&D.

Category	Regulations and Policy Drivers
GHG Emissions	California Climate Commitment: Establishes plans and directs funding to achieve State goals regarding GHG emission reduction, improved air quality, energy affordability, and energy reliability. Assembly Bill (AB) 32: Reduce CO_2 emissions 40% below 1990 levels by 2030. AB 1279: By 2045, achieve a carbon-neutral California economy and reduce statewide anthropogenic GHG emissions to at least 85% below 1990 levels. AB 3232: Building decarbonization. Senate Bill (SB) 905: Establishes a regulatory framework for carbon removal and carbon capture, utilization, and sequestration. SB 596: For cement use in California, achieve a GHG emissions intensity 40% below baseline levels by 2035 and net-zero GHG emissions by 2045.
Pipeline Safety	CPUC General Order 112F: Rules governing design, testing, operation, and maintenance of gas transmission and distribution systems. U.S. Department of Transportation (DOT) 49 Code of Federal Regulations (CFR) Part 192: Federal pipeline safety regulations. AB 1900: Biomethane quality standards. Order Institute Rulemaking (OIR) R.13-02-008, Phase 4: Addresses injection of renewable hydrogen into gas pipelines. Joint H2 Blending Demonstration Projects (A.22-09-006): Joint application of SoCalGas, San Diego Gas & Electric, and Southwest Gas to establish H2 blending demonstration projects. Cal/OSHA Title 8 CCR: Injury and Illness Prevention Program
Local Air Quality	Clean Air Act: Air quality standards for nitrogen oxides (NOx) and particulate matter (PM). AB 617: Pilot communities for air quality improvements. SCAQMD Air Quality Management Plan (AQMP): Regional air quality plan to meet federal standards for stationary source emitters of air pollutants (e.g., GHG, NOx, PM).

Environmental Protection	Climate Adaptation OIR (R.18-04-019): Integrate climate change adaptation matters in relevant CPUC proceedings. National Environmental Policy Act (NEPA): National framework for protecting the environment.
Methane Emissions	SB 1383: Reduce methane emissions from the decomposition of organic wastes. CARB Oil and Gas Rules: Requires new monitoring and repairs to reduce methane emissions. Natural Gas STAR Program: Encourages adoption of methane-reducing technologies and practices. EPA Methane Challenge Program: Recognizes oil and gas companies that take comprehensive action to reduce methane emissions. SB 1440: Authorizes a state procurement program for RNG.
Clean Transportation	CARB Implementation Plan: Low-NOx standard for trucks. AB 8: Development of 100 hydrogen fueling stations in California. EO-B32-15: Sustainable freight action plan. EO-B48-18: 200 hydrogen refueling stations by 2025. EO N-79-20: Mandates 100% of passenger vehicle sales are zero emission by 2035, and 100% of medium- and heavy-duty vehicles are zero emission by 2045 for all operations where feasible. Low Carbon Fuel Standard (LCFS): Reduce carbon intensity of fuels by 20% by 2030.
Clean Power Generation	SB 100: 100% of all retail sales of electricity to California end-use customers must be renewable by 2045. SB 1020: 100% of electricity procured to serve all state agencies must be renewable by 2035.
Equity	CPUC General Order 156: Encourages investor-owned utilities (IOUs) to procure or contract goods and services from women, minority, disabled veteran, and/or LGBT owned business enterprises. CPUC ESJ Action Plan: Increases investment in clean energy resources to benefit environmental and social justice communities, especially to improve local air quality and public health.

3 Stakeholder Input

3.1 Stakeholder Outreach

SoCalGas RD&D works closely with industry professionals and SMEs at universities, national labs, public agencies, businesses, and industry research consortia to maximize the impact of its funding of promising technologies and products focused on producing or delivering cleaner, safer, and more reliable energy. These relationships help SoCalGas engage with science and technology experts, other utilities, and industry stakeholders to effectively identify and close knowledge and research gaps, avoid duplication of previous and ongoing research, and reduce technology and commercialization risks to achieve the goals of SoCalGas RD&D. Conversations with these (and other) stakeholders and SMEs are ongoing throughout the year, but in preparation for the 2024 funding allocations, RD&D staff also conducted a series of targeted interviews with approximately 16 people from 13 different organizations in the first quarter of 2023 shown below.

Table 3: 2023 Stakeholder Organizations Interviewed.

7th Generation Advisors	Pipeline Research Council International
California Energy Commission	National Renewable Energy Laboratory
Cal State LA	South Coast Air Quality Management District
Darcy Partners	Stanford Doerr School of Sustainability
Energy Independence Now!	University of California, Los Angeles
GTI Energy	U.S. Department of Energy
Pacific Gas and Electric Company	

During these interviews, the SMEs and industry stakeholders were asked a series of standard questions and then engaged in a freeform discussion about the industry and its RD&D needs. See Appendix A for a summary of responses. The 2023 outreach questions follow:

1. Which of the four program areas and associated subprograms are most relevant to you?
2. Within the areas you selected as most relevant, what are the most critical knowledge gaps or research priorities?
3. Keeping these areas of relevance in mind, are there any regulatory issues we should be aware of?
4. Are you aware of any ongoing research in these areas on which we could collaborate?
5. What new trends or technologies are you aware of that you would recommend us to explore further? What do you consider has the most potential for quicker deployment in this space? What excites you?
6. What could SoCalGas consider doing to strengthen its RD&D department?
7. SoCalGas RD&D is interested in increasing the equity component of the projects it supports. Can you share any best practices or lessons learned from your program?
8. If we were to remember only one thing from our discussion with you, what should that be?
9. Who else should we talk to get guidance in setting our research priorities?

After completing this outreach process, RD&D staff aggregated the input obtained from these stakeholders and reviewed and assessed whether changes to the research plan were needed. Participants represented a broad cross section of the industry and expressed interest across all four RD&D programs in the aggregate.

Table 4: Interviewed Stakeholder Research Interests.

C&RER	12
Carbon Management	10
Renewable Gas Production	9
Gas Operations	6
Environmental & Safety	5
Operations Technology	4
System Design & Materials	3
System Inspection & Monitoring	3
Clean Transportation	8
Off-Road	5
On-Road	3
Refueling Infrastructure	4
Clean Energy Applications	8
Energy Reliability	3
Residential & Commercial	7
Industrial Applications	5

Of the 13 organizations interviewed, all 13 expressed a strong interest in hydrogen and 10 in carbon management. More broadly, key themes identified in the 2023 outreach include:

- A standard definition for green hydrogen is needed with a focus on carbon intensity.
- More testing is needed on the impact of blending hydrogen and biogas into existing natural gas pipelines. Topics should include leakage prevention, pipeline injection, and reducing the cost of associated equipment.
- Better understanding is needed about the bulk transport of hydrogen under high pressure and there is a need for more exploration in this area.
- Engagement and education of policy makers, legislators, and the environmental community is critical to advancing hydrogen pathways. More fact-based evidence is needed for decision makers to make informed decisions.
- It is important to leverage ongoing relationships and trust in disadvantaged communities so that they can have meaningful input in projects. Target high schools, community colleges, Minority Serving Institutions (MSI). Building more personalized connections helps to better understand their particular energy needs.

- It is important to look at how to improve pipeline integrity and inspection and monitoring processes and equipment to prevent incidents.
- Standardization is needed across the hydrogen ecosystem, particularly for refueling infrastructure, leak detection and mitigation, and safety.
- Continue collaboration and consider convening an annual meeting of RD&D personnel from other utilities.
- Design projects from the start with equity in mind.
- Invest more in hydrogen and conduct research into how this transition will impact SoCalGas.
- Start a PhD graduate internship for postdocs from underserved populations.
- Consider starting a new program focused on workforce development and retraining around the transition to hydrogen.
- Explore the use of new valves, flow meters, and welding spots to maintain the integrity of pipelines carrying hydrogen.
- Ammonia for shipping applications is highly suspect because there are many regulatory hurdles associated with its use and there can be a significant safety risk to ship personnel.
- The cost of microgrid applications for fuel cells must come down.
- Explore carbon capture and use of depleted oil reservoirs for carbon or hydrogen storage. Look also at repurposing infrastructure for CO_2 service.
- Explore satellite technology for methane detection.
- Look at more distributed production of hydrogen and local consumption.
- Examine how to better quantify the value of RD&D over various time periods.
- Investment in R&D is needed today to maintain the safety and integrity of our current systems and that a mosaic of the energy is needed in the future.
- Deployment of technologies is critical. Consider larger deployments at higher Technological Readiness Levels (TRLs).
- Look at containerized fuel cells paired with batteries to charge fleets while the grid is adapting to increased demand associated with electrification.
- Focus more on turning electrons into infrastructure-compatible molecules.
- Design R&D work from the beginning with scale in mind.
- Explore methane removal from the atmosphere via oxidation of methane into CO_2.
- Use carbon-negative RNG or carbon-neutral natural gas to produce carbon/graphite for batteries and other products.
- Historically underserved populations are more sensitive to affordability.
- Perform lifecycle analyses of CO_2 and H_2 transport.
- Advocate for a central clearinghouse of R&D data to support wider deployment of technologies and reduce duplication of work.

3.2 Annual Stakeholder Workshop

On April 25, 2023, SoCalGas RD&D hosted an online workshop to present the results of the previous year's program and obtain input regarding proposed spending allocations for 2024. SoCalGas RD&D staff publicly announced the workshop on the SoCalGas RD&D website and LinkedIn page and by email notice to the service lists of CPUC proceedings A.17-10-008, A.22-05-015/016, R.19-10-005, R.20-01-007, R.19-01-011, and R.13-11-005.

238 individuals from a wide variety of organizations attended the workshop. Organizations sending attendees included two national laboratories, six public agencies, and numerous

industry organizations, universities, community-based organizations (CBOs), and private companies.[3]

2023 Annual Stakeholder Workshop Attendee List

2H Offshore Engineering Ltd.	K2 Sales Consulting
Air Products	Larta Institute
American Gas Association	Law Office of Elizabeth Kelly
Argonne National Laboratory	Los Angeles Department of Water and Power
Arthur Little	Los Angeles Valley College
Avangrid, Inc.	McCracken Stemerman & Holsberry LLP
Baker Hughes	Mote Hydrogen
Bakersfield College	National Grid
Barr Engineering Co.	National Renewable Energy Laboratory
Buchalter	Nearshore Natural Gas, LLC
Burns & McDonnell	New Jersey Resources
C-Quester	NGV America
California Air Resources Board	Noble Thermodynamics
California Energy Commission	Northeast Gas Association
California Public Utilities Commission	NW Natural
Cal State LA	Opinion Dynamics
Cal State Sacramento	Pacific Gas and Electric Company
Caltrol	Pipeline Research Council International
Capgemini	Process Ecology
Carlton Forge Works	RedwoodAdaptive
Clean Energy	Rinnai
Cordoba Corporation	San Diego Gas and Electric
Darcy Partners	Small Business Utility Advocates
East Los Angeles College	South Coast Air Quality Management District
Electric Power Research Institute, Inc.	Southern California Edison
Emission Free Generators, Inc.	Southwest Gas
Enbridge	Sowing Seeds For Life
Energy Capital Ventures	SPEC Services
Environmental Defense Fund	SPX Technologies
Foresight Canada	Stantec
GTI Energy	Stoel Rives LLP
Guidehouse	Tour Engine
H2U Technologies	Triple E Energy Advisors
HDR, Inc.	Tulare County Economic Development Corp.
Hydrogen Fuel Cell Partnership	University of California, Irvine
Hyundai America Technical Center, Inc.	U.S. Department of Transportation
ICF	WEC Energy Group
Jacobs	

[3] To encourage participation by CBOs, RD&D provided stipends to several CBOs to cover their time attending the workshop and providing feedback.

During the five-hour workshop, RD&D team members introduced SoCalGas RD&D at a high level, summarized 2022 results, described each program in detail, and discussed plans for 2024. At the end of each section of the presentation, the RD&D team fielded questions and comments from attendees. SoCalGas also posted a link to the workshop recording on the SoCalGas RD&D web page.[4]

3.3 Quarterly Webinars

In 2022, SoCalGas presented quarterly research webinars discussing four projects supported by SoCalGas RD&D.

- **Thermal Particle Fluid for Commercial and Industrial Emissions Reduction**
  This webinar with GTI Energy discussed an innovative thermal particle fluid (TPF) that can recover, store, and transport heat for large commercial and industrial processes. By recovering and reusing waste heat, TPFs can reduce fuel demand for large process heat systems, resulting in lower combustion emissions and decreased customer costs.
- **Gas Mapping LiDAR™ Airborne Methane Leak Detection and Emissions Monitoring**
  During this program, Mike Thorpe, CTO of Bridger Photonics, Inc., spoke about Gas Mapping LiDAR™ (GML), an airborne methane emission monitoring technology that detects, localizes, and quantifies methane emissions from all segments of the natural gas value chain. Thorpe provided an overview of the GML technology, discussed results from performance validation testing, and described how it's being used for emissions monitoring surveys in the SoCalGas service area.
- **An Inflection Point for Global Pipeline Safety and Integrity**
  In this webinar, Cliff Johnson, President of Pipeline Research Council International (PRCI), introduced his organization's drive for lower emissions and a lower carbon future. This session explained the multifaceted strategy that PRCI is taking to enable the safe transport and storage of hydrogen and renewable natural gas.
- **Metal Supported Solid Oxide Fuel Cells: The Key to Efficient, Fast Start Backup Power Generation**
  In this webinar, SoCalGas RD&D and Lawrence Berkeley National Laboratory (LBNL) discussed an innovative metal-supported solid oxide fuel cell (MS-SOFC) that can be used for clean power generation and electrolytic hydrogen production.

3.4 Coordination with CEC and Other IOUs

SoCalGas RD&D is committed to continue building stronger relationships and coordination with the CEC, the California Air Resources Board (CARB), the South Coast Air Quality Management District (SCAQMD), and the U.S. Department of Energy (DOE), and other government agencies, IOUs, and municipally-owned utilities.

Conversations with these and other stakeholders and SMEs are ongoing throughout the year, but in preparation for the 2024 funding allocations, RD&D staff also conducted a series of targeted interviews with 16 people from 13 different organizations, including the CEC and IOUs, in the first quarter of 2023. During these interviews, the SMEs and industry stakeholders were asked a series of standard questions and then engaged in a freeform

[4] https://www.socalgas.com/sustainability/research-development-demonstration-rdd

discussion about the industry and its RD&D needs. See Section 3.1 for a summary of input obtained during this outreach process.

SoCalGas RD&D enjoys a close collaboration with the CEC.[5] For example, several SoCalGas RD&D staff attended and participated in the CEC's Workshop to review the Gas R&D Budget Plan for Fiscal Year 2023-24. Furthermore, on April 21, 2023, SoCalGas RD&D staff met with CEC Gas R&D staff to coordinate on upcoming R&D activities ahead of SoCalGas' Public Workshop. SoCalGas RD&D staff routinely communicate with CEC staff regarding ongoing projects and future research interests.

SoCalGas RD&D also collaborates and coordinates with other IOUs through involvement with national research consortia. These consortia are made up of IOUs and other researcher organizations. Their intent is to leverage funding, expertise, and collaboration to maximize the value of research projects and avoid duplication of R&D efforts.

In addition, the research consortia meet with other organizations and agencies to discuss on-going and future research plans to avoid duplication of research, publish public Annual Reports summarizing their work, and develop project proposals in response to agency funding opportunities. The Operations Technology Development (OTD) and Utilization Technology Development (UTD) research consortia monitor CEC solicitations as a mechanism to further leverage critical research dollars. Industry-led research consortia such as UTD and OTD not only provide cost-share to projects, but also provide industry technical representation and input. SoCalGas RD&D also works directly with other utilities to advance technologies that will benefit all Californians. For example, SoCalGas RD&D collaborated with Pacific Gas and Electric Company (PG&E) to support the development of Brimstone Energy's low-cost, low-energy hydrogen and sulfuric acid coproduction via electrolysis technology. See Section 5.2 for more information about SoCalGas RD&D's participation in research consortia.

[5] Molin, Daphne. 2023. Energy Research and Development Division. 2023. Gas Research and Development Program Proposed Budget Plan for Fiscal Year 2023–24. California Energy Commission. Publication Number: CEC-500-2023-020, p.10.

4 Equity

The urgency of climate action cannot be understated. Indeed, many studies have concluded that achieving ambitious decarbonization goals across all economic sectors will be necessary to avert climate catastrophe.[6, 7, 8] For those in historically under-resourced communities, the stakes are particularly high. Associated negative impacts—including heat waves, drought, wildfires, and flooding—can affect those groups disproportionately, not only because they lack adequate access to resources such as health care and insurance but also because they often live in areas subject to recurrent geo-hazards or with poorly developed infrastructure.

SoCalGas shares the goal of reaching carbon neutrality while maintaining safe, reliable, and resilient service at affordable rates. In 2021, SoCalGas announced ASPIRE 2045, a sustainability strategy that includes a commitment to net zero emissions in the company's operations and energy delivery by 2045.[9]

Figure 2: SoCalGas' Three Pillars of Engagement.[10]

People	Purchasing & Supplier Diversity	Community Investments
The company's more than 8,000 employees mirror the diversity of the more than 21 million consumers in more than 500 Californian communities served by SoCalGas.	Working with culturally and ethnically diverse business owners is an integral part of SoCalGas' corporate strategy and benefits its suppliers and the local community.	SoCalGas' charitable investments and partnerships help create safe, healthy, and thriving communities. SoCalGas also strives to provide economic opportunities among under-resourced communities.

SoCalGas also seeks to provide benefits to the communities it serves, including under-resourced communities, through a variety of internal programs, including:[11] Climate

[6] https://unfccc.int/news/rapid-decarbonization-needed-to-prevent-climate-disaster
[7] https://www.nature.com/articles/d41586-021-00864-9
[8] https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/
[9] https://www.socalgas.com/sustainability/aspire-2045-faqs
[10] https://www.socalgas.com/careers/diversity
[11] During the roadmapping process, stakeholders encouraged SoCalGas to share information about the benefits it provides to its employees and the communities it serves.

Champions Grant Program,[12] community donations,[13] workforce development, employee engagement, and supplier diversity.[14]

4.1 SoCalGas RD&D Equity Engagement Roadmap

Recognizing the role that it can play in mitigating some of the negative impacts of climate change on historically under-resourced communities—and in response to input received from community and agency stakeholders, including the CPUC—SoCalGas RD&D completed an Equity Engagement Roadmap (EER) in 2022.

Designed to clearly communicate with both the public and government agencies, this document describes a multi-year vision for enhancing equity engagement with stakeholders. The ultimate goal of this engagement is to maximize the likelihood that the benefits of new, clean energy technology positively and equitably impact all communities within California, including those communities that have been historically under-resourced.[15]

The EER incorporates input from an extensive literature review and numerous stakeholders, including many representatives from ESJ communities and internal stakeholders. SoCalGas RD&D staff solicited input from 14 CBOs on the draft EER:

- Anaheim Family YMCA
- Boys & Girls Club Anaheim and Cypress
- Boys Republic
- Community Action Partnership of Kern
- Delhi Center
- DIY Girls
- Endowment for Youth Committee
- FIND Food Bank
- Imperial Valley Economic Development Corporation (IVEDC)
- Mar Vista Family Center
- Tulare Kings Hispanic Chamber of Commerce
- United Boys & Girls Club of Santa Barbara County
- Wilmington YMCA
- Young Visionaries

SoCalGas RD&D will use the EER to guide its ongoing engagement efforts. RD&D staff also use it to develop, update, and track equity engagement metrics that serve as a way to evaluate program success, inform research priorities in the annual Research Plan, and select projects.

For more information, read the attached *SoCalGas Research, Development, and Demonstration Equity Engagement Roadmap*.

[12] https://socalclimatechampionsgrant.com/
[13] https://www.socalgas.com/our-community/empower
[14] https://www.socalgas.com/for-your-business/supplier-diversity
[15] Based on input received during the road-mapping engagement process, SoCalGas RD&D uses the term *under-resourced* rather than *underrepresented* or *underserved*.

5 Proposed 2024 Funding Allocations

5.1 Proposed 2024 Funding Allocations

The 2024 funding levels were forecast by SoCalGas RD&D as part of the 2024 General Rate Case (GRC), which will establish the authorized funding for Test Year 2024 and the escalation and attrition rates for each subsequent year in SoCalGas' rate case cycle. In 2024, SoCalGas RD&D proposes to allocate approximately 10% or $2,324,900 to program administration. Activities in the Program Administration Budget were organized to align with allowable Electric Program Investment Charge (EPIC) administration cost categories developed in the process launched by D.21-11-028.

Program Administration Budget Items[16]	**2024 Forecast**
1. Investment Plan Development	$ 195,620
3. Project Initiation	$ 86,654
5. Project Oversight and Governance	$ 121,664
6. Stakeholder Communication, Engagement, and Outreach	$ 957,500
9. Regulatory Support and Compliance	$ 462,258
10. Internal Management Coordination	$ 56,814
11. Program and Process Coordination and Improvement	$ 194,036
12. Administration Activities	$ 108,317
13. Supervision and Personnel	$ 113,629
14. Training and Development	$ 28,408
Total	**$ 2,324,900**

The remaining authorized budget, approximately $20,924,000, is allocated across the subprograms. First, each subprogram identified committed funds for 2024. These are funds that are related to continuing projects and will be spent in 2024 with a high degree of certainty.

Next, each subprogram identified funds for projects that are under development for 2024. Subprogram personnel identified key research areas of interest for 2024. This funding is allocated to support projects in these key research areas for which some uncertainty in timing or budget remains. For example, on some projects, certain components such as research partner, testing location, co-funding source, or timeline have not yet been determined. The key research areas are examples of research concepts that could be funded if the appropriate project is developed. Funds may also be redirected to new research areas that arise during the plan year.

Table 5: SoCalGas RD&D Proposed 2024 Funding Allocations by program and subprogram.

Programs	**Program Funding**	**Subprograms**	**Subprogram Funding**

[16] Program Administration Budget Items are taken from the categories listed in PG&E Advice No. 6478-E.

Clean & Renewable Energy Resources	$7,504,000	Carbon Management	$3,752,000
		Renewable Gas Production	$3,752,000
Gas Operations	$3,973,000	Environmental & Safety	$794,600
		Operations Technology	$595,950
		System Design & Materials	$1,589,200
		System Inspection & Monitoring	$993,250
Clean Transportation	$4,470,000	Off-Road	$1,698,600
		On-Road	$1,698,600
		Refueling Infrastructure	$1,072,800
Clean Energy Applications	$4,977,000	Energy Reliability	$1,493,100
		Industrial Operations	$1,990,800
		Residential & Commercial	$1,493,100
Program Administration	$2,324,900		
Total	**$23,248,900**		

After careful review and consideration of stakeholder input (Section 3.1), RD&D staff identified the subprograms listed above and the key research areas described below. In response to new stakeholder input, changing market conditions, new legislation or policy drivers, or significant advances in technology, RD&D Program staff may also choose to fund projects that are in alignment with overall program goals and objectives but do not fall under the research areas listed in the Research Plan.

5.2 Funding Allocations by Research Consortium

Per Resolution G-3586, SoCalGas RD&D is instructed to:

> *Provide detail quantifying research funding allocations by research consortium, as well as project costs related to each consortium.*

The breakdown for each Research Consortium is listed in the table below.

Research Consortium	**2024 Dues[17]**	
	Total	**Portion available for Project Allocation[18]**
NYSEARCH	$72,250	$0
OTD	$750,000	$693,750

[17] Estimated dues. OTD dues offset by projects funded under the SB1371 Leakage Abatement Program. PRCI dues are calculated annually based upon miles of pipe.
[18] Estimated based upon historical trends after administrative deduction.

PRCI	$150,000	$100,000
UTD	$350,000	$315,000

Research Consortium	**Total Consortium-related Project Costs[19]**	
	Total SoCalGas Cost	**Total Project Cost**
NYSEARCH	$0	$0
OTD	$251,912	$9,191,615
PRCI	$ 1,199,605	$9,751,266
UTD	$140,638	$2,931,000

The utilization of consortium dues varies by organization. Dues cover administrative expenses, with the remaining portion allocated to projects.

[19] The total consortium-related project costs include 2024 "continuing projects" (projects previously initiated and spanning multiple years) based upon estimated end dates as of 5/31/2023. More details on continuing projects can be found in the Project Details section of this document. The project selection and funding process for the 2024 year will begin in the 4th quarter of 2023, subject to the timing of the Commission's approval of the 2024 RD&D Research Plan.

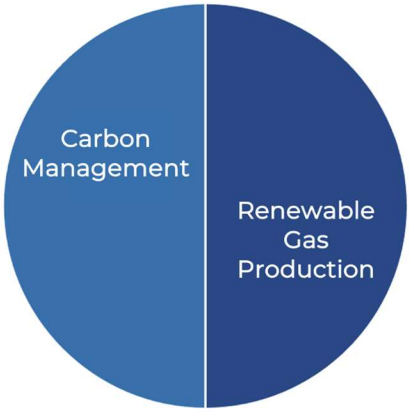
6 CLEAN & RENEWABLE ENERGY RESOURCES

The primary goal of the Clean & Renewable Energy Resources (C&RER) program is to advance decarbonization of the gas supply while maintaining its affordability and reliability. To achieve this goal, program staff members develop, promote, and advance new technologies aimed at increasing and expanding the production of renewable gas to displace conventionally sourced pipeline gas, while mitigating GHG emissions or capturing them for utilization or sequestration.

The program invests in technology development projects in the following subprograms: 1) Carbon Management and 2) Renewable Gas Production.

6.1 Proposed 2024 C&RER Funding Allocation

Figure 3: Summary of proposed 2024 Funding Allocations for Subprograms within the C&RER Program.



Subprogram	Allocation
Carbon Management	50%
Renewable Gas Production	50%
Total	**$7,504,000**

6.2 Policy Considerations

C&RER activities align with California's decarbonization goals. By reducing the carbon-intensity of the gas grid through gradual decarbonization, this subprogram supports the following policies:

Policy	Description
California Climate Commitment	Invests $54B in programs fighting climate change, mitigating its impacts, and transitioning to a climate-friendly economy
EO B-55-18	2045 Carbon-neutral California economy
AB 32	Reduce CO_2 emissions 40% below 1990 levels by 2030
AB 1279	By 2045, reduce statewide anthropogenic GHG emissions to at least 85% below 1990 levels
Clean Air Act	Air quality standards for NOx and PM
EO-S-3-05	GHG emission reduction targets
SB 1383	Reduce methane (CH_4) emissions from organic waste
LCFS	Reduce carbon intensity of transportation fuels

SB 905	Establishes a regulatory framework for carbon removal and carbon capture, utilization, and sequestration

6.3 Carbon Management

6.3.1 Subprogram Overview

This subprogram focuses on carbon capture, utilization, and sequestration activities that can enable decarbonization efforts. Roughly half of the excess CO_2 released into the atmosphere by human activity is absorbed by plants and the world's oceans. CCUS technologies seek to capture, utilize, or sequester the balance of these CO_2 emissions through a variety of approaches, including direct air capture coupled with either conversion into plastics, cement, or biofuels (carbon capture utilization or CCU) or sequestration into depleted oil fields and or saline aquifers (carbon capture sequestration or CCS). This subprogram's portfolio also includes methane pyrolysis projects in which solid carbon is produced from a methane feedstock and captured simultaneously with hydrogen generation. However, because the solid carbon produced can either be converted into a useful product or sequestered in solid form, methane pyrolysis will be listed as a stand-alone category under CCUS.

6.3.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Carbon Capture and Utilization (CCU)**
  Projects in this research area explore different carbon capture and utilization pathways, techniques, and methodologies. Carbon capture technologies under consideration in this area—including direct air capture —aim to investigate and improve various CO_2 capture technologies while also targeting cost reduction needed for mass deployment.

  Carbon utilization encompasses a wide variety of conversion technologies through which CO_2 is converted into valuable end products, including methanol, plastics, dimethyl ether (DME), cement, and biofuels such as RNG. Examples of technologies and processes that can be leveraged to convert CO_2 into useful products include:
  - Electrochemical and electrocatalytic processes used to produce plastics and biofuels from CO_2 and water using electricity.
  - Electro-methanogenesis processes that use electricity to convert CO_2 and water into RNG.
  - Mineralization processes used to produce substances such as concrete.
- **Area 2: Carbon Capture and Sequestration (CCS)**
  CCS involves the use of geological formations such as active or depleted oil and gas reservoirs or saline aquifers to sequester CO_2. Studies by the Intergovernmental Panel on Climate Change (IPCC)[20] and the California Council on Science and Technology (CCST) show that CCS has the potential to reduce carbon emissions by billions of metric tons and may be an integral part of meeting California's climate

[20] IPCC, 2014, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, page 151.

goals in 2050.[21] Indeed, CCS allows for existing fossil fuel resources, such as natural gas, to be used in a way that produces far fewer carbon emissions than their use without CCS. Due to the potential importance of CCS in meeting California's long-term climate goals, CARB plans to integrate CCS into its climate programs in compliance with the AB 32 requirements that GHG emissions reductions achieved are real, permanent, quantifiable, verifiable, and enforceable. Studies have concluded that there is sufficient pore space available in California to inject 3.6 to 6.6 $GtCO_2$.[22] CCS is already being demonstrated to sequester carbon emission from large-scale steam methane reforming (SMR) facilities and improve the carbon intensity of natural-gas-derived hydrogen.[23] [24] Projects in this research area seek to fill research gaps for the safe and reliable transportation of gaseous CO_2 via pipeline, as well as modeling of CO_2 injection in depleted reservoirs, to provide stable, long-term sequestration.

- **Area 3**: **Emissions-Free Hydrogen Production via Methane Pyrolysis**
  SoCalGas is investigating multiple methane pyrolysis pathways. Methane pyrolysis is a nascent but extremely interesting technology that can be combustion-free, to decompose methane into hydrogen and solid elemental carbon. The carbon is used for a wide variety of applications depending on the product characteristics, from cement additives to carbon nanotubes. This technology has tremendous decarbonization potential because it does not generate any gaseous carbon emissions and reduces the cost of large-scale hydrogen generation while simultaneously offsetting GHG emissions. Most importantly, by using RNG as feedstock and renewable electricity as the source of energy to drive the reaction, the overall process can demonstrate methane conversion with negative carbon intensity.

6.3.3 Subprogram Benefits

Benefit	Explanation
Reliability	Leveraging synergies between renewable energy surplus/curtailment, carbon capture, and RNG production from captured CO_2 through advanced methanation processes can help improve gas system reliability and reduce reliance on out-of-state gas resources while simultaneously decarbonizing the pipeline. This benefit relates to the identical benefit under the "Renewable Gas Production" subprogram.
Environmental: Reduced GHG Emissions	CCUS systems can permanently remove CO_2 from the air, resulting in potentially negative overall carbon emissions. In addition, emissions-free hydrogen production via methane pyrolysis can further help decarbonize the pipeline and

[21] CCST, 2011, California's Energy Future: The View to 2050.
[22] Tae Wook Kim , Catherine Callas , Sarah D. Saltzer , Anthony R. Kovscek, "Assessment of oil and gas fields in California as potential CO_2 storage sites," International Journal of Greenhouse Gas Control 114 (2022) 103579, 2 January 2022. Page 1.
[23] https://www.axens.net/resources-events/faq/faq-what-options-are-there-co2-capture-smr-based-hydrogen-unit
[24] https://www.osti.gov/biblio/1437618

	reduce its associated GHG emissions as well as offset emissions from hard-to-decarbonize industrial sectors.
Environmental: Improved Air Quality	Many CDR pathways such as DAC could provide the co-benefit of potentially reducing criteria air pollutants.[25]

A summary of specific benefits of the Carbon Management subprogram to residential ratepayers follows. More detail can be found in SoCalGas RD&D's May 19, 2023, response to the CPUC data request dated May 5, 2023.

- **CCUS could provide cost-effective mitigation of emissions from residential customers.** Carbon removal and sequestration will be an essential tool for California to achieve carbon neutrality[26]. Governor Newsom recognized the importance of CO_2 removal strategies and directed CARB to establish CO_2 removal and carbon capture targets of 20 $MMTCO_2$ and 100 $MMTCO_2$ by 2030 and 2045, respectively. He also signed 2022 legislation on carbon removal and sequestration, including: AB 1279, SB 905, SB 1137, and AB 1757.[27] Even with those significant targets, there will still be legacy GHG emissions that should be addressed for California to achieve the 2045 carbon neutrality target. Increased deployment of carbon dioxide removal (CDR) technologies can help achieve negative emissions in the desired timeframe. Direct air capture is one of the available technologies currently under development, where R&D projects can make a significant impact in accelerating deployment and reducing cost. Large, centralized direct air capture systems could provide a cost-effective way to mitigate the impacts of incremental and legacy emissions from residential ratepayers, without requiring costly equipment replacements or electrical upgrades.
- **CCUS could improve local air quality for Southern California residential ratepayers.** According to the U.S. Department of Energy' Fossil Energy and Carbon Management Office, many CDR pathways could provide the co-benefit of potentially reducing criteria air pollutants.[28] RD&D can advance how CDR pathways are developed and deployed, which will influence the co-benefits that can be realized. This potential air quality improvement is especially important for California's ESJ communities, where air quality is often measurably worse than in other communities, largely due to the disproportionate share of industrial facilities in these areas.[29] Furthermore, this benefit is particularly important to residential ratepayers in SoCalGas's service territory, which encompasses the only two extreme federal non-attainment areas for ozone in California.[30]
- **RD&D is uniquely positioned to develop CCUS technologies to address equity concerns.** To address the impacts of climate change, California must not only reduce GHG emissions, but also remove legacy CO_2 emissions from the

[25] https://www.energy.gov/sites/default/files/2021-11/Carbon-Dioxide-Removal-FAQs.pdf/de/d
[26]CARB 2022 Scoping Plan, p. 84 available at https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf
[27]CARB 2022 Scoping Plan, p. 84 available at https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf
[28] https://www.energy.gov/sites/default/files/2021-11/Carbon-Dioxide-Removal-FAQs.pdf
[29] CPUC Disadvantage Community Action Plan, at 10, available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/news-and-outreach/documents/news-office/key-issues/esj/esj-action-plan-v2jw.pdf
[30] 8-Hour Ozone (2015) Nonattainment Areas | Green Book | US EPA, available at https://www3.epa.gov/airquality/greenbook/jnc.html

atmosphere. Aside from the global warming impacts of removing excessive CO_2, assessing CCUS projects must include consideration of local communities. Whether it is through SoCalGas's Regional Public Affairs team, SoCalGas's Diversity, Equity, & Inclusion (DEI) program, or RD&D's annual public workshop, RD&D has a critical direct connection to residential ratepayers that informs the foundation of its research program.

- **CCUS could bring jobs for Southern California residential ratepayers.** According to the U.S. Department of Energy's Fossil Energy and Carbon Management Office, many CDR pathways could provide the co-benefit of job creation.[31] The extent to which co-benefits are realized will depend on how CDR pathways are developed and deployed, something that RD&D can promote through research and demonstration projects. This is especially important for SoCalGas's residential ratepayers, because SoCalGas RD&D endeavors to attract high quality research and demonstration projects, and the associated co-funding, to our service territory.
- **CCUS could reduce carbon Cap & Trade costs paid for by residential customers.** Residential rates are affected by the requirement to purchase allowances under California's Cap & Trade Program.[32] RD&D seeks to advance CCUS technologies and make them more cost-effective. These new technologies could reduce the cost of capturing and sequestering carbon which, in turn, could reduce residential ratepayers' costs.
- **CCUS can help enable a diversified supply of low-carbon hydrogen.** Several hydrogen production routes produce CO_2 as a byproduct (including biologically-derived hydrogen, gasification, and steam methane reforming); additional R&D in carbon capture and utilization projects can help enable a diversified portfolio of hydrogen supply through multiple feedstocks and production routes. Residential ratepayers could benefit from an energy supply that is more diverse and potentially more reliable and affordable and less susceptible to rapid price swings.
- **CCUS could reduce the cost of RNG delivered to residential ratepayers.** The CPUC established a renewable gas standard[33] that requires SoCalGas to replace 12.2 percent of the traditional natural gas it delivers to core customers with RNG by 2030. The overwhelming majority of gas utility customers in California are residential and small commercial core customers.[34] The standard also sets an interim goal of procuring approximately 3 percent RNG by 2025. CO_2 can be combined with clean renewable hydrogen to produce RNG. Advancing CCUS technologies via RD&D projects could reduce the cost of CO_2 supply used to produce RNG and/or increase the supply of RNG available in California. Both actions would tend to drive down the cost of RNG for residential ratepayers. Use of CO_2 to make RNG brings the benefits of decarbonizing (and increasing) renewable gas supply and reduction of GHGs and improvement in local air quality.

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[31] Carbon-Dioxide-Removal-FAQs.pdf (energy.gov) at FECM8 – FECM9 available at https://www.energy.gov/sites/default/files/2021-11/Carbon-Dioxide-Removal-FAQs.pdf

[32] Cap-and-Trade Program | California Air Resources Board available at https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program

[33] SoCalGas Applauds Establishment of First Renewable Gas Standard in the United States | SoCalGas Newsroom. available at https://newsroom.socalgas.com/press-release/socalgas-applauds-establishment-of-first-renewable-gas-standard-in-the-united-states#:~:text=Under%20this%20new%20renewable%20gas%20standard%2C%20SoCalGas%20will,procuring%20approximately%203%20percent%20renewable%20gas%20by%202025.

[34] https://www.cpuc.ca.gov/natural_gas/.

6.3.4 Equity

Deployment of carbon capture technologies near industrial facilities, which tend to be co-located in ESJ communities, can improve the local air quality in those communities. In addition, hydrogen from methane pyrolysis can be used directly to provide carbon-neutral emissions-free energy in hard-to-decarbonize industries, such as steel and aluminum, which are also located in ESJ communities. These benefits to ESJ communities are aligned with Goal 2 of the CPUC ESJ Action Plan. Equally as important, by offsetting GHG emissions, CCS technologies will reduce the negative impact of climate change on ESJ communities (Section 4.1).

As explained in SoCalGas RD&D's May 19, 2023, response to the CPUC data request dated May 5, 2023, according to the U.S. DOE's Fossil Energy and Carbon Management Office, many CDR pathways could provide the co-benefit of potentially reducing criteria air pollutants.[35] RD&D can advance how CDR pathways are developed and deployed, which will influence the co-benefits that can be realized. This potential air quality improvement is especially important for California's ESJ communities, where air quality is often measurably worse than in other communities, largely due to the disproportionate share of industrial facilities in these areas.[36] Furthermore, this benefit is particularly important to residential ratepayers in SoCalGas's service territory, which encompasses the only two extreme federal non-attainment areas for ozone in California.[37]

To address the impacts of climate change, California must remove legacy CO_2 emissions from the atmosphere in addition to reducing current GHG emissions. Aside from the global warming benefits of removing excessive CO_2, assessment of CCUS projects must include consideration of local communities. Through SoCalGas's Regional Public Affairs team, SoCalGas's DEI program, or RD&D's annual public workshop, RD&D has a critical direct connection to residential ratepayers that informs the foundation of its research program.

One such example of an RD&D project is the deployment of hybrid direct air capture (HDAC) technology by Avnos. In this project, Avnos is installing a pilot-scale system in Bakersfield, California, which removes CO_2 directly from the atmosphere while capturing a stream of deionized water. Since water is a critical resource in the Central Valley region around Bakersfield, this technology can benefit local industry and agriculture by providing a supply of water. Furthermore, this type of demonstration project could help provide training for the local workforce to operate this system once at scale. In addition to GHG reduction benefits, projects like this can enable a circular carbon economy by increasing the supply of CO_2 for use in other emerging technologies, such as those targeting the conversion of CO_2 into products or fuels with a zero or net-negative carbon intensity.

6.3.5 Funding Table

Clean & Renewable Energy Resources Program
Carbon Management Subprogram 2024 Funding Allocation

[35] https://www.energy.gov/sites/default/files/2021-11/Carbon-Dioxide-Removal-FAQs.pdf
[36] CPUC Disadvantage Community Action Plan, at 10, available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/news-and-outreach/documents/news-office/key-issues/esj/esj-action-plan-v2jw.pdf
[37] 8-Hour Ozone (2015) Nonattainment Areas | Green Book | US EPA, available at https://www3.epa.gov/airquality/greenbook/jnc.html.

Committed Funds for 2024[38]	$7,500
Funds Available for Project Development in 2024	$3,744,500
Total Subprogram Funding for 2024	$3,752,000
Subprogram Percentage of Funding	50%

6.4 Renewable Gas Production

6.4.1 Subprogram Overview

This subprogram focuses on the safe, reliable, and cost-effective production of renewable gaseous fuels—specifically RNG and hydrogen—from various feedstocks and multiple technological pathways.

6.4.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Clean Renewable Hydrogen Production via Advanced Water-Splitting**
  Direct, high-efficiency sunlight/photon-driven water splitting into hydrogen and oxygen is an important research area with tremendous potential to streamline the conventional multi-step water electrolysis process by coupling renewable electric power and water electrolysis into a one-step hydrogen-producing process. By decoupling clean renewable hydrogen production from the power grid, this technology could also eliminate intrinsic power system conversion and transmission losses, costly transmission system upgrades, and competition with electricity end uses. The C&RER Program is also exploring ways to reduce conventional electrolysis costs and improve its efficiency by relying on earth-abundant catalysts and exploring pathways to reduce the operating cost burden imposed through electric T&D costs.
- **Area 2: Renewable Methane Production via Various Methanation Pathways**
  Renewable methane production from biogenic CO_2 with methanation—via conventional thermo-catalytic methanation, electrocatalytic processes, or the use of biological methanogens—is a key area of research that can be broadly deployed to capture and convert biogenic CO_2 emissions from bio-digesters, ethanol plants, landfills, and biomass gasifiers into RNG. Therefore, methanation technologies can expand the availability of renewable gas and avoid the upstream production, gathering, storage, transportation, and end-use GHG emissions associated with fossil-sourced gas; reduce net emissions; and improve air quality. Most importantly, RNG can be directly injected into the existing gas grid without the need for any system retrofit or modification.
- **Area 3: Renewable Gas Production via Biomass Gasification**
  Biomass is an abundant domestic resource that literally "recycles" CO_2. California has tremendous biomass resources that can be leveraged to not only produce renewable energy, but also mitigate the effects of devastating fires, which release very large quantities of GHG and criteria pollutants. Biomass gasification uses a controlled process involving heat, steam, and oxygen to convert biomass to hydrogen, RNG, and other products without combustion. Because growing biomass removes CO_2 from the atmosphere, the net carbon emissions of this

[38] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

method can be low, or even negative, especially if coupled with CCUS in the long term. Key challenges to hydrogen production via biomass gasification involve reducing costs associated with capital equipment and procuring continuous biomass feedstocks.

- **Area 4: Distributed Hydrogen Production via Advanced Steam Methane Reforming of Biomethane**
  SoCalGas is exploring different SMR technologies, including advanced catalytic non-thermal plasma (CNTP) and 3-D printed meso- and micro-channel SMR reactors. SMR technology has progressed greatly in recent years with the development and manufacturing of a new, high-efficiency, low-cost, modular, combustion-free, solar- and/or induction-heat-driven, SMR technology for distributed hydrogen production. Originally developed by Pacific Northwest National Laboratory (PNNL) and being commercialized by STARS corporation, this technology has now reached a high technology readiness level (TRL) and is being deployed for field demonstration to support distributed hydrogen production. Incidentally, the first-ever production of oxygen on Mars was recently achieved by MOXIE (Mars Oxygen In-situ Utilization Experiment) onboard the NASA Mars2020 using similar 3-D printed microchannel heat exchanger technology, originally developed by PNNL, and now used in the STARS SMR reactor.
- **Area 5: Concentrated Solar Power Technology for Renewable Gas Production**
  Concentrated solar power (CSP) technology can be leveraged to drive renewable gas production through seamless integration with biomass conversion processes to further reduce the carbon intensity of biomass-derived renewable gas, increase system efficiencies, and improve overall performance.

6.4.3 Subprogram Benefits

Benefit	Explanation
Reliability	Broadly, the gas grid can improve energy reliability by absorbing renewable energy that would otherwise be curtailed and synchronizing renewable energy supply with demand by storing energy in the form of RNG and hydrogen. This can shift utilization of the stored energy over days, weeks, and months. Specifically, surplus renewable energy from wind, solar, and organic wastes can be channeled to make hydrogen for pipeline injection and long-duration energy storage. Alternatively, clean renewable hydrogen can be processed with biogenic CO_2 emissions to produce RNG via methanation processes. In 2022, up to 2,449,247 megawatt hours of electricity were curtailed in California according to the California Independent System Operator.[39] This translates to approximately 49,400 metric tons of hydrogen production from electrolysis and, correspondingly, roughly 260,000 metric tons of CO_2 that potentially could have been recycled to methane from methanation pathways. In addition, hydrogen and RNG can be produced from biomass—a clean, reliable, locally available energy resource.

[39] http://www.caiso.com/informed/Pages/ManagingOversupply.aspx

Safety	The latest hydrogen high-pressure tube trailer storage technology can allow the transport of 560–720 kilograms for on-road vehicles. Distributed hydrogen generation of similar capacity located at end-user sites and closely matching production to end-user demand eliminates the need for hydrogen transportation from centralized production points in high-pressure containers and large quantities of end-user storage, making hydrogen adoption inherently safer. In addition, small, modular on-site hydrogen generation systems contain relatively small amounts of hydrogen and can more easily be turned off should a plant issue occur.
Improved Affordability	The development of technologies and innovations for renewable gas production at the lowest possible cost would result in increased affordability and accessibility of renewable gas to ratepayers. Importantly, a hydrogen production target price of $2 per kilogram by 2030 would allow hydrogen to become a cost-effective consumer alternative to conventional fuels.
Environmental: Reduced GHG Emissions	Hydrogen and RNG production can displace fossil-sourced hydrocarbons, thereby reducing, mitigating, or eliminating associated CO_2 and methane emissions. Carbon-negative hydrogen production cycles are now being deployed that directly remove CO_2 from the atmosphere.
Environmental: Improved Air Quality	Replacement of fossil-sourced gas with clean renewable hydrogen can improve air quality, especially in industrial zones, by facilitating the transition for manufacturing hydrogen via conventional combustion technologies to electro- and thermo-catalytic processes that eliminate NO_x and PM emissions.

In addition to the general benefits described above, projects in this subprogram can deliver specific benefits to residential ratepayers. For example:

- **Residential ratepayers will benefit from reduced RNG costs.** The CPUC established a renewable gas standard[40] that requires SoCalGas to replace 12.2 percent of the traditional gas it delivers to core customers with renewable gas by 2030. The overwhelming majority of natural gas utility customers in California are residential and small commercials customers.[41] The standard also sets an interim goal of procuring approximately 3 percent renewable gas by 2025. RD&D seeks to develop new Renewable Gas production technologies to increase the scale of hydrogen production and reduce the cost of producing hydrogen. Low-cost hydrogen could be used to produce low-cost RNG that could be delivered through

[40] SoCalGas Applauds Establishment of First Renewable Gas Standard in the United States | SoCalGas Newsroom, available at https://newsroom.socalgas.com/press-release/socalgas-applauds-establishment-of-first-renewable-gas-standard-in-the-united-states#:~:text=Under%20this%20new%20renewable%20gas%20standard%2C%20SoCalGas%20will,procuring%20approximately%203%20percent%20renewable%20gas%20by%202025.

[41] https://www.cpuc.ca.gov/natural_gas/.

existing common carrier pipelines to residential ratepayers. This could provide a cost-effective alternative for decarbonizing homes.

- **Residential ratepayers will benefit from reduced hydrogen costs.** RD&D seeks to develop new renewable gas production technologies to increase the scale of hydrogen production and reduce the cost of producing hydrogen. This could provide a more cost-effective alternative for decarbonizing all end uses, including residential equipment.
- **SoCalGas's pipelines can deliver RNG to fueling stations to produce hydrogen.** For example, RD&D is demonstrating technology that can use renewable electricity to convert RNG to hydrogen for SunLine Transit. RD&D is also investigating technologies like distributed methane pyrolysis that could convert natural gas or RNG to low-carbon hydrogen. Utilizing the existing pipeline could be a cost-effective pathway to decarbonize transportation and improve local air quality[42] for residential ratepayers. Reducing transportation emissions is particularly important to residential ratepayer in SoCalGas's service territory which encompasses the only two federal extreme non-attainment areas for ozone in California.[43]
- **Advanced separation technology could extract hydrogen from pipeline blends to provide hydrogen at fueling stations.** For example, RD&D demonstrated an electrochemical hydrogen purification and compression technology to separate hydrogen from a gas blend. Utilizing the existing pipeline could be a cost-effective pathway to decarbonize transportation and improve local air quality for residential ratepayers.

6.4.4 Equity Considerations

By decarbonizing the pipeline and replacing its fossil-sourced content with renewable gas, this subprogram seeks to reduce emissions and improve air quality in areas neighboring industrial facilities, most of which fall within ESJ Communities. This work is in direct alignment with Goal 2 of CPUC's ESJ Action Plan: "Increase investment in clean energy resources to benefit environmental and social justice communities, especially to improve local air quality and public health." Equally as important, by reducing GHG emissions, the development and deployment of zero-emission transportation fuels will reduce the negative impact of climate change on ESJ communities (Section 4.1).

A good example is the STARS project, which is benefiting public transportation users in the area (already an ESJ community) by providing hydrogen to zero-emission fuel cell buses. Technologies to produce RNG that RD&D is pursuing, such as the NREL Biomethanation project and the LLNL Composite Sorbents for Economical Biomethane Production, are also benefiting communities by potentially increasing the supply of gas. Hydrogen affordability is also an important factor during the energy transition. One

[42] "Air monitoring shows that over 90 percent of Californians breathe unhealthy levels of one or more air pollutants during some part of the year." In addition, "CARB has identified about 200 pollutants as air toxics, and measures continue to be adopted to reduce emissions of air toxics. Estimated total cancer risk from all air toxics is 730 per million. Of this total, 520 per million are due to diesel particulate matter." Furthermore, "Climate change will also pose risks to public health. Changes in our climate are leading to extreme high temperatures which could result in more heat-related sickness and deaths, increased allergens (such as pollen) will trigger worsened allergies and increases in disease-carrying mosquitoes and other pests will cause elevated disease risk." (https://ww2.arb.ca.gov/resources/health-air-pollution)

[43] 8-Hour Ozone (2015) Nonattainment Areas | Green Book | US EPA, available at https://www3.epa.gov/airquality/greenbook/jnc.html.

C&RER project that impacts affordability is H2U, where they are working to reduce or even eliminate the use of costly rare-earth materials such as iridium in electrolyzers.

6.4.5 Funding Table

Low Carbon Resources Program	
Renewable Gas Production Subprogram 2024 Funding Allocation	
Committed Funds for 2024[44]	$424,000
Funds Available for Project Development in 2024	$3,328,000
Total Subprogram Funding for 2024	$3,752,000
Subprogram Percentage of Funding	50%

[44] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

7 GAS OPERATIONS

The Gas Operations program supports pipeline and storage operations through innovations that enhance public and employee safety, maintain system reliability, increase operational efficiency, minimize criteria pollutants, and reduce GHG and operational impacts to the environment. The program also facilitates technology development driven by emerging regulatory requirements. Its primary goal is to develop, test, and introduce new gas operations technologies that are beneficial to ratepayers, public safety, and the environment. As system decommissioning policies are developed, RD&D needs may be identified related to the core areas for each Gas Operations subprogram.

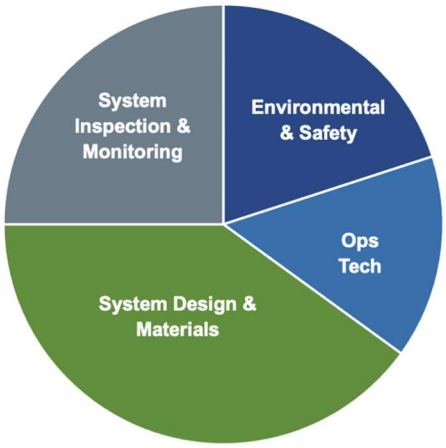
More broadly, the objectives of the Gas Operations program are to:

- Improve gas safety and system integrity
- Improve or enhance system reliability
- Advance system design and materials
- Increase operational efficiencies and effectiveness
- Reduce system emissions

The program invests in technology development projects in the following subprograms: 1) Environmental & Safety, 2) Operations Technology, 3) System Design & Materials, and 4) System Inspection & Monitoring.

7.1 Proposed 2024 Gas Operations Funding Allocation

Figure 4: Summary of proposed 2024 Funding Allocations for Subprograms within the Gas Operations Program.



Subprogram	Allocation
Environmental & Safety	20%
Operations Technology	15%
System Design & Materials	40%
System Inspection & Monitoring	25%
Total	$3,973,000

7.2 Program Benefits

Projects supported by the Gas Operations Program deliver a wide range of benefits.

Benefit	Explanation

Reliability	Projects in this program focus on developing methods and technologies for more effective pipeline construction, alteration, and repair and on minimizing impacts to the public through avoidance of service interruptions and construction disruptions by extending the service life of the pipeline infrastructure.
Safety	Projects in this program seek to develop advanced systems to identify and mitigate threats to the pipeline system, protect pipelines from intentional and unintentional damage, and focus on various other aspects related to the safety of the public, company employees, and contractors working on or around the pipeline and system facilities.
Operational Efficiency	Projects in this program seek to identify practices that streamline processes, reduce time-on-task, leverage automation of data gathering and analytics, improve effectiveness, and develop new technologies to advance pipeline safety and regulatory compliance. Examples of such projects include developing less-invasive pipeline construction methods or more efficient operation and maintenance methods.
Improved Affordability	Projects in this program seek to drive development of technologies and innovations that reduce or avoid operational costs to increase energy affordability for ratepayers.
Environmental: Reduced GHG Emissions	Projects in this program develop technologies and best practices for reducing GHG emissions and mitigating the impacts of gas system emissions on climate change.
Environmental: Improved Air Quality	Projects in this program reduce the environmental impact of the gas system emissions through reducing the emissions of harmful air pollutants, such as post-combustion criteria pollutants.

7.3 Policy Considerations

This program aligns with California's decarbonization goals through its direct relevance and applicability to several key policies, including:

Policy	Description
Clean Air Act	Air quality standards for NOx and PM
AB 32	Reduce CO_5 emissions 40% below 1990 levels by 2030
SB 1440	Authorizes a state procurement program for biomethane
Cal/OSHA Title 8 CCR	Injury and Illness Prevention Program
CPUC General Order 112F	Rules governing design, testing, operation, and maintenance of gas transmission and distribution systems
DOT 49 CFR Part 192	Federal pipeline safety regulations

Climate Adaptation OIR (R.18-04-019)	Integrate climate change adaptation matters in relevant CPUC proceedings
National Environmental Policy Act (NEPA)	National framework for protecting the environment
Hydrogen Strategy	DOE US National Clean Hydrogen Strategy and Roadmap
Joint H_2 Demonstration Blending Projects (A.22-09-006)	Joint application of SoCalGas, San Diego Gas & Electric, and Southwest Gas to establish H_2 blending demonstration projects
(OIR) R.13-02-008 Phase 4	Injection of renewable hydrogen into gas pipelines
(OIR) R.20-01-007	OIR to ensure safe and reliable gas systems in California and perform long-tern gas system planning

7.4 Equity Considerations

The natural gas pipeline system serves customers regardless of their socioeconomic status. The Gas Operations Program funds a wide variety of projects applicable to all aspects of system pipeline operations. Many of this program's projects improve the efficiency of the gas pipeline and therefore its affordability. This keeps energy costs more affordable, which has a greater positive impact on ESJ community members, for which energy costs may comprise a greater share of their incomes. Importantly, many of the innovations developed by this program are adopted nationally by other utilities, which supports equity efforts throughout the nation.

7.5 Environmental & Safety

7.5.1 Subprogram Overview

This subprogram seeks to advance the environmental integrity of the pipeline network and the safety of ratepayers and others who live and work in proximity to it. Projects for this subprogram are categorized into three key research areas: 1) System Emissions, 2) Environment, and 3) Safety.

Furthermore, gas emissions monitoring and reduction research is being supported by the SoCalGas Natural Gas Leakage Abatement R&D Program under the SB 1371 compliance plan, pursuant to the Gas Leak Abatement OIR (R.15-01-008).

Projects include developing new materials and technologies that reduce or prevent system leaks and emissions; technologies and systems focused at preventing system damages; studies of human factors impacting safety; and exploring how blending hydrogen into the pipeline affects the operation and maintenance of the pipeline system regarding safety, reliability, integrity, and environmental impacts.

7.5.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: System Emissions**
  Projects in this research area seek to address post-combustion criteria air pollutants and GHG emissions. This research area supports the development of

advanced technologies to detect, quantify, and provide real-time monitoring of emissions. Projects also include development of technologies or systems aimed at reduction or prevention of emissions. Projects are also needed to study diverse sources of energy and the effects on system emissions. This area supports the SoCalGas policy drivers for decarbonization, digitalization, and development of a diversified portfolio of energy sources.

- **Area 2: Environment**
  This area includes projects related to the impact of diversified energy and to acquiring real-time information on the impact of ground subsidence and movement caused by drought and groundwater replenishment. Environmental projects focus on developing methods to prevent or mitigate contaminated water or hazardous waste run-off and preserve plants and endangered species during pipeline construction and repair within environmentally sensitive areas. Environmental projects also focus on developing technologies that support State environmental goals.
- **Area 3: Safety**
  Safety projects are concerned with protecting the pipeline from intentional and unintentional damage and with improving the safety of the general public, company employees, and/or contractors working on or around pipelines. The majority of safety incidents in the pipeline system are associated with third-party damage. Safety projects concerned with protecting the pipeline from intentional and unintentional damage include those developing 1) advanced sensors and monitoring systems to alert pipeline operators of third-party encroachment and construction activities near pipeline rights-of-way and 2) automatic shutoff systems for aboveground and belowground piping systems. Safety projects related to worker safety include those advancing training technologies and knowledge transfer.

7.5.3 Funding Table

Gas Operations Program	
Environmental & Safety Subprogram 2024 Funding Allocation	
Committed Funds for 2024[45]	$502,011
Funds Available for Project Development in 2024	$292,589
Total Subprogram Funding for 2024	$794,600
Subprogram Percentage of Funding	20%

7.6 Operations Technology

7.6.1 Subprogram Overview

This subprogram advances and develops advanced techniques for the construction, operation, maintenance, rehabilitation, and testing of gas pipelines and systems that facilitate continued safe and reliable service. It also supports technologies that improve employee training and explores how to prevent gas leaks that result from blending hydrogen into the pipeline.

[45] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

7.6.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Steel and Plastic Pipeline Construction, Operations, and Repair Technologies**
  Projects in this area would develop cost-effective polyethylene (PE) or steel pipe repair technologies that improve the efficiency of maintaining the integrity of the infrastructure. Projects in this area could also determine construction best practices for maintaining system integrity, such as how to select the most effective trenchless installation method. These projects improve the efficiency of construction operation and repair processes of the pipeline infrastructure.
- **Area 2: Mapping and Locating Technologies**
  Projects in this area improve pipeline locating and mapping technologies through further enhancement of acoustic, electromagnetic, and ground probing radar systems to produce accurate 3D images of buried substructures. GIS mapping technologies are designed to improve the safety and integrity of underground natural gas pipelines by increasing the accuracy and availability of pipeline location information in areas where traditional methods and technology are inadequate. These technologies could help address excavation damage incidents caused by insufficient or inaccurate mapping methodologies. This research area includes the deployment of advanced technologies and analytics to improve planning, safety, resiliency, and the integration of real-time information to benefit participants across the energy value chain.
- **Area 3: Measurement, Equipment and Tools**
  Projects in this area would validate the capabilities of state-of-the-art measurement equipment and devices for both natural gas and other constituents, such as trace constituents in RNG and hydrogen. Through evaluation and testing of new methane hydrogen blend leak detection equipment, this research area supports SoCalGas' goals of decarbonization and diversity of energy.

7.6.3 Funding Table

Gas Operations Program	
Operations Technology Subprogram 2024 Funding Allocation	
Committed Funds for 2024[46]	$361,125
Funds Available for Project Development in 2024	$234,825
Total Subprogram Funding for 2024	$595,950
Subprogram Percentage of Funding	15%

7.7 System Design & Materials

7.7.1 Subprogram Overview

The objectives of this subprogram are to advance materials and materials science, materials tracking and traceability, and technical tools for designing pipeline systems and infrastructure for safety, reliability, efficiency, and maintainability throughout the life cycle of pipeline assets. Projects include research to advance engineering design standards and

[46] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

models, developing risk analytical tools to comply with pipeline integrity regulations, modeling operational efficiencies and design of gas storage and compressor station assets; storage well design technologies; and assessing the effects of incorporating gas from nontraditional sources (RNG and hydrogen blend) on overall natural gas quality and system integrity. Ultimately, lessons learned on these projects help SoCalGas better design, engineer, and develop its pipeline system.

7.7.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Gas Composition and Quality**
  Gas quality affects the integrity and safety of the pipeline infrastructure and end-use combustion equipment. RNG from non-conventional sources contains trace constituents that can impact pipeline integrity and customer combustion equipment performance. RNG-related research projects in this area will seek to identify trace constituents of concern and seek to establish upper concentration limits for acceptanceof RNG. Hydrogen-related research projects help identify technologies that can enable the blending and monitoring of hydrogen into existing pipeline infrastructure. In addition, projects in this area could develop cost-effective, miniature online volatile organic compound (VOC) and siloxane analyzers that have the detection levels and accuracies of laboratory equipment. This research area supports the SoCalGas goals of decarbonization and the development of a diversified portfolio of clean energy sources.
- **Area 2: System Design**
  Projects in this research area seek to improve the understanding of the implications of potential risk factors, such as stresses due to internal gas pressure, construction procedures, and environmental factors (corrosive and geohazards). Integrating this understanding with analytics of materials that mitigate these risks enables improvements in system design that can mitigate risks prior to installation. Development of metal loss criteria for anomalies in the pipeline enables the establishment of acceptable limits for pipelines operating at various pressures, which in turn enables the redesign of pipeline specifications and repair solutions to maintain system integrity. In addition, projects that focus on external loads, such as geohazards or construction hazards, create opportunities to better understand the stresses these hazards would potentially place on the pipeline, enabling these factors to be incorporated into the original design or retrofitted into legacy pipeline segments. Projects provide the capabilities to enhance pipeline integrity, supporting SoCalGas' decarbonization initiative by reducing the risk of pipeline damage that can result in methane emissions. They also help determine the impacts to the system infrastructure of the new diversified energy sources.
- **Area 3: Materials**
  Projects in this area will analyze state-of-the-art materials and coatings to identify those that can improve the longevity and reliability of newly installed pipeline segments. Area 3 projects can also help identify materials and coatings that are suitable for internal and external environments, which provides knowledge that is key to maintaining a safe and reliable pipeline system. Understanding the advancements of both pipeline and weld materials will enable appropriate selections for the wide variety of environmental scenarios to which pipelines are exposed. With hydrogen and RNG as key initiatives, work is being done to

understand which materials would complement the anticipated change in the internal environment of the pipeline to maintain the integrity of the legacy system as well as to incorporate that information into material selection for future designs of newly constructed segments. Research efforts for tracking and traceability projects improve the data collection of materials by developing an approach to streamline the traceability of pipeline assets and traceability standards for pipeline components.

7.7.3 Funding Table

Gas Operations Program	
System Design & Materials Subprogram 2024 Funding Allocation	
Committed Funds for 2024[47]	$1,052,039
Funds Available for Project Development in 2024	$537,161
Total Subprogram Funding for 2024	$1,589,200
Subprogram Percentage of Funding	40%

7.8 System Inspection & Monitoring

7.8.1 Subprogram Overview

The objectives for this subprogram include developing technologies and methods for inspection, monitoring, and testing of pipelines and pipeline components to assess the condition and performance of pipeline facilities. The goal is to improve system performance, reliability, safety, and operational efficiencies through data management to identify precursors to failures or incidents. Projects in this subprogram leverage AI, machine learning, and preventive and predictive maintenance technologies, including data analytic models and data lakes. Projects include new technologies to collect and analyze the pipeline system data for supporting system integrity and reliability, utilize innovative data sources such as Crowd Source and the Internet of Things (IoT). This subprogram also seeks to explore tools for managing the potential impacts of blending hydrogen into the pipeline system.

7.8.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Pipeline Systems Inspection Technologies—Inline and Nondestructive Examination (NDE)**
  Projects in this area improve pipeline inspection technologies such as inline and NDE; and monitoring and sampling of indicators for microbiological influenced corrosion (MIC). Projects continuing for 2024 include enhancing modules or sensors detection capabilities, extending the inspection range for the Explorer robotic platform, and developing nondestructive inspection technologies such as using THz methods to interpret PE butt fusion joint defects with 2D and 3D reconstruction imaging.
- **Area 2: Remote Pipeline Monitoring Systems**

[47] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

Projects in this area include the evaluation of remote inspection and monitoring systems to detect temporal changes in the operating environment. These non-intrusive technologies include satellite, aerial (manned and unmanned), and aboveground measurement of ground subsidence, methane emissions, distressed or dead vegetation, pipeline coating condition, and corrosion.

- **Area 3: Geohazard Threat Inspection and Monitoring**
  Projects in this area seek to monitor environmental threats, such as weather-related landslides and floods as well as seismic ground faults impacting pipeline integrity. This technology can provide continuous real-time measurement of strain imposed on the pipeline and alert pipeline operators to take mitigative measures to avoid pipeline failures. This research area supports the SoCalGas goal of digitalization of critical environmental information that can support system safety and reliability.

7.8.3 Funding Table

Gas Operations Program	
System Inspection & Monitoring Subprogram 2024 Funding Allocation	
Committed Funds for 2024[48]	$478,880
Funds Available for Project Development in 2024	$514,370
Total Subprogram Funding for 2024	$993,250
Subprogram Percentage of Funding	25%

[48] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

8 CLEAN TRANSPORTATION

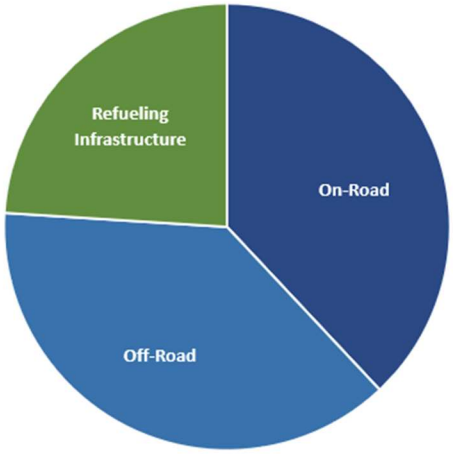
The Clean Transportation Program supports activities that minimize environmental impacts related to the transportation sector, particularly through the integration of hydrogen. Key objectives of this RD&D program are to develop:

- Cost-competitive, zero-emission transportation technologies that meet the robust operating requirements of a wide variety of users
- Advanced onboard storage technologies and refueling infrastructure for alternative fuels

The program invests in technology development projects in the following subprograms: 1) Off-Road, 2) On-Road, and 3) Refueling Infrastructure.

8.1 Proposed 2024 Clean Transportation Funding Allocation

Figure 5: Summary of proposed 2024 Funding Allocations for Subprograms within the Clean Transportation Program.



Subprogram	Allocation
On-Road	38%
Off-Road	38%
Refueling Infrastructure	24%
Total	**$4,470,000**

8.2 Policy Considerations

This program aligns and conforms with several of California's decarbonization goals:

Policy	Description
EO N-79-20	100% zero-emission off-road vehicles and equipment by 2035 where feasible
CARB Clean Fleets Rule	Establishes a medium- and heavy-duty zero-emission fleet regulation with the goal of achieving a zero-emission truck and bus California fleet by 2045 where feasible
CARB At-Berth Regulations	Reduce diesel PM and NOx emissions from the auxiliary engines of ocean-going vessels while they are docked at California ports
EO B-48-18	5 million ZEVs by 2030; 200 hydrogen refueling stations by 2025

EO N-79-20	Eliminate new internal combustion engine vehicles by 2035; 100% light-duty vehicles and drayage trucks sold will be zero-emission by 2035; 100% MHD vehicles sold and operated are zero-emission by 2045
CARB Clean Truck Rule	100% ZEV where feasible for drayage, public fleets, last-mile delivery by 2045
CARB Clean Fleet Rule	100% zero-emission trucks and buses where feasible by 2045
CARB In-Use Locomotive Regulation	Achieve emission reductions from diesel-powered locomotives and increase the use of zero-emission technology.
AB 8	100 Hydrogen Refueling Stations in California
EO B-48-18	5 million ZEVs by 2030; 200 hydrogen refueling stations by 2025
Low Carbon Fuel Standard	Reduce carbon intensity in transportation fuels as compared to conventional petroleum fuels, such as gasoline and diesel

8.3 General Equity Considerations

ESJ communities are disproportionately affected by both mobile and stationary source (MSS) pollution. MSS emissions reductions will highly benefit ESJ communities. This program seeks rapid transition to zero-emission technology in and near ESJ communities, complementing AB 617 strategies and consistent with CARB's equity goals.[49] By seeking to develop zero-emissions MHD on-road vehicles, which frequently operate in ESJ communities, this program will not only improve air quality, but also reduce GHG emissions—which will help reduce the impact of climate change. This program also supports development of zero-emission clean transit solutions, which typically benefit residents of ESJ communities more than other groups.

"Pollution from the transportation sector has been a long-standing obstacle to advancing environmental justice (EJ), as many communities of color and low-income families live near areas where pollution from vehicles and engines is abundant, and therefore experience disproportionate exposures to this pollution."

—U.S. Environmental Protection Agency

8.4 Ratepayer Benefits

A summary of specific benefits of the Clean Transportation program to residential ratepayers follows. More detail can be found in SoCalGas RD&D's May 19, 2023, response to the CPUC data request dated May 5, 2023.

- **SoCalGas's pipelines can deliver RNG to fueling stations to produce hydrogen.** Utilizing the existing pipeline could be a cost-effective pathway to decarbonize transportation and improve local air quality for residential ratepayers.[50] SoCalGas

[49] California Air Resources Board "2020 Mobile Source Strategy"

[50] "Air monitoring shows that over 90 percent of Californians breathe unhealthy levels of one or more air pollutants during some part of the year." In addition, "CARB has identified about 200 pollutants as air

RD&D is exploring a variety of technologies in this area, including hydrogen production using renewable electricity and methane pyrolysis to convert natural gas or RNG to low-carbon hydrogen.

- **Advanced separation technologies could extract hydrogen from pipeline blends to provide hydrogen at fueling stations.** Using the existing pipeline to transport clean fuels, including hydrogen, could be a cost-effective pathway to decarbonize transportation and improve local air quality for residential ratepayers.
- **SoCalGas common carrier hydrogen pipelines could deliver to fueling stations.** Utilizing the common-carrier pipelines to deliver hydrogen could be a cost-effective pathway to decarbonize transportation and improve local air quality for residential ratepayers.
- **SoCalGas is adopting hydrogen fuel cell electric vehicles (FCEV) to decarbonize fleet operations.**[51] RD&D is developing vehicles and fueling technologies that could be used by the utility's fleet to help decarbonize operations. Developing cost-effective decarbonization technologies for utility operations could help reduce residential rates.
- **SoCalGas is seeking authority to develop fueling stations to decarbonize utility fleet operations and drive zero-emission vehicle (ZEV) market adoptions.**[52] Developing hydrogen fueling stations to serve the utility fleet, and potentially opening those stations to the public, will help drive the adoption of ZEVs to decarbonize transportation and improve local air quality for residential ratepayers.
- **Replacing heavy-duty vehicles with ZEV technology will significantly reduce diesel particulate matter (PM) emissions in low-income communities and communities of color adjacent to ports, distribution centers, and highways.**[53] Heavy-duty trucks are the largest source of diesel PM, a toxic air contaminant that is directly linked to several adverse health impacts. This is especially critical for residential ratepayers within SoCalGas's service territory, which encompasses three federal non-attainment zones for PM2.5.[54]
- **Increased throughput of clean fuels on the system drives down marginal costs on gas infrastructure and pipeline transport costs.** Using the existing common carrier pipeline for new applications like delivering RNG or hydrogen blends to hydrogen fueling station can increase system throughput of these clean fuels thereby reducing the marginal infrastructure and pipeline transportation costs for all ratepayers, including residential ratepayers.

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toxics, and measures continue to be adopted to reduce emissions of air toxics. Estimated total cancer risk from all air toxics is 730 per million. Of this total, 520 per million are due to diesel particulate matter." Furthermore, "Climate change will also pose risks to public health. Changes in our climate are leading to extreme high temperatures which could result in more heat-related sickness and deaths, increased allergens (such as pollen) will trigger worsened allergies and increases in disease-carrying mosquitoes and other pests will cause elevated disease risk." (https://ww2.arb.ca.gov/resources/health-air-pollution)

[51] SoCalGas Among First Utilities in the Nation to Transition its Over-the-Road Fleet with Hydrogen Fuel Cell Electric Vehicles | SoCalGas Newsroom, available at https://newsroom.socalgas.com/press-release/socalgas-among-first-utilities-in-the-nation-to-transition-its-over-the-road-fleet

[52] Microsoft Word - Revised Direct Testimony - SCG Real Estate and Facility Operations_1393.docx (socalgas.com) at BKG-37, available at https://www.socalgas.com/sites/default/files/SCG-19-R_Revised_Direct_Testimony_of_Brenton_Guy-SCG_Real_Estate_and_Facility_Operations_1394.pdf

[53] CARB 2022 Scoping Plan, p. 185, available at https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

[54] https://www3.epa.gov/airquality/greenbook/kbtc.html

8.5 Off-Road

8.5.1 Subprogram Overview

The Off-Road subprogram focuses on developing zero-emission off-road transportation solutions using hydrogen. This subprogram targets emissions reductions from off-road vehicles such as rail, ocean-going vessels and commercial harbor craft, and construction and cargo handling equipment. Subprogram staff have also begun to explore aviation applications, including hydrogen fuel cell aircraft and drones.

8.5.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Zero-Emission Locomotives**
  This research area seeks to develop and demonstrate hydrogen fueled zero-emission locomotives to replace current diesel locomotives, helping reduce emissions from rail-based transportation of freight and people.
- **Area 2: Zero-Emission Technology for Marine**
  Projects in this area aim to develop and demonstrate new zero-emission technologies to help reduce emissions from ocean going vessels and harbor craft, particularly those in service at the ports.
- **Area 3: Zero- Emission Technology for Construction and Agricultural Equipment**
  This area seeks to develop and demonstrate new zero-emission construction and agricultural equipment. These types of heavy-duty machinery are ideal candidates for hydrogen fuel cell technology.
- **Area 4: Zero-Emission Technology for Aviation**
  This research area aims to help reduce emissions from both aircraft as well as ground service equipment at airports.

8.5.3 Subprogram Benefits

The Clean Transportation program delivers both the broad-based benefits discussed in the table below and specific benefits to SoCalGas residential ratepayers.

Benefit	Explanation
Reliability	This subprogram aims to develop technologies that meet the demanding requirements of a variety of use cases, with minimal downtime. ZEVs also require less maintenance than their gasoline and diesel counterparts.
Safety	Introducing a new fuel (hydrogen) to off-road technology end users requires new safety protocols and training, which are often part of demonstration projects in this subprogram.
Operational Efficiency	This subprogram aims to develop new technologies that can directly replace their gasoline and diesel counterparts, including the ability to refuel quickly, so operators can maximize their operational efficiency.

Benefit	Explanation
	FCEVs are also more energy-efficient than their gasoline and diesel counterparts.
Improved Affordability	Projects in this subprogram help to advance technologies that can become more cost-effective over time through operational savings, scaled adoption, and incentives.
Environmental: Reduced GHG Emissions	Projects in this subprogram aim to develop hydrogen-fueled, zero-emission, off-road technologies. FCEVs do not emit GHGs.
Environmental: Improved Air Quality	Projects in this subprogram aim to develop hydrogen-fueled, zero-emission, off-road technologies. FCEVs do not emit harmful air pollutants such as NOx or PM.

In addition to the general benefits described above, projects in this subprogram can deliver specific benefits to residential ratepayers. For example:

- **Replacing heavy-duty vehicles with ZEV technology will significantly reduce diesel particulate matter (PM) emissions in low-income communities and communities of color adjacent to ports, railyards, distribution centers, and airports.** Ports, railyards, distribution centers, and airports are hubs of a variety of off-road vehicles, such as cargo handling equipment. These vehicles currently use highly polluting diesel engines that emit diesel PM, a toxic air contaminant that is directly linked to several adverse health impacts. Developing new zero-emissions off-road transportation solutions, such as the Hydrogen Fuel Cell Yard Trucks that we demonstrated at the Port of Los Angeles with GTI Energy, is especially critical for residential ratepayers within SoCalGas's service territory, which encompasses three federal non-attainment zones for PM2.5.[55]

8.5.4 Equity

RD&D projects in the Off-Road subprogram play a crucial role in improving equity and delivering substantial benefits to ESJ communities. These communities face a disproportionate impact from MSS pollution, making reductions in MSS emissions particularly important for their well-being. The subprogram is committed to achieving a rapid transition to zero-emission technology in and near ESJ communities, aligning with the strategies outlined in AB 617 and consistent with the equity goals set by CARB. Within the Off-Road subprogram, projects in Zero-Emission Locomotives (Research Area 1) focus on the advancement of hydrogen-fueled zero-emission locomotives. By replacing diesel locomotives with zero-emission alternatives, these projects significantly reduce emissions from rail-based transportation, benefiting both ESJ communities adjacent to railyards and freight corridors as well as the broader population. In Zero-Emission Technology for Marine (Research Area 2), projects aim to develop and demonstrate new zero-emission technologies for ocean-going vessels and harbor craft, particularly those operating in ports. By reducing emissions from maritime transportation, these projects directly contribute to improving air quality in port areas, which are often in close proximity to ESJ communities. This shift towards cleaner technologies helps mitigate the environmental

[55] https://www3.epa.gov/airquality/greenbook/kbtc.html

and health impacts associated with traditional maritime operations, benefiting both ESJ communities and the surrounding population.

Zero-Emission Technology for Construction and Agricultural Equipment (Research Area 3) focuses on developing and demonstrating zero-emission solutions for heavy-duty machinery used in construction sites and agricultural activities. These projects, which include hydrogen fuel cell technology and other zero-emission alternatives, effectively reduce pollution and improve air quality in ESJ communities that are often located nearby. By addressing emissions from construction and agricultural equipment, these projects contribute to creating cleaner and healthier environments for these ESJ communities. Additionally, Zero-Emission Technology for Aviation (Research Area 4) aims to reduce emissions from aircraft and ground service equipment at airports. Through the exploration of hydrogen fuel cell technology and other zero-emission solutions, these projects help improve air quality in airport surroundings, benefiting both airport employees and nearby ESJ communities.

8.5.5 Funding Table

Clean Transportation Program	
Off-Road Subprogram 2024 Funding Allocation	
Committed Funds for 2024[56]	$50,000
Funds Available for Project Development in 2024	$1,648,600
Total Subprogram Funding for 2024	$1,698,600
Subprogram Percentage of Funding	38%

8.6 On-Road

8.6.1 Subprogram Overview

The On-Road subprogram is focused on developing zero-emission on-road transportation solutions using hydrogen. This subprogram seeks to help fleets and individual vehicle operators achieve emission reduction goals as well as meet the robust duty cycle requirements for a variety of use cases.

8.6.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Zero-emission Hydrogen Fuel Cell Medium- and Heavy-Duty (MHD) Vehicles**
  Projects in this area develop and demonstrate zero-emission, MHD FCEVs to serve demanding duty cycles and longer routes for the transportation goods and people.
- **Area 2: Zero-emission Hydrogen Fuel Cell Light-Duty Vehicles**
  Projects in this area develop and demonstrate new, light-duty hydrogen FCEVs, which include Class 1 and Class 2 vehicles. It should be noted that Class 2 is further split between Class 2a and 2b, the latter of which includes trucks with a gross vehicle weight rating (GVWR) of up to 10,000 lbs. Examples of Class 2b trucks include the Ford F-250 and Chevrolet Silverado 2500, which are common fleet

[56] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

vehicles. This research area seeks to help utilities and emergency service fleets with remote and long-range operating requirements reduce their emissions. This research area also helps advance light-duty hydrogen vehicles for users who need an alternative to battery-electric options.

- **Area 3: Connected and Autonomous Vehicles**
  Projects in this area perform research into state-of-the-art, sustainable transportation technologies such as connected and autonomous vehicles (CAVs) to increase efficiency, safety, and reliability in goods movement and public transportation.

8.6.3 Subprogram Benefits

In addition to the general benefits described above, projects in this subprogram can deliver specific benefits to residential ratepayers. For example:

Benefit	Explanation
Reliability	This subprogram aims to develop technologies that meet the demanding requirements of a variety of use cases, with minimal downtime. ZEVs also require less maintenance than their gasoline and diesel counterparts.
Safety	Introducing a new fuel to on-road vehicle users requires new safety protocols and training, which are often part of demonstration projects in this subprogram.
Operational Efficiency	This subprogram aims to develop new technologies—including those that enable fast refueling—that can directly replace their gasoline and diesel counterparts so users can maximize operational efficiency. FCEVs are also more energy-efficient than their gasoline and diesel counterparts.
Improved Affordability	Projects in this subprogram help advance technologies that can become more cost-effective over time through operational savings, scaled adoption, and incentives.
Environmental: Reduced GHG Emissions	Projects in this subprogram aim to develop hydrogen-fueled, zero-emission off-road technologies. FCEVs do not emit GHGs.
Environmental: Improved Air Quality	Projects in this subprogram aim to develop hydrogen-fueled, zero emission off-road technologies. FCEVs do not emit harmful air pollutants such as NOx or PM.

In addition to the general benefits described above, projects in this subprogram can deliver specific benefits to residential ratepayers. For example:

- **Hydrogen blending could help enable the State to achieve decarbonization goals.** California could use existing infrastructure to accelerate clean fuels adoption. Developing a complete ecosystem of supply, delivery, and end-use will allow for hydrogen to scale reducing the cost of decarbonizing with hydrogen for all ratepayers. Residential ratepayers benefit from assessments of cost-effective

decarbonization alternatives that could complement other decarbonization measures such as electrification.

- **SoCalGas's pipelines can deliver RNG to fueling stations to produce hydrogen.** For example, RD&D is demonstrating technology that could use renewable electricity to convert RNG to hydrogen for SunLine Transit. RD&D is also investigating technologies like distributed methane pyrolysis that could convert natural gas or RNG to low-carbon hydrogen. Utilizing the existing pipeline could be a cost-effective pathway to decarbonize transportation and improve local air quality[57] for residential ratepayers. Reducing transportation emissions is particularly important to residential ratepayer in SoCalGas's service territory which encompasses the only two federal extreme non-attainment areas for ozone in California.[58]
- **Replacing heavy-duty vehicles with ZEV technology will significantly reduce diesel particulate matter (PM) emissions in low-income communities and communities of color adjacent to ports, distribution centers, and highways.**[59] Heavy-duty trucks are the largest source of diesel PM, a toxic air contaminant that is directly linked to several adverse health impacts. Developing new zero-emissions on-road vehicles, such as the Hydrogen Fuel Cell Delivery Vans that we are currently demonstrating with The Center for Transportation and the Environment (CTE) and UPS, is especially critical for residential ratepayers within SoCalGas's service territory, which encompasses three federal non-attainment zones for PM2.5.[60]

8.6.4 Equity

RD&D projects in the On-Road subprogram play a crucial role in improving equity and delivering substantial benefits to ESJ communities. These communities face a disproportionate impact from MSS pollution, making reductions in MSS emissions particularly important for their well-being. The subprogram is committed to achieving a rapid transition to zero-emission technology in and near ESJ communities, aligning with the strategies outlined in AB 617 and consistent with the equity goals set by CARB. Projects in Zero-emission Hydrogen Fuel Cell Medium- and Heavy-Duty Vehicles (Research Area 1) focus on developing and demonstrating zero-emission hydrogen FCEVs that cater to demanding duty cycles and longer routes for transportation goods and people. By enabling the adoption of zero-emission technologies in the medium- and heavy-duty vehicle sector, these projects help reduce air pollution and improve air quality in communities disproportionately affected by transportation-related emissions. In Zero-emission Hydrogen Fuel Cell Light-Duty Vehicles (Research Area 2), projects target the

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[57] "Air monitoring shows that over 90 percent of Californians breathe unhealthy levels of one or more air pollutants during some part of the year." In addition, "CARB has identified about 200 pollutants as air toxics, and measures continue to be adopted to reduce emissions of air toxics. Estimated total cancer risk from all air toxics is 730 per million. Of this total, 520 per million are due to diesel particulate matter." Furthermore, "Climate change will also pose risks to public health. Changes in our climate are leading to extreme high temperatures which could result in more heat-related sickness and deaths, increased allergens (such as pollen) will trigger worsened allergies and increases in disease-carrying mosquitoes and other pests will cause elevated disease risk." (https://ww2.arb.ca.gov/resources/health-air-pollution)

[58] 8-Hour Ozone (2015) Nonattainment Areas | Green Book | US EPA, available at https://www3.epa.gov/airquality/greenbook/jnc.html.

[59] CARB 2022 Scoping Plan, p. 185, available at https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

[60] https://www3.epa.gov/airquality/greenbook/kbtc.html

development and demonstration of light-duty hydrogen FCEVs. This research area addresses the emission reduction needs of utilities, emergency service fleets, and users with remote and long-range operating requirements. By providing zero-emission alternatives, these projects expand access to zero-emission transportation options for fleets often operating in and around ESJ communities, helping to mitigate environmental and health impacts associated with traditional combustion-powered vehicles. These projects also provide opportunities for people without access to charging infrastructure to purchase zero-emission vehicles. Connected and Autonomous Vehicles (Research Area 3) focuses on sustainable transportation technologies such as CAVs. These projects aim to enhance efficiency, safety, and reliability in goods movement and public transportation. By improving transportation accessibility, reliability, and efficiency, particularly in underserved areas, these projects can benefit disadvantaged communities by offering better mobility options and reducing transportation-related barriers.

8.6.5 Funding Table

Clean Transportation Program	
On-Road Subprogram 2024 Funding Allocation	
Committed Funds for 2024[61]	$546,000
Funds Available for Project Development in 2024	$1,152,600
Total Subprogram Funding for 2024	$1,698,600
Subprogram Percentage of Funding	38%

8.7 Refueling Infrastructure

8.7.1 Subprogram Overview

The Refueling Infrastructure subprogram targets the development, demonstration, and deployment of technologies and systems that support refueling with alternative fuels, including gaseous and liquid hydrogen. This subprogram focuses on both vehicle storage as well as refueling station technologies.

8.7.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Advanced Fast-Fill Technologies**
  Projects in this area seek to improve the fueling speed for hydrogen FCEVs. New refueling station components, designs, and protocols are required to help achieve industry targets, which seek to match or exceed current diesel refueling times.
- **Area 2: Easily Deployable Hydrogen Fueling Solutions**
  Projects in this area seek to develop and demonstrate new refueling solutions that can be quickly and easily deployed. These technologies may include mobile refuelers that enable fleets to fuel pilot vehicles before permanent infrastructure is in place, or even novel permanent infrastructure designs that reduce construction complications and duration.
- **Area 3: Advanced On-Board Hydrogen Storage**

[61] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

This research area seeks to develop and demonstrate novel hydrogen storage technologies to improve on-board vehicle fuel storage capacity, weight, performance, and safety.

8.7.3 Subprogram Benefits

In addition to the general benefits described above, projects in this subprogram can deliver specific benefits to residential ratepayers. For example:

Benefit	Explanation
Reliability	Projects in this subprogram seek to develop and demonstrate new refueling station technologies that can increase uptime, alleviating adoption hesitancies.
Safety	This subprogram aims to develop refueling station and on-board storage technologies that meet or exceed all safety requirements for hydrogen vehicles.
Operational Efficiency	This subprogram seeks to improve fueling efficiency, whether through improved fuel storage density or faster refueling times, and ultimately to meet or exceed current gasoline and diesel refueling times.
Improved Affordability	Developing new refueling technologies can potentially reduce both capital and operating costs. Capital costs may be reduced through material advancements or simplified station designs, while operating costs may be reduced through more energy-efficient fuel transfer technologies as well as reduced maintenance.
Environmental: Reduced GHG Emissions	Projects in this subprogram enable increased adoption of FCEVs for both on- and off-road applications, ultimately reducing GHG emissions.
Environmental: Improved Air Quality	Projects in this subprogram enable increased adoption of FCEVs for both on- and off-road applications, ultimately reducing pollutant emissions such as NOx and PM.

8.7.4 Equity

RD&D projects in the On-Road subprogram play a crucial role in improving equity and delivering substantial benefits to ESJ communities. These communities face a disproportionate impact from MSS pollution, making reductions in MSS emissions particularly important for their well-being. The subprogram is committed to achieving a rapid transition to zero-emission technology in and near ESJ communities, aligning with the strategies outlined in AB 617 and consistent with the equity goals set by CARB. In Advanced Fast-Fill Technologies (Research Area 1), projects aim to enhance the fueling speed for FCEVs. By improving refueling station components, designs, and protocols, these projects help achieve industry targets that match or exceed current gasoline and diesel refueling times. This accessibility to fast, efficient, and reliable refueling supports ESJ communities by providing convenient and time-efficient transportation options without compromising performance or convenience. In Easily Deployable Hydrogen Fueling Solutions (Research Area 2), projects focus on developing and demonstrating

innovative refueling solutions that can be quickly and easily deployed. This includes mobile refuelers that allow fleets to fuel pilot vehicles before permanent infrastructure is established, as well as novel designs for permanent infrastructure that streamline construction processes. By enabling flexible and rapid deployment of refueling options, these projects enhance accessibility to alternative fuels, benefiting ESJ communities that may have limited access to traditional refueling infrastructure. Making refueling easy and accessible is also a critical component in increasing hydrogen fuel cell vehicle adoption, which results in decreased emissions. Advanced On-Board Hydrogen Storage (Research Area 3) aims to develop and demonstrate novel hydrogen storage technologies for vehicles. By improving storage capacity, weight, performance, and safety of on-board hydrogen storage systems, these projects contribute to the viability and usability of hydrogen-powered vehicles. This can provide ESJ communities with clean and sustainable transportation options, reducing reliance on fossil fuels and improving air quality in those communities.

8.7.5 Funding Table

Clean Transportation Program	
Refueling Stations Subprogram 2024 Funding Allocation	
Committed Funds for 2024[62]	$50,000
Funds Available for Project Development in 2024	$1,022,800
Total Subprogram Funding for 2024	$1,072,800
Subprogram Percentage of Funding	24%

[62] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

9 CLEAN ENERGY APPLICATIONS

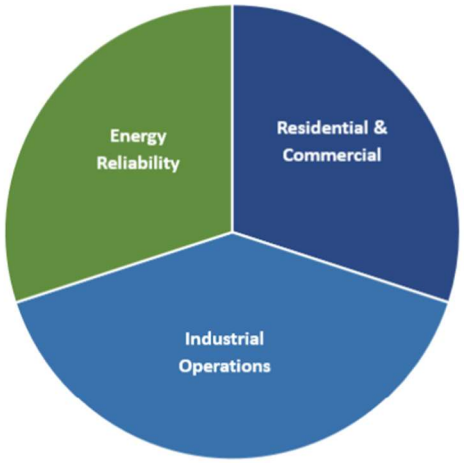
The Clean Energy Applications RD&D program supports the development and demonstration of highly efficient, low-emission technologies associated with the stationary utilization of gaseous fuels for power generation and thermal applications. This program seeks to:

- Improve efficiencies
- Reduce emissions
- Lower costs
- Improve reliability for residential, commercial, and industrial customers.

The program invests in technology development projects in the following subprograms: 1) Energy Reliability, 2) Residential & Commercial, and 3) Industrial Operations.

9.1 Proposed 2024 Clean Energy Applications Funding Allocation

Figure 6: Visual Summary of proposed 2024 Funding Allocations for Subprograms within the Clean Energy Applications Program.



Subprogram	Allocation
Energy Reliability	30%
Residential & Commercial	30%
Industrial Operations	40%
Total	**$4,977,000**

9.2 Policy Considerations

This program aligns and conforms with several of California's decarbonization goals, including:

Policy	Description
CPUC R.19-09-009	Microgrids and resiliency proceeding
AB 3232	Building decarbonization
SB 32	Reduce CO_2 emissions
Clean Air Act	Air quality standards for NOx and PM
SB 100	Zero-carbon electricity by 2045
EO B-55-18	Carbon-neutral California economy by 2045
SB 1298	DG regulation
SGIP	Self-Generation Incentive Program

SB 1339	Microgrids for increased electricity reliability
CA Title 24	Buildings Energy Efficiency
CA Title 20	Appliance Energy Efficiency
AB 617	Disadvantaged communities for air quality improvements
CPUC ESJ Action Plan	Increase investment that benefits ESJ communities

9.2.1 Alignment of Energy Efficiency RD&D with California's Transportation and Building Decarbonization Goals

AB3232 requires California residential and commercial building stock to reduce their GHG emissions level by at least 40% below 1990 emissions levels (23.6 MMTCO2e) by 2030. According to a 2019 study by the Energy Future Initiative, even if the State enacted aggressive electrification policies and electrified 22% of residential buildings and all new construction by 2030, this would only equate to about 3.9 MMTCO2e in emissions reduction by 2030 or a 10% reduction from 2016 building emissions (39.4 MMTCO2e).

In comparison, energy efficiency has contributed to a decrease in the sector's emissions since 2000, despite the sector's growth since then. According to the California Energy Commission (CEC), mandatory energy efficiency codes and standards, plus programs that incentivize emissions reductions through behavioral and financial mechanisms, equates to a reduction of 8.4 MMTCO2e by 2030. Technology development that improves the energy efficiency of end-use gas appliances would only further drive emissions reduction potential. Therefore, a diversified pathway that includes improved energy efficiency, building retrofits, and fuel-switching opportunities (i.e., RNG, hydrogen, and electrification) will help enable California to achieve its short- and long-term building decarbonization goal more cost-effectively and expeditiously. While there is strong technical potential for each of these measures to play a role in reducing emissions, it is important to consider the impacts to buildings and homeowners regarding costs, consumer preferences, and potential for service disruption.

The gas and electric grids are complementary. As the energy system's reliance on renewable and intermittent resources increases to meet the State's decarbonization goals, gas system infrastructure is critical to maintaining reliability for the electric grid by providing fuel when it is needed. A synergistic approach towards developing energy infrastructure recognizes the value in this relationship and coordinates the gas and electric systems to manage decarbonization, reliability, safety and resiliency at affordable rates. For instance, a valuable attribute of the gas system is its ability to provide firm power to meet extreme peaks. It can store, transport, and deliver high volumes of energy and address large shifts in volume over time. This includes the ability to ramp up and ramp down quickly based on the requirements of its electric generation customers to maintain electric system reliability through demand peaks and dips when renewable resources are not available.

9.3 Energy Reliability

9.3.1 Subprogram Overview

This subprogram develops and enhances distributed generation technologies and the control systems that integrate diverse distributed generation resources and thermal loads. The focus is on microgrids using RNG and hydrogen and on enabling low-emissions,

distributed generation, and storage technologies to provide energy resilience and affordability to customers.

9.3.2 2024 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Commercialization of Small-Scale (< 50 kilowatt) Solid Oxide Fuel Cells (SOFCs)**
  Projects in this area seek to commercialize SOFCs for residential and small commercial customers. Small-scale SOFC units are widely available in foreign markets, such as Japan and Europe, and recently are becoming increasingly available in South Korea. Lab testing, field demonstrations, optimization, and safety certifications are required to facilitate wide adoption in the U.S market. Projects in this area also seek to integrate fuel cells into microgrid solutions to help customers maintain energy resilience. Fuel cell integration has the potential to provide efficient, reliable, and continuous power generation when renewable sources, such as solar, are not available.
- **Area 2: Hydrogen Integration with Existing Power Generation Technologies**
  Projects in this area seek to continue to test and identify pathways for increased levels of hydrogen blending for fuel cell, engine, and turbine-based DG technologies currently operating on natural gas. Identifying and increasing hydrogen thresholds of existing DG equipment are critical components of meeting California's decarbonization goals. Projects in this area also seek to develop integration of existing power generation assets in a hydrogen-enabled microgrid or CHP system.
- **Area 3: Development of Low-emission CHP and Backup Generation**
  Projects in this area seek to develop and demonstrate low-emission DG technologies that can help customers maintain energy resilience year-round, including during public safety power shutoff (PSPS) events and other grid disturbances, while limiting GHG and criteria pollutant emissions.
- **Area 4: Development of Hydrogen Energy Storage Integration**
  Surplus renewable energy from wind and solar that would potentially be curtailed can be channeled to make hydrogen for long-duration energy storage. Currently, long-duration storage of hydrogen is energy intensive, resulting in increased costs. Projects in this area seek to develop and demonstrate lower-cost, long-duration hydrogen storage technologies and seek to integrate these innovative technologies into microgrid assets.

9.3.3 Subprogram Benefits

Benefit	Explanation
Reliability	Gas-fueled DG has the ability to provide highly reliable and resilient electricity to customers by enabling them to operate partially or completely independent of the electric grid, when needed.
Safety	Projects in this subprogram seek to identify, reduce, and mitigate potential risks associated with hydrogen integration in distributed generation applications.
Operational Efficiency	Combined heat and power (CHP) systems have the ability to maximize customers' operational efficiency by productively using "waste heat," often offsetting other heating- and cooling-related energy consumption.
Improved Affordability	By improving the overall efficiency of DG technologies and microgrids, customer energy costs can be reduced.
Environmental: Reduced GHG Emissions	Improving the efficiency (reduced fuel utilization) and increasing hydrogen tolerance of DG technologies can result in lower GHG emissions.
Environmental: Improved Air Quality	Projects in this subprogram specifically focus on developing and demonstrating technologies that can meet or exceed CARB-DG certification standards, resulting in improved air quality.

In addition to the general benefits described above, projects in this subprogram can deliver specific benefits to residential ratepayers. For example:

- **Residential ratepayers will benefit from more reliable and resilient energy supply.** RD&D seeks to develop new distributed generation and integration and controls technologies to improve the reliability and resiliency of energy supply to customers through backup generation and microgrid development. By pursuing hydrogen blending in these technology areas, RD&D seeks to mitigate the emissions that may be associated with technologies that enable energy reliability and resiliency.
- **The gas grid can improve energy system reliability by storing power that would otherwise be curtailed and synchronize renewable energy supply with demand.** Surplus renewable energy from wind, solar, and organic wastes can be channeled to make hydrogen for pipeline injection and long-duration energy storage. In 2020, over 1.5 million megawatt hours of electricity were curtailed in California according to the California Independent System Operator. This translates to approximately 32,000 metric tons of hydrogen production from electrolysis. This hydrogen could be a low-cost, reliable, in-state source of clean energy for residential ratepayers that would be less susceptible to drastic price swings. RD&D projects focused on proving less expensive and more widely available materials for electrolyzer manufacturing can help in reducing the cost of electrolyzers. In addition, RD&D projects focused on improved efficiencies in operation of electrolyzers will also result in cost reductions, which is critical to achieve this vision.

9.3.4 Equity

Low-emission, DG technologies can provide energy resilience to vulnerable populations, such as medical baseline customers, during power outages—including those resulting from PSPS events. Deployment of diesel-replacing DG within industrial areas adjacent to low-income communities (LICs) improves air quality. By simplifying and standardizing DG integration, installation costs will decrease, making resilience and energy efficiency more affordable. In addition, by simplifying the integration of clean generation technologies, the current reliance on dirtier forms of backup generation decreases, resulting in improved air quality in DACs. Guided by RD&D's Equity Engagement Roadmap, demonstrations of DG technologies are specifically sited in communities that are disproportionately burdened by multiple sources of pollution. For example, lower cost / high efficiency/ low emissions DG technology (such as Mainspring Energy's Linear Generator and Lochinvar's engine-based Combined Heat and Power (CHP) system) have been developed and demonstrated in cities such as Colton and City of Industry, California. These demonstrations highlight and inform of the value and emission reducing potential the technologies have when adopted in commercial and industrial facilities located in DACs.

9.3.5 Funding Table

Clean Energy Applications Program	
Energy Reliability Subprogram 2024 Funding Allocation	
Committed Funds for 2024[63]	$425,000
Funds Available for Project Development in 2024	$1,068,100
Total Subprogram Funding for 2024	$1,493,100
Subprogram Percentage of Funding	30%

9.4 Residential & Commercial

9.4.1 Subprogram Overview

This subprogram develops and enhances technologies and advancements related to gas consumption and end uses in the residential, commercial, and commercial food service sectors. Relevant applications include furnaces, hot water heaters, stoves, ovens, dryers, laundry, and heating, ventilation, and air conditioning (HVAC).

9.4.2 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Food Service Burner Improvements**
  Projects in this area seek to develop safe, efficient, and effective next-generation foodservice burners.
- **Area 2: Hydrogen Blending Applications**
  Projects in this area seek to investigate how hydrogen blends impact the performance of residential and commercial equipment, with particular focus on

[63] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

NOx emissions and energy efficiency. Projects will identify feasible modifications to equipment to accommodate higher blends.

- **Area 3: Catalytic Burner for Near-Zero Emissions**
  Projects in this area seek to develop safe, efficient, and effective near-zero residential and commercial appliances where decarbonization via electrification is most difficult.
- **Area 4: Building Envelope Improvements**
  Projects in this area seek to develop technologies that improve energy efficiency and enhance building comfort.

9.4.3 Subprogram Benefits

Benefit	Explanation
Operational Efficiency	Increasing energy efficiency and burner performance for residential and commercial equipment provides improved operational efficiency for customers by reducing fuel costs associated with space conditions, water heating, and other residential and commercial operations.
Improved Affordability	Increased energy efficiency improves cost savings and reduces overhead expenditures for ratepayers. This could lead to attractive Return on Investment (ROI) for customers that adopt high-efficiency technologies.
Environmental: Reduced GHG Emissions	Developing advanced end-use equipment that is compatible with RNG and hydrogen provides an environmental benefit by reducing GHG emissions from residential and commercial buildings.
Environmental: Improved Air Quality	Increasing energy efficiency and burner performance for residential and commercial equipment provides an environmental benefit by reducing NOx and PM emissions.

Through this subprogram, SoCalGas RD&D supports projects in the commercial food service industry. As detailed in SoCalGas RD&D's May 19, 2023, response to the CPUC's May 5, 2023, data request, such projects can have a range of benefits to residential ratepayers.

- **Residential ratepayers are closely connected to the benefits of RD&D work in Commercial Food Service (CFS).** Residential ratepayers are often customers of CFS businesses. In addition, 63% of American adults have worked in the restaurant industry.[64] Keeping CFS businesses healthy and economically viable through the energy transition is important to retaining jobs in the State and local communities. Moreover, it is likely that CFS cost-burdens will be passed onto residential ratepayers. CFS businesses are often located within residential communities. Improving local air quality by reducing emissions from CFS equipment directly benefits residential customers. The local air quality benefit is particularly important

[64] National Statistics | National Restaurant Association available at https://restaurant.org/research-and-media/research/industry-statistics/national-statistics/

to residential ratepayer in SoCalGas's service territory which encompasses the only two extreme federal non-attainment areas for ozone.[65]

- **New CFS technology may be applicable to residential cooking appliances.** New technologies developed to reduce emissions in the CFS space could be scaled down or adopted for residential appliances, like stove or ovens. This synergy could make low emission cooking equipment more affordable for residential customers.
- **Increased throughput of clean fuels on the system drives down marginal costs on gas infrastructure and pipeline transport costs.** Using the existing common carrier pipeline for current applications like delivering RNG or potential new applications like hydrogen blends to CFS customers can result in an increase in system throughput of these clean fuels which can reduce marginal infrastructure and pipeline transportation costs for all ratepayers, including residential ratepayers.

9.4.4 Equity

Buildings are part of the community. Where office buildings are located determines who will have access to the jobs they house, how much energy they use, and how much waste they produce. Therefore, the goal of this subprogram is to provide highly efficient and socially responsible technology to the built environment that improves the quality of life for all people.

Half of all American adults have worked in the restaurant industry. This subprogram also seeks to reduce emissions, improve air quality, and increase profitability for an important sector that employs more minority workers than any other industry.[66]

Finally, because the introduction of hydrogen may have higher upfront costs than conventional fuels, high-energy-efficiency appliances in the residential space will have greater importance in ensuring that clean energy is affordable and equitable.

9.4.5 Funding Table

Clean Energy Applications Program	
Residential & Commercial Subprogram 2024 Funding Allocation	
Committed Funds for 2024[67]	$412,250
Funds Available for Project Development in 2024	$1,080,850
Total Subprogram Funding for 2024	$1,493,100
Subprogram Percentage of Funding	30%

9.5 Industrial Operations

9.5.1 Subprogram Overview

This subprogram develops advanced heating technologies and systems for use in the industrial sector. In particular, the industrial process heat end-use sector represents some of the largest users of gaseous fuels and the most difficult applications to decarbonize via

[65] 8-Hour Ozone (2015) Nonattainment Areas | Green Book | US EPA available at https://www3.epa.gov/airquality/greenbook/jnc.html.

[66] https://restaurant.org/about/our-industry/commitment-to-diversity-equity-and-inclusion

[67] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

electrification. Examples include food processing, manufacturing, cement production, chemical processing, textile drying, and agriculture.

9.5.2 2023 Key Research Areas

This subprogram, guided in part by input received during outreach activities, will target the following key research areas with funds for projects under development:

- **Area 1: Point-Source CCUS**
  Projects in this area seek to develop scalable, low-energy, and cost-effective CO_2 capture technology for point-source emission.
- **Area 2: Distributed Hydrogen Production for Industrial Applications**
  Projects in this area seek to decarbonize the hard-to-abate sectors via the development and deployment of scalable, less-energy-intensive, and cost-efficient distributed hydrogen production for industrial applications.
- **Area 3: Industrial Process Innovation**
  Projects in this area seek to develop industrial process innovations such as novel raw materials, additive manufacturing, and combustion enhancements that are retrofittable and can improve burner performance.
- **Area 4: Combined Heat and Power & Thermal Energy Storage**
  Projects in this area seek to develop combined heat and power systems that produce electricity and thermal energy at high efficiencies using a range of technologies and fuels such as RNG and hydrogen. Additionally, projects in this area seek to decarbonize process heat in industrial and commercial applications by developing thermal energy storage technologies that can recover waste heat for industrial process and dispatchable power.

9.5.3 Subprogram Benefits

Benefit	Explanation
Operational Efficiency	Increasing energy efficiency and burner performance for industrial equipment provides operational efficiency improvements for industrial customers by reducing fuel costs associated with high-temperature processes, improving throughput, and increasing quality, including the ability to refuel quickly.
Improved Affordability	Developing solutions that can be implemented as modifications or retrofits to existing equipment enables cost-effective and energy efficient decarbonization of industrial end-uses.
Environmental: Reduced GHG Emissions	Developing advanced industrial equipment that is compliant with RNG and hydrogen reduces GHG emissions from industrial process, which are difficult and costly to electrify.
Environmental: Improved Air Quality	Increasing energy efficiency and burner performance for industrial equipment provides an environmental benefit by reducing NOx and PM emissions.

9.5.4 Equity

Industrial facilities that are often situated near low-income and disadvantaged communities are the primary focus of the Industrial Operations subprogram. This subprogram aims to enhance energy efficiency and replace conventional fuels with RNG and hydrogen, resulting in significant emission reductions and improved air quality within these regions. The RD&D projects within the Industrial Operations subprogram contribute to improving equity and delivering benefits to disadvantaged communities in various ways. First, in Point-Source CCUS (Research Area 1), the development of cost-effective CO_2 capture technologies helps mitigate GHG emissions from industrial operations. This reduction in carbon emissions contributes to a healthier environment and improved air quality for communities residing near industrial facilities. Distributed Hydrogen Production for Industrial Applications (Research Area 2) focuses on scalable and cost-efficient hydrogen production technologies. By enabling the use of clean renewable hydrogen as a fuel source, these projects reduce dependence on fossil fuels, leading to lower pollution levels and promoting sustainable industrial practices. This transition benefits disadvantaged communities by creating cleaner and healthier environments. Thermal Energy Storage (Research Area 3) emphasizes the development of technologies that decarbonize process heat in industrial applications. By recovering waste heat and utilizing it for industrial processes, these projects enhance energy efficiency and reduce reliance on fossil fuels. This results in lower energy costs, improved air quality, and a more sustainable industrial sector that positively impacts disadvantaged communities.

Projects in Combustion Enhancement (Research Area 4) strive to develop retrofittable combustion enhancement technologies that improve burner performance. These projects focus on energy efficiency and low emissions, reducing GHG and NOx emissions. By enhancing combustion efficiency and reducing pollutants, these projects contribute to improved air quality, benefiting both the environment and the health of disadvantaged communities. Projects in Industrial Process Innovation (Research Area 5) and Combined Heat and Power (Research Area 6) drive innovation in industrial processes, fostering efficient energy use. By developing novel materials, additive manufacturing techniques, and high-efficiency combined heat and power systems, these projects enhance productivity, reduce emissions, and promote a sustainable industrial sector. This benefits all communities, including disadvantaged ones, by creating job opportunities and improving environmental conditions.

9.5.5 Funding Table

Customer End-use Applications Program	
Industrial Operations Subprogram 2024 Funding Allocation	
Committed Funds for 2024[68]	$0
Funds Available for Project Development in 2024	$1,990,800
Total Subprogram Funding for 2024	$1,990,800
Subprogram Percentage of Funding	40%

[68] Committed funds are based on the RD&D project portfolio as of 05/31/2023. New projects are pending approval of the 2023 Research Plan.

Appendix A: Project Selection Process

When identifying promising projects and evaluating them for potential funding, RD&D Program staff take a comprehensive and flexible approach that enables them to 1) identify potential projects most in alignment with RD&D Program goals, State and Federal safety and environmental policies, and industry demand; 2) accurately assess the likelihood of potential projects to succeed; 3) work with proven partners and technologies over time; and 4) respond nimbly to changing market, technology, and policy drivers. In addition—remembering that some technologies will not result in concrete benefits until implemented at scale—RD&D Program staff consider the overall development and implementation process and research life cycle of a given technology or product.

RD&D Program staff explore a variety of avenues to identify and conceive potential projects, including:

Table 6: RD&D Program staff explore many avenues to identify and conceive potential projects.

Addressing Internal Operations Needs	RD&D Program staff address the needs of SoCalGas operations through regular engagement with a large number of SMEs within the organization. These SMEs provide input into technology development strategies, review research proposals, and participate in RD&D Program projects by providing technical input and guidance. They also serve as the internal technical leaders in regulatory proceedings, provide awareness of industry activities, and help manage internal policies and procedures.
Addressing Customer Needs	SoCalGas Account Executives work closely with commercial and industrial customers. The Customer Strategy & Engagement group interacts with residential customers through programs such the Customer Insight Panel. These teams often bring customer challenges to RD&D Program staff, seeking to identify available products or technologies to address a need, or, if none exists, to spur research aimed at advancing or developing appropriate new technologies or products.
Literature Surveys, Conferences, and Workshops	RD&D Program staff engage in ongoing education in their areas of expertise to remain abreast of the latest technologies and research and also scout potential opportunities. They regularly read technical journals, visit national laboratories, and attend clean technology forums/webinars held by various DOE divisions, such as the Advanced Research Projects Agency-Energy (ARPA-E), Energy Efficiency and Renewable Energy (EERE), and the Office of Fossil Energy's National Energy Technology Laboratory (NETL). These activities enable them to identify the latest technology developments in their respective fields as soon as they are made available and perform detailed gap analyses to better understand which research areas merit further study and evaluation.

Research Consortia	RD&D Program staff leverage the national and international experience of other utilities through participation in industry research consortia, such as Utilization Technology Development (UTD) and Pipeline Research Council International (PRCI). Close relationships with these organizations facilitate the generation of project ideas, enable SoCalGas to vet potential projects with real-world end-users, and provide access to significant amounts of co-funding.
External Funding Opportunities	When public agencies, such as the CEC or the DOE, release a funding opportunity, RD&D Program staff often receive proposals from third-party researchers or entrepreneurs applying to the opportunity with a request for a letter of support and/or cost share from SoCalGas. Additionally, RD&D Program staff continually track various governmental funding opportunities and leverage their existing relationships with researchers and entrepreneurs to assemble teams, develop proposals, and submit applications when funding opportunities are identified.
Proposals from Researchers	RD&D Program staff have developed a strong network of researchers throughout North America. These researchers serve as a rich source of project concepts for RD&D Program staff, who often work with the researchers to refine and improve concepts of interest and identify relevant co-funding opportunities, project demonstration sites, or strategic partners that can enhance the quality of the project and maximize potential customer benefit.
Technology Roadmap Development	RD&D Program staff often engage groups of SMEs to identify scientific and technological gaps as well as promising technology pathways in each program. After identifying the gaps and pathways, the team recommends promising technologies that are close to demonstration or commercialization and others that are earlier in the development cycle but are likely to result in significant long-term benefits. Staff then develop a detailed long-term plan to address the gaps and demonstrate the feasibility of a selected technological pathway.
Public Workshops and Outreach	The annual RD&D Stakeholder Workshop provides a forum for many stakeholders—including private, governmental, and academic researchers, regulatory and policy staff, entrepreneurs, businesses, equity and environmental justice advocates, community-based organizations (CBOs), and the general public—to offer guidance, discuss research needs, and describe project ideas to RD&D Program staff. SoCalGas also conducts pre- and post-workshop outreach to interested stakeholders to enable longer, more thoughtful discussion about RD&D topics. RD&D Program staff also participate in panel discussions and conferences where stakeholders present project proposals or where education and engagement opportunities exist.

Policy Drivers	SoCalGas strives to align the RD&D Program with California's policy goals, including building and transportation decarbonization. RD&D Program staff leverage a network of relationships with experts at local, state, and federal agencies to track current and potential future policies and regulations in order to identify and develop project concepts to achieve these goals.

Although staff from each of the four programs have distinct research interests, goals, and industry relationships, all follow a similar high-level approach to project identification and selection. In summary, program staff 1) identify potential areas for research, development, and demonstration and collaborate with researchers to develop project proposals; 2) prepare or receive project proposals; 3) review project proposals with the RD&D Program team and SMEs, considering a wide range of evaluation criteria and the overall portfolio strategy; 4) refine scopes of work for approved projects, if necessary; 5) allocate funding following SoCalGas accounting policies; and 6) execute the project contract and initiate project research.

ATTACHMENT B

Advice No. 6182-G

SoCalGas Research, Development, & Demonstration
Equity Engagement Roadmap

SOCALGAS RESEARCH, DEVELOPMENT & DEMONSTRATION EQUITY ENGAGEMENT ROADMAP

August 28, 2023

SoCalGas

Contents

1 Executive Summary

Backed by forward-thinking energy and environmental policy, countries around the world are developing scalable, effective, and increasingly affordable clean energy and clean transportation solutions. More and more people, businesses, and governments are adopting these solutions, driving costs down and gaining increased confidence in the new technologies being developed.

These efforts are paying off. In the last 10 years, the price of solar electricity has dropped by 89% and the price of wind electricity by 70%.[1] Major U.S. cities have committed to buying clean energy by 2025.[2] Businesses are on board too. Nearly half of the largest companies in the U.S. now recognize that they have a responsibility to tackle climate change and help preserve the planet for future generations.[3]

Despite this progress, however, there is still more to do, particularly for historically disadvantaged and marginalized communities.

Recognizing the role that it can play in mitigating some of the negative impacts of climate change on these communities—and in response to input received from community and agency stakeholders, including the California Public Utilities Commission (CPUC)—the Southern California Gas Company Research, Development, & Demonstration Department (SoCalGas RD&D) has developed an Equity Engagement Roadmap (EER).

Figure 1: SoCalGas RD&D identified three key themes and six associated tasks.

Designed to clearly communicate with both the public and government agencies, this document describes a multi-year vision for improving equity engagement within SoCalGas RD&D. The ultimate goal of this engagement is to maximize the likelihood that the benefits of new, clean energy technology positively and equitably impact all

[1] https://www.goodgoodgood.co/articles/climate-change-good-news-roundup
[2] https://www.mic.com/impact/climate-change-good-news
[3] https://www.worldwildlife.org/stories/the-good-news-about-climate-change

communities within California, with special consideration for those communities that have been historically under-resourced.[4]

The EER incorporates input from an extensive literature review and numerous stakeholders, including many representatives from Environmental & Social Justice (ESJ) communities and internal stakeholders.

SoCalGas RD&D will use the EER to guide its ongoing engagement efforts and to develop, update, and track equity engagement metrics that SoCalGas leadership, the CPUC, and the public can use to evaluate the degree to which the projects supported by SoCalGas RD&D address inequities related to climate, income, and race/ethnicity, age, and other diversity dimensions in the communities served by SoCalGas.

[4] Based on input received during the road-mapping engagement process, SoCalGas RD&D uses the term *under-resourced* rather than *underrepresented* or *underserved*.

2 Introduction

The urgency of climate action cannot be understated. Indeed, many studies have concluded that achieving ambitious decarbonization goals across all economic sectors will be necessary to avert climate catastrophe.[5, 6, 7]

For those in historically under-resourced and marginalized communities, the stakes are particularly high. Associated negative impacts—including heat waves, drought, wildfires, and flooding—can affect those groups more profoundly, not only because they lack adequate access to resources such as health care and insurance but also because they often live in areas subject to recurrent geo-hazards or with poorly developed infrastructure.

As a global leader in the energy space, SoCalGas recognizes this reality and its role in mitigating climate change. In 2021, SoCalGas announced ASPIRE 2045, a sustainability strategy that includes a commitment to net zero emissions in the company's operations and energy delivery by 2045.[8]

People	Purchasing & Supplier Diversity	Community Investments
The company's more than 8,000 employees mirror the diversity of the more than 21 million consumers in more than 500 Californian communities served by SoCalGas.	Working with culturally and ethnically diverse business owners is an integral part of SoCalGas' corporate strategy and benefits its suppliers and the local community.	SoCalGas' charitable investments and partnerships help create safe, healthy, and thriving communities. SoCalGas also strives to provide economic opportunities among under-resourced communities.

Figure 2: SoCalGas' Three Pillars of Engagement.

[5] https://unfccc.int/news/rapid-decarbonization-needed-to-prevent-climate-disaster
[6] https://www.nature.com/articles/d41586-021-00864-9
[7] https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/
[8] https://www.socalgas.com/sustainability/aspire-2045-faqs

SoCalGas also seeks to provide benefits to the communities it serves, including under-resourced communities.[9] For example:

- **The Climate Champions Grant Program:** This program invests up to $400,000 annually in programs, projects, and research that address community climate solutions in Southern California. This program is designed to encourage and foster clean, safe, and innovative solutions toward decarbonization, diversification, and digitalization toward a clean energy future.[10]
- **Community Donations:** In 2021, SoCalGas invested a total of $9.6 million in charitable causes, of which 70% was spent with nonprofits serving communities of color.[11]
- **Workforce Development:** SoCalGas funded six new or expanded workforce programs with organizations such as LA Urban League, Brotherhood Crusade, and Youth Action Project. The workforce training programs created opportunities for Black, Latino, Asian, and veteran populations within the company's service territory to gain a variety of jobs at SoCalGas.
- **Employee Engagement:** The SoCalGas Diversity, Equity & Inclusion (DEI) Department offers several ways for company employees to be involved, including five employee resource groups and counting, a Diversity & Inclusion Mentoring Program, an Annual Diversity & Inclusion Summit, and various community conversations, townhall events, and volunteer opportunities.
- **Supplier Diversity:** In 2021, SoCalGas spent $972.6 million—more than 42% of total purchases—with 577 culturally and ethnically diverse suppliers. This was the 29th year that SoCalGas exceeded the diverse spending goals set by the CPUC. To identify diverse suppliers, SoCalGas conducts outreach to local, regional, state, and national organizations and holds two Small Contractor Boot Camps each year aimed at diverse suppliers with under $5 million in revenue.[12]

These concrete commitments to sustainability, diversity, equity, and inclusion demonstrate the support that SoCalGas RD&D receives from company leadership in the development of the Equity Engagement Roadmap and its ultimate execution.

[9] During the roadmapping process, stakeholders encouraged SoCalGas to share information about the benefits it provides to its employees and the communities it serves.
[10] https://socalclimatechampionsgrant.com/
[11] https://www.socalgas.com/our-community/empower
[12] https://www.socalgas.com/for-your-business/supplier-diversity

3 SoCalGas RD&D

SoCalGas RD&D is a department within SoCalGas that identifies and supports projects and technologies with the potential to save energy, reduce greenhouse gas (GHG) emissions, improve air quality, and increase the safety, reliability, and affordability of energy. Its vision is to advance innovative technologies for safer, cleaner, and more reliable energy. Its mission is to identify transformational energy solutions, build them, and share them with the world.

SoCalGas relies on its three values—science, synergy, and equity—when selecting the projects it funds every year. In 2022 alone, SoCalGas RD&D invested almost $14 million in hundreds of energy technology and clean fuels projects, allocated across five research program areas:

- **Low Carbon Research:** The primary goal of the Low Carbon Resources program area is to decarbonize the gas supply while maintaining its affordability and reliability. To accomplish this goal, program staff members develop, promote, and advance new technologies aimed at increasing the production of renewable gas to displace conventionally sourced pipeline gas, while limiting or recycling GHG emissions. This program area is further broken down into two research areas:
    - Carbon Capture, Utilization, and Sequestration
    - Renewable Gas Production
- **Gas Operations:** The Gas Operations RD&D program supports pipeline transportation and storage operations through innovations that enhance pipeline and employee safety, maintain system reliability, increase operational efficiency, and minimize GHG impacts to the environment. The program also supports technology development driven by emerging regulatory requirements. Its primary goals are to develop, test, and introduce new gas operations technologies that are beneficial to ratepayers through improvements in public and pipeline safety,

system reliability, operational efficiency, and environmental benefits. This program area is further broken down into four research areas:
    - Environmental & Safety
    - Operations Technology
    - System Design & Materials
    - System Inspection & Monitoring
- **Clean Transportation:** The Clean Transportation program supports activities that reduce environmental impacts related to the transportation sector. Focusing on utilization of renewable natural gas (RNG) and renewable hydrogen, this program facilitates the development of zero-emissions technology for on-road and off-road applications, fueling infrastructure, and on-board storage technologies. This program area is further broken down into four research areas:
    - Off-Road
    - Onboard Storage
    - On-Road
    - Refueling Stations
- **Clean Generation:** This program targets the development and demonstration of high-efficiency products and technologies associated with the generation of power for the residential, commercial, and industrial market segments. Its goals are to reduce emissions, lower customer costs, integrate renewable fuels, and improve energy reliability and resiliency. This program area is further broken down into two research areas:
    - Distributed Generation
    - Integration & Controls
- **Customer End-Use Applications:** This program focuses on developing, demonstrating, and commercializing technologies that cost-effectively improve efficiency and reduce the environmental impacts of gas equipment used in residential, commercial, and industrial settings. This program area is further broken down into five research areas:
    - Advanced Innovation
    - Commercial Applications
    - Commercial Food Service
    - Industrial Process Heat
    - Residential Appliances

SoCalGas RD&D is staffed with experts in science, engineering, industrial process technology, and environmental policy. In collaboration with researchers from some of the world's top institutions, it helps identify, test, and develop transformational products that promote decarbonization.

At present, SoCalGas RD&D engages with the regulatory, scientific, and regional community—including under-resourced groups—in a variety of ways, including:

- **Website:** The central repository for all publicly available material about SoCalGas RD&D, the website includes project spotlights, videos, links to previous annual reports, recordings of webinars, press releases, and more.[13]
- **Annual Reports:** These documents, available in English and Spanish, describe

[13] https://www.socalgas.com/sustainability/research-development-demonstration-rdd

SoCalGas RD&D, summarize the projects and technologies it funds, and highlight many of its projects in informative case studies.[14]

- **Annual Stakeholder Workshop:** Each spring, SoCalGas RD&D hosts a public workshop to share information about its accomplishments of the previous year and to solicit input about its research plan for the coming year.
- **Quarterly Research Webinars:** In these webinars, representatives from projects supported by SoCalGas RD&D discuss their technologies, the research they conducted, and the results.[15]
- **Quarterly Newsletters:** These communications share information about SoCalGas RD&D, its projects, and its principles.
- **LinkedIn Page:** Here, SoCalGas RD&D provides information about the projects, technologies, and companies it supports as well as material about the activities of RD&D staff.[16]

SoCalGas RD&D plans to increase its engagement with under-resourced communities and to develop metrics to track how the projects it supports benefit those communities. This document represents a foundational component of that approach, one that SoCalGas RD&D can use for years to develop, maintain, and track its efforts to improve engagement with disadvantaged communities.

[14] https://www.socalgas.com/sustainability/research-development-demonstration-rdd-reports
[15] https://www.socalgas.com/sustainability/research-development-demonstration-rdd/webinars
[16] https://www.linkedin.com/showcase/socalgas-research-development-&-demonstration-rd&d-

4 Methodology

The EER is meant to serve as an operating framework that integrates equity considerations throughout SoCalGas RD&D's work. It is based on an extensive literature review as well as consultation with numerous internal SoCalGas stakeholders and representatives of disadvantaged communities. It also includes key definitions and a set of action items to improve engagement with the community.

The goals of the EER are to improve outreach efforts to hard-to-reach, low-income communities disproportionately burdened by poor air quality within SoCalGas' service territory and to increase the likelihood that the benefits of clean energy technology impact all communities, with special consideration for historically under-resourced communities. To that end, the EER identifies actions that are both feasible and impactful.

For help in coordinating activities and completing the EER, SoCalGas RD&D engaged 2020vet, a veteran, woman-owned company with leaders highly experienced in strategy, advocacy, working with local communities facing conflict and crisis, building highly functional teams, training, and including both internal and external stakeholders at the table.[17] Working with 2020vet, RD&D staff:

- Conducted an extensive literature review
- Assessed SoCalGas' current community engagement capabilities through stakeholder interviews
- Identified numerous themes and narrowed them down to three key themes
- Brainstormed tasks that would support the three key themes
- Drafted the EER
- Shared the draft EER with internal and external stakeholders
- Incorporated stakeholder feedback and finalized the EER

4.1 The CPUC Environmental and Social Justice Action Plan

One of the key drivers behind the formation of the EER is CPUC's Environmental & Social Justice Action Plan. This document serves as a vision for how CPUC seeks to advance equity in its programs and policies for ESJ communities.

The Action Plan identifies existing inequities and proposes clear actions for how CPUC can use its regulatory authority to address safety, consumer protection, program benefits, and enforcement to encompass all the industries it regulates, including energy, water, and communications. The document utilizes the following broad guiding principles to inform its strategies to advance environmental and social justice:

- Consider impacts on ESJ communities when initiating discretionary proceedings.
- Use CPUC's planning, permitting, and regulatory role to advance social and environmental justice goals.
- Increase investment in clean energy resources to benefit ESJ communities, especially to improve local air quality, address negative health impacts, and prevent financial burdens.
- Strive to improve access to high-quality water, communications, and

[17] https://2020vet.com/

transportation services for ESJ communities.
- Increase climate resiliency and financial benefits to ESJ communities.
- Enhance outreach and public participation opportunities for ESJ communities to meaningfully participate in CPUC's decision-making process.
- Enhance enforcement to ensure safety and consumer protection for ESJ communities.
- Promote economic and workforce development opportunities in ESJ communities.
- Promote access and education ensuring that ESJ communities will benefit from and participate in CPUC programs and proceedings.
- Improve training and staff development related to environmental and social justice issues within CPUC's jurisdiction.
- Monitor CPUC's environmental and social justice efforts to ensure that they are achieving their objectives.

When forming its own EER, SoCalGas RD&D followed many of the same principles.

4.2 Literature Review

The first step that SoCalGas RD&D took in the development of the EER was to conduct a literature review of 50+ source documents and reports from federal, state, and local agencies; industry and utilities; academia; and non-governmental organizations (NGOs). This review helped RD&D staff identify common themes and industry best practices, as well as possible structures for the EER.

During the literature review, RD&D staff:

- Conducted more than 100 hours of ESJ research
- Reviewed 50+ sources and thousands of pages of content
- Identified the source, title, and theme of each document; extracted best practices; and highlighted common observations
- Reviewed federal, state, and local government reviews, papers, and laws
- Reviewed private industry and utility companies
- Reviewed academic reports and NGO publications
- Conducted analysis to identify key themes, gaps, pain points, opportunities, and best practices
- Identified and consolidated key definitions

Four main concepts emerged from the literature review: 1) defining communities of interest, 2) community engagement, 3) metrics and evaluation, and 4) furthering the principles of ESJ.

4.3 Internal Stakeholder Interviews

ESJ activities are cross-cutting. To benefit from lessons learned, SoCalGas RD&D sought to coordinate its efforts with activities already underway within the company and to leverage existing company relationships with community members. Thus, RD&D staff conducted internal stakeholder interviews with representatives from a variety of SoCalGas departments, including:

- Regional Public Affairs

- Diversity, Equity, & Inclusion
- Supplier Diversity
- Community Giving
- Customer Assistance

The internal stakeholders raised many considerations, including the need to:

- Pursue clean energy workforce development through technical training and scholarships
- Include more diverse suppliers
- Support training and environmental education partnerships and programs
- Support the cross-cutting nature of ESJ in SoCalGas policy, planning, and budgeting
- Leverage current connections to reach under-resourced communities
- Build grassroots community capacity in decision-making efforts
- Ensure equitable distribution of benefits and access
- Highlight companywide efforts and successes to the public and CPUC

4.4 Identify Key Themes

Upon completion of the literature review and stakeholder interviews, SoCalGas RD&D held a series of internal meetings to review findings to date and narrow the team's focus. In this process, staff identified three broad themes for further thought:

	Theme	Description
Context	Obtain Situational Awareness	This provides the context necessary to engage under-resourced groups in a meaningful way.
Community	Increase Community Engagement	This builds the relationships that help gather accurate information about the interests, concerns, and needs of under-resourced groups and communities.
Culture	Institutionalize Diversity, Equity, & Inclusion	This builds a culture within SoCalGas RD&D that values DEI and includes equity engagement as a natural and obvious component of its work.

4.5 Define Environmental & Social Justice Communities

Upon completion of the literature review and stakeholder interviews, SoCalGas RD&D worked to define ESJ Communities for the purposes of the roadmap.

SoCalGas RD&D builds upon the CPUC's definition of ESJ Communities to include the following:

- Census tracts that score in the top 25% of CalEnviroScreen 4.0, along with those that score within the highest 5% of CalEnviroScreen 4.0's Pollution Burden but do not receive an overall CalEnviroScreen score over 75%[18]
- All tribal lands
- Low-income households (incomes below 80 percent of the area median income)
- Low-income census tracts (where aggregated household incomes are less than 80

[18] https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

percent of area or state median income)

Based on feedback received during the stakeholder engagement process, SoCalGas has expanded its definition of ESJ communities to include two federal programs, both of which maintain interactive maps to identify qualifying locations:

- **HUBZone Program:** This program fuels small business growth in historically underutilized business zones and is managed by the U.S. Small Business Administration.[19]
- **Opportunity Zones:** These are economically distressed communities, defined by individual census tract, nominated by America's governors, and certified by the U.S. Secretary of the Treasury. Opportunity Zones are managed by the U.S. Department of Housing and Urban Development.[20]

These communities, by virtue of their categorization as ESJ communities, typically have reduced access to environmental resources, experience more burdens, and are less able to participate in the environmental decision-making process.

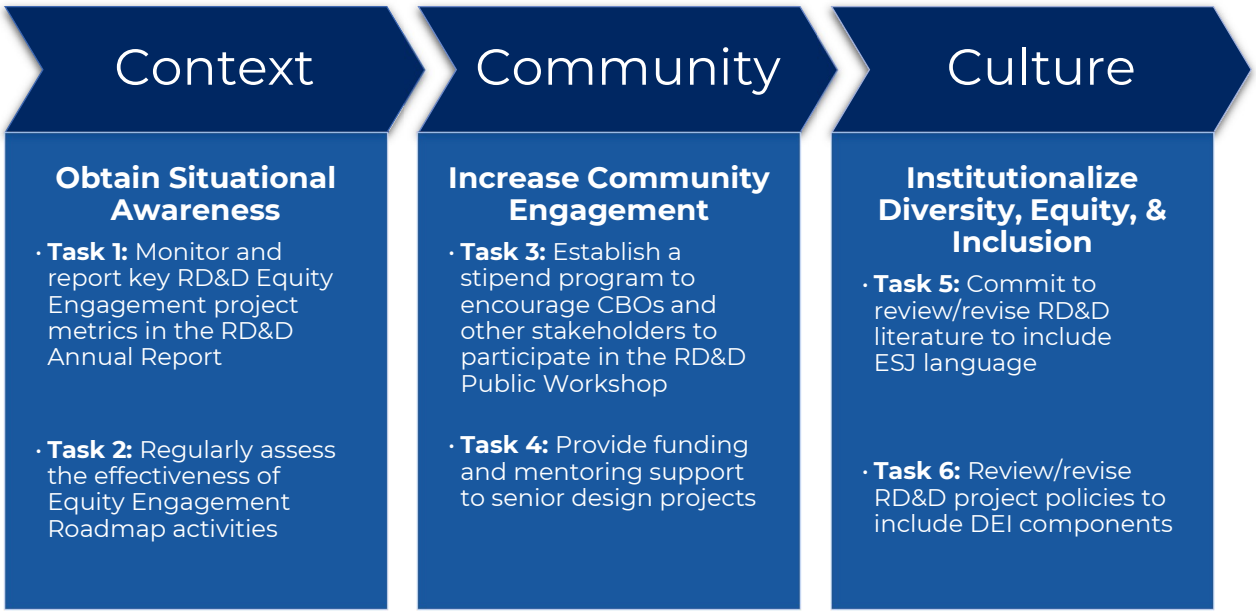
4.6 Analysis and Brainstorming

Once SoCalGas RD&D had identified and agreed upon the three themes, staff began identifying associated actionable items that could be performed. After brainstorming a large number of potential tasks, RD&D staff narrowed down the list by evaluating each using the following criteria:

- Internal factors, such as resources required
- Time to implement
- Alignment with SoCalGas RD&D's capabilities
- Community empowerment
- Health and environmental impacts
- Public confidence

Ultimately, RD&D identified six core tasks to support the three themes.

[19] https://www.sba.gov/federal-contracting/contracting-assistance-programs/hubzone-program
[20] https://opportunityzones.hud.gov/



4.7 Stakeholder Feedback

Once RD&D staff had developed the tasks, they completed a draft of the EER to share with both internal and external stakeholders. Internal stakeholders included those identified in Section 5.3. External stakeholders included:

- Anaheim Family YMCA
- Boys & Girls Club Anaheim and Cypress
- Boys Republic
- Community Action Partnership of Kern
- Delhi Center
- DIY Girls
- Endowment for Youth Committee
- FIND Food Bank
- Imperial Valley Economic Development Corporation (IVEDC)
- Mar Vista Family Center
- Tulare Kings Hispanic Chamber of Commerce
- United Boys & Girls Club of Santa Barbara County
- Wilmington YMCA
- Young Visionaries

RD&D then incorporated stakeholder feedback and finalized the draft.

5 The Six Core Tasks

As discussed previously, SoCalGas RD&D identified three key themes and six core tasks to support them, two for each theme.

5.1 Theme #1: Obtain Situational Awareness

At its most basic, situational awareness is the knowledge of what is happening in a given environment and its implications for the present and the future.[21] Without a clear understanding of where disadvantaged communities are and the challenges they face, the EER would lack relevance and serve merely as another "box checking" equity activity.

> "You can't manage what you don't measure."
>
> —Peter F. Drucker

5.1.1 Task 1: Monitor and Report Key Equity Engagement Metrics

Likewise, to maximize the effectiveness of its equity engagement, SoCalGas RD&D must understand its engagement baseline, regularly examine how it can improve its efforts, and determine metrics it can use to evaluate progress over time.

In this task, RD&D staff will develop, monitor, and report key equity engagement metrics. Examples of potential metrics include:

- Number of RD&D projects located in ESJ communities
- Total RD&D funding to projects in ESJ communities
- Number of Disadvantaged Business Enterprise (DBE) vendors funded
- Total RD&D funding to DBE vendors
- Percent of total RD&D funding to DBE vendors

RD&D staff will monitor these metrics throughout the year and report them in the SoCalGas RD&D Annual Report.

5.1.2 Task 2: Assess the Effectiveness of EER Activities

Using the equity engagement metrics defined above, RD&D staff will regularly assess the effectiveness of its EER activities. One of the ways to assess the effectiveness of engagement is to present results—such as the metrics defined in Task 1—at the SoCalGas RD&D annual workshop and then solicit feedback from stakeholders, which RD&D staff can use to modify the EER in the research plan submitted to CPUC for approval.

5.2 Theme #2: Increase Community Engagement

The core question related to this common theme is: "How can SoCalGas RD&D better connect with the communities it serves? As described below, RD&D staff identified

[21] https://www.ckju.net/en/dossier/situational-awareness-what-it-and-why-it-matters-management-tool

two tasks associated with answering this question:

5.2.1 Task 3: Establish a Stipend Program

SoCalGas RD&D wants to encourage diverse researchers as well as advocates for ESJ communities to participate and provide input through the annual RD&D public workshop, advisory committees, or interviews. But RD&D staff recognize that this takes time and resources, a big ask for stakeholders with limited funding. We can provide small stipends to encourage participation by stakeholders that otherwise might not have the resources to make their voices heard.

5.2.2 Task 4: Provide Funding and Mentoring to Student Engineers

SoCalGas RD&D seeks to encourage and inspire the next generation of diverse researchers. In the past, RD&D staff have engaged with students at California State University, Los Angeles as part of their senior design program, providing project ideas and mentoring support. RD&D staff plan to continue and expand this work to engage with science and engineering students at Hispanic- and Minority-Serving Institutions throughout the SoCalGas service territory interested in applying their skills to address California's environmental challenges.

5.3 Theme #3: Institutionalize Diversity, Equity, & Inclusion

The challenges faced by historically under-resourced communities are longstanding. Any solution to these challenges must be built into the fabric of the organizations addressing the challenges. To that end, SoCalGas RD&D formulated two core tasks designed to institutionalize diversity, equity, and inclusion into its activities.

5.3.1 Task 5: Review and Revise RD&D Literature

Language matters. It shapes thought, establishes meaning, and impacts the way we think about and understand people, occurrences, and experiences.[22] The words we use can promote inclusion or enforce exclusion. Embrace difference or limit connection. And acknowledge issues or excuse problematic behavior.[23]

Therefore, it is essential that SoCalGas RD&D uses language that supports its equity engagement goals. To do this, RD&D staff have committed to reviewing all RD&D literature and, when necessary, revising it to include more inclusive ESJ language. Examples of relevant documents include the Annual Report, the Research Plan, webinar templates, and newsletters.

[22] https://kojoinstitute.com/the-language-of-equity
[23] Ibid.

"Language matters. It shapes thought, establishes meaning, and impacts the way we think about and understand people, occurrences, and experiences."

—KOJO Institute

5.3.2 Task 6: Review and Revise RD&D Project Policies

One of the most significant ways that SoCalGas RD&D's equity engagement efforts can have a lasting and meaningful impact is the inclusion of people from under-resourced groups in the projects funded by SoCalGas RD&D. One of the best ways to do this is to enact policies that favor the inclusion of people from these groups in the project team as principal investigators, research scientists, graduate student researchers, interns, and contractors.

According to the U.S. Department of Energy:

> *"Diversity in STEM is important because diverse teams bring a variety of perspectives and experiences, which can often lead to more innovative solutions and increased success and competitiveness."*[24]

Likewise, The Harvard Business Review asserts that "diverse teams are more likely to constantly reexamine facts and remain objective," "process information more carefully," and be "more likely to develop new products."[25]

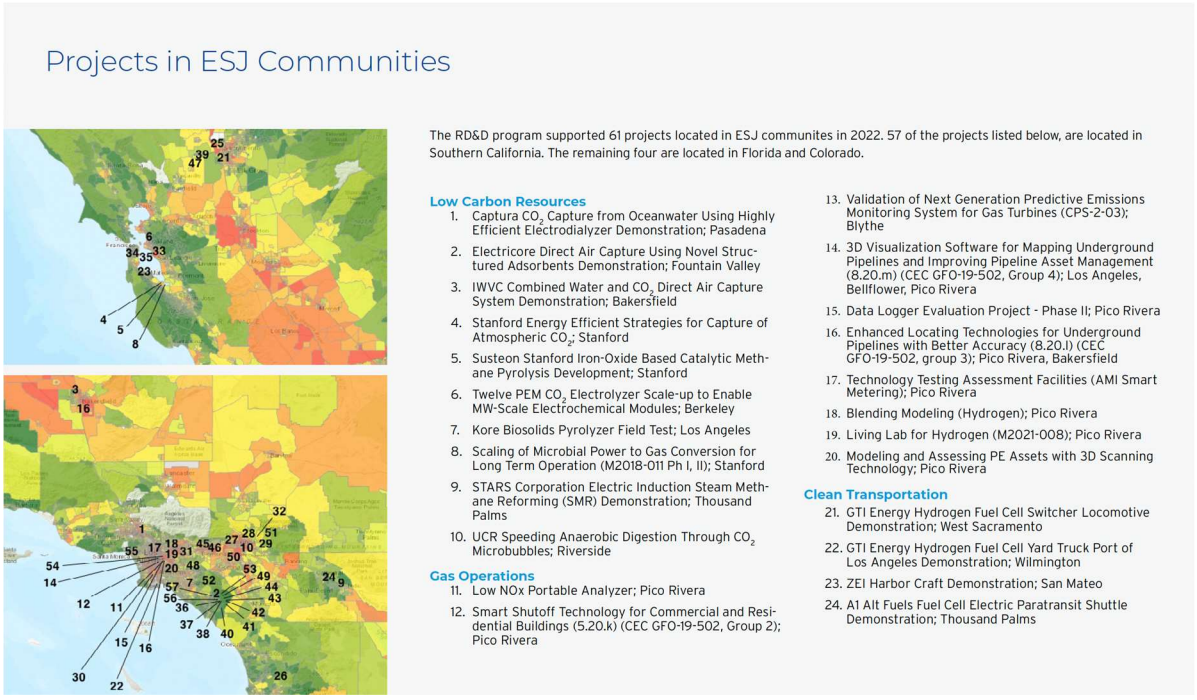
In addition, there is value in siting projects in under-resourced communities. SoCalGas RD&D plans to explicitly include equity considerations in its project evaluation criteria and to request that all potential research teams complete a DEI questionnaire. Outreach conducted during the site selection process could help project teams gain valuable support from the community, de-risk projects, and provide valuable insights into how a project or technology could impact historically disadvantaged and marginalized communities.

[24] https://www.energy.gov/eere/diversity-stem-clean-energy-industries
[25] https://hbr.org/2016/11/why-diverse-teams-are-smarter

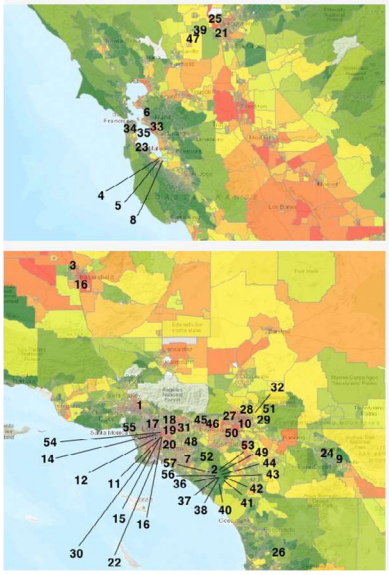
6 Actionable Steps Taken to Date

Although this roadmap helps formalize the steps needed to increase engagement across SoCalGas RD&D, it is important to note RD&D staff have already engaged in a number of equity engagement activities.

- RD&D staff began mapping its projects and identifying those located in ESJ communities. As reported in the 2021 RD&D Annual Report[26], RD&D supported 27 projects located in ESJ communities. In 2022, RD&D supported 57 projects located in ESJ communities in California.



26 https://www.socalgas.com/sites/default/files/2021%20SoCalGas%20RD%26D%20Annual%20Report.pdf



25. Cummins Integrated Fuel Cell Electric Powertrain Demonstration; West Sacramento
26. GTI Energy Symbio Class 8 Long-Haul Hydrogen Fuel Cell Truck Demonstration; Poway
27. SCAQMD Heavy Duty Truck Engine In-Use Emission Study; Riverside
28. SCAQMD Hydrogen Blended Natural Gas in NZE Engine Emissions Study; Riverside
29. UC Riverside Hydrogen Blended Natural Gas Engine Durability Test; Riverside

Clean Generation

30. EPRI ORC Waste Heat Recovery Demonstration; Compton
31. GTI Energy Marathon/EC Power mCHP Testing and Demonstration; City of Industry
32. Mainspring Energy Ultra-Low NOx Linear Power Generator Demonstration; Colton
33. Noble Thermodynamic Systems Ultra-Efficient CHP using a Novel Argon Power Cycle Development; Alameda
34. QSI Nano-Power Generation System Proof-of Concept; San Francisco
35. Scaled Power 40kw Turbogenerator Low Emissions Burner Development and Testing; San Francisco
36. UCI Effect of Hydrogen Addition into Natural Gas on SCR of NOx Lab Testing; Irvine
37. UCI Fuel Flexible Rotary Engine MicroCHP Development; Irvine
38. UCI Low-Cost Sensors for Smart Burners Research; Irvine
39. Blue Frontier Fuel Cell Integrated Air Conditioning System Dynamic Lab Testing; Davis
40. UCI Fuel Cell Supported Nanogrid Controls Evaluation; Irvine
41. UCI Fuel Cells in Data Research; Irvine
42. UCI Hydrogen Enabled Microgrids for Critical Infrastructure Research; Irvine
43. UCI Hydrogen Energy Storage and Integration with Dispatchable Power Generator System Design; Irvine
44. UCI Integrated SOFC, Solar, and Storage System in ZNE Residential Nanogrid Design; Irvine

Customer End-Use Applications

45. METRON Energy Virtual Assistant (EVA) Industrial AI Demonstration; El Monte
46. GTI ENERGY Model-Based Control Hospital Decarbonization Demonstration, Baldwin Park
47. UC Davis Aerosol Sealant Demonstration; Davis
48. GTI ENERGY SCAQMD HE/Low-NOx EcoZone Burner Kroger Demonstration; La Habra
49. UCI Hydrogen Blend Commercial Stove Low NOx Catalytic Burner Development; Irvine
50. GTI ENERGY Burner Exchange to Support Radiative Recuperator Demonstration; Ontario
51. GTI ENERGY Ceramic Radiant Tube Inserts for Waste Heat Recovery Demonstration; San Bernardino
52. GTI ENERGY Waste Heat Effective Transfer in Brewery & Distillery Demonstration; Santa Ana
53. UCI Solid Oxide Electrolysis Cells for Green Steel Production Demonstration; Irvine
54. EAC H2 Home Appliance Set Validation Test Research; Pico Rivera
55. GTI Energy Strategic Pathways and Analytics for Tactical Decommissioning of Natural Gas Infrastructure Research; Santa Monica
56. UCI Catalytic Burner Retrofitted Water Heater Lab Demonstration; Irvine
57. UCI Low NOx Water Heater Retrofit for Hydrogen Blends Development; Irvine

- In five different workshops, RD&D staff met with 33 groups, including community-based organizations and diverse academic populations, to better understand the needs of under-resourced communities. These groups include:
    - Home Aid Orange County
    - Proteus Inc.
    - Pomona Chamber of Commerce
    - Unity Shoppe Santa Barbara
    - Santa Barbara Zoo
    - Southeast Community Development Corporation
    - Family Assistance Ministries
    - El Concilio Family Services
    - Family Service Association
    - CSET Community Services Employment Training
    - Orange County Asian and Pacific Islander Community Alliance, Inc.
    - Community Action Partnership of Kern
    - Asian Youth Center
    - Endowment for Youth Committee
    - Greater Lakewood Chamber of Commerce
    - University of California Riverside's Center for Renewable Natural Gas
    - Cal Poly Pomona
    - California State University (CSU) Long Beach
    - CSU Fullerton
    - University of California-Irvine
    - Cal State Los Angeles
    - Cypress College
    - Pasadena City College
    - Santa Barbara City College

    - Kern Community College District
    - East Los Angeles College, Department of Engineering & Technologies
    - Bakersfield College
    - Cerritos Community College
    - Saddleback College
    - University of Southern California
    - California Greenworks
    - Delhi Center
    - Municipal Water District of Orange County
- Socialized the draft EER with internal and external stakeholders to gain feedback.
- Worked with the SoCalGas Regional Public Affairs team to identify and connect with contacts in disadvantaged and low-income communities to seek input and needs.
- Connected with regional California universities to identify researchers engaged with members of disadvantaged and low-income communities.
- Leveraged existing connections with Air Districts, CARB, and CEC to identify promising contacts in disadvantaged and low-income communities.

Appendix A – Literature Review

Source	Title	Themes	Best Practices
California Public Utilities Commission (CPUC)			
CPUC	2019 Annual Affordability Report	The report uses **metrics to quantify the affordability of utility services** at a geographically granular level so that it is possible to ID where utility affordability concerns are most serious in California.	**Mapping: Geographically-focused approach** to understanding and addressing utility affordability, which **enables more cost-effective and targeted delivery of relief.** Evaluate the extent to which assistance programs such as CARE and FERA are effectively deployed to customers in these communities to address affordability concerns.
CPUC	Environmental & Social Justice Action Plan V. 2	The (ESJ) Action Plan serves as both a commitment to furthering principles of environmental and social justice as well as an operating framework with which to integrate ESJ considerations throughout the agency's work.	Identified nine overarching goals, subset objectives, and 95 action items to nest within. **Defines targeted communities and critical items for consideration** that are relevant (COVID, wildfires, outreach, workforce development, etc.).
CPUC	Program Options to Promote Clean Energy and Reduce Air Pollution in AB 617 ESJ Communities	Developed a **typology of air pollution source sectors** affecting the initial 10 communities selected pursuant to Assembly Bill 617 for air monitoring and community emissions reduction programs through the CA Air Resources Board's Community Air Protection Program. Additional analysis needed; thus, the ESJ Action Plan development.	**Mapping:** Pollution areas defined. Key emission types defined. Community characteristics and pollution source types by community.
CPUC	Disadvantaged Communities Advisory Group Press Release	Advisory group consisting of **representatives from disadvantaged communities** who will provide advice on state programs proposed to achieve clean energy and pollution reduction.	Fulfills a requirement in Senate Bill (SB) 350. As defined, disadvantaged communities are the census tracts in California that are **disproportionately burdened by multiple sources of pollution.** Relative burden is determined by review of data on 20 pollution, health, and socio-economic

			factors.
Energy Companies			
PG&E	Environmental Justice Policy	To: 1) **Comply** fully with the letter and spirit of all applicable environmental justice laws and regulations. 2) **Minimize impacts to low-income communities** and communities of color in PG&E's operations by incorporating environmental justice considerations into the management, purchase, sale, and development of existing and planned facilities and delivery of energy to customers. 3) Consider environmental justice impacts in **policy engagement,** including climate change policies, to minimize adverse effects on low-income communities and communities of color and to support the development of sustainable communities. 4) **Educate employees** about Environmental Justice Policy and the responsibility to work collaboratively with neighbors and surrounding communities. 5) Maintain **open communication and seek opportunities to partner with stakeholders** on environmental justice concerns.4) Educate employees about Environmental Justice Policy and the responsibility to work collaboratively with neighbors and surrounding communities. 5) Maintain open communication and seek opportunities to partner with stakeholders on environmental justice concerns.	**A 1-page policy.** For PG&E, Environmental Justice means making better business decisions by understanding and considering the potential impacts of activities and investments on low-income communities and communities of color, and by understanding community needs.
PG&E	Employee Resource Groups	PG&E **identified employees by demographics** to include access/disability network, Asian, Black, Latino, Legacy group-sharing experience, and Middle East, Europe, North African (MEENA), Nonenergy (onboarding), Pride, Samahan (Filipino), Veterans and Women. They also have	**Using internal employee network to perform community outreach efforts.**

		Engineering Groups focused on teaching STEM to women and diversity groups.	
PG&E	Docketed 16-OIR-06 Climate Vulnerability Assessment (CVA) to CA Energy Commission	**PG&E's CVA Community Engagement Proposal (CEP)** is intended as a framework for how PG&E and climate-vulnerable community stakeholders may work together to build mutual trust and engage in authentic and meaningful exchange regarding the expected climate resilience of the energy system and building community resilience through the energy system.	The CVA CEP is an opportunity for PG&E to **practice engagement that moves beyond informing and consulting the community to involving and collaborating with the community.** The CEP is explicitly framed as a proposal to invite collaboration with stakeholders that represent disadvantaged and vulnerable communities at the outset of the process.
SCE	SCE Building Electrification Proceeding	**Proposing to create healthier, clean energy homes and businesses** by reducing the use of carbon-emitting fossil fuels in buildings.	If approved by the California Public Utilities Commission, the overall plan would provide **$677.2 million for programs** to help accelerate the growth of the building electrification market over **four years.** It prioritizes **income-qualified customers** and **environmental and social justice communities**.
California Agencies			
CalEPA	DESIGNATION OF DISADVANTAGED COMMUNITIES PURSUANT TO SENATE BILL 535 (DE LEÓN)	CalEPA is **responsible for identifying disadvantaged communities for purposes of the Cap-and-Trade** funding program. Describes how they arrived at their decision to identify communities of interest. Although CalEnviroScreen provides a reasoned, scientific base from which to work, identifying disadvantaged communities remains a challenging task.	**Mapping:** Identified areas based on legislative actions: 1) SB 535 Disadvantaged Communities and census tracts and 2) AB 1550 Low-Income Communities. Identified both graphically and overlayed.
California Energy Commission	Energy Equity Indicators	Recommendations include solar offerings, labor and workforce development strategy, common metrics, expand funding, outreach and technical assistance, collaboration with community-based orgs, fund R&D, and **study**	Tracks progress through **mapping.** Barriers study reviewed clean energy performance in low-income and disadvantaged communities and **points to key data gaps. Identifies**

		to increase small business contracting located in COIs.	**energy equity objectives:** Customers served in communities of interest, **Small Business contracts, clean energy jobs, investment amount, and energy savings.**
The White House	Justice40	Justice40 is a whole-of-government effort to ensure that federal agencies work with states and local communities to make good on President Biden's promise to **deliver at least 40 percent of the overall benefits from federal investments in climate and clean energy to disadvantaged communities.**	The pilot **identifies 21 priority programs** to immediately begin enhancing benefits for disadvantaged communities. These priority programs will provide a blueprint for other agencies to help inform their work to implement the Justice40 Initiative across the government.
White House Environmental Justice Advisory Council	Justice40 Climate and Economic Justice Screening Tool & Executive Order 12898 Revisions	State-by-state climate and clean energy summaries.	Initiative recommendations for the whole of government to focus on include: **clean energy and efficiency;** clean transit; safe, affordable, and sustainable housing and communities; **training and workforce development;** remediation; clean water infrastructure; climate mitigation and resiliency; and **community and university partnerships.**
Environmental Protection Agency	EJSCREEN: Environmental Justice Screening and Mapping Tool	EJSCREEN allows users to **access high-resolution environmental and demographic information** for locations in the United States and compare their selected locations to the rest of the state, EPA region, or nation.	**Mapping.** EPA has developed a **new environmental justice (EJ) mapping and screening tool called EJSCREEN.** It is based on nationally consistent data and an approach that combines environmental and demographic indicators in maps and reports.
Environmental Protection Agency	College / Under-served Community Partnership Program	Provides a creative approach to partnering and delivering technical assistance to underserved communities. **The program enlists colleges and universities to assist these communities** through student internships, practicums, and capstone	Communities receive vital assistance and services on a voluntary basis at no cost. Objectives are to build capacity and provide technical support to under-resourced communities based on **community-**

		projects.	**identified needs** and to provide practical, problem-solving experiences for college and university students. Technical assistance addresses environmental, economic, and social issues enabling communities to advance toward sustainability and a better quality of life. Academic institutions and students receive valuable capacity-building and community engagement opportunities
Federal Agencies			
Environmental Protection Agency	Environmental Justice Research Roadmap	Office of R&D (ORD) research directs attention to the myriad issues raised by environmental justice and **captured through discussions with advisory groups.**	The EJ Roadmap is presented as a summary inventory of ORD's research efforts, categorized by four overlapping EJ science challenges: 1) **developing decision-support tools** for identifying and prioritizing concerns, assessing cumulative impacts, and evaluating mitigation options; 2) improving our understanding of environmental health disparities and developing methods and data for assessing cumulative risks; 3) supporting Tribal sustainability and well-being; and 4) characterizing climate justice.
DOT: Federal Highway Administration	Environmental Justice Resources	EJ at the Federal Highway Administration (FHWA) means **identifying and addressing disproportionately high and adverse effects of the agency's programs, policies, and activities on minority and low-income populations.**	Guiding Principles: 1) To ensure **full and fair participation** by all potentially affected communities in the transportation decision-making process. 2) To avoid, minimize, or **mitigate disproportionately high and adverse human health and environmental effects,** including social and economic effects, on

			minority or low-income populations. 3) To **prevent the denial** of, reduction in, or significant delay in the receipt **of benefits** by minority or low-income populations.
DOT: Federal Highway Administration	Federal Highway Administration Environmental Justice Reference Guide	EJ at FHWA means identifying and addressing disproportionately high and adverse effects of the agency's **programs, policies, and activities** on minority populations and low-income populations to **achieve an equitable distribution of benefits** and burdens. This also includes the full and fair participation by all potentially affected **communities in the transportation decision-making process.**	The USDOT EJ Strategy identifies three fundamental principles of EJ that guide USDOT actions: Same as above.
Civil Society & Private Sector			
Justice40 Accelerator	The Solutions Project	The Justice40 Accelerator will **serve frontline communities applying for federal funds** across multiple agencies, flowing from the administration's executive order. 170 grantees across 35 states. $15.5M invested-major donors.	The Justice40 Accelerator's offerings include **informational briefings and resources to learn about federal grants and eligibility,** philanthropic capacity-building grants for dozens of eligible organizations, p**roject pre-development workshops,** partnership opportunities, and t**echnical expertise** to support successful applications for federal funding, including accounting, legal, and government grant writing.
Environmental Law Institute	Ground Truth: Operationalizing Environmental Justice: PEOPLE PLACES PLANET PODCAST · EPISODE 19 · SEASON 3	To clarify Justice40. Advocates that we must make sure that **EJ communities have real opportunities to engage** and maximize the odds that the most vulnerable can frame out a new, more inclusive direction.	Environmental justice has gained new momentum in recent years, amplified by a global focus on social justice, climate, and equity. Shortly after taking office, President Biden released Executive Order 14008, *Tackling the Climate Crises at Home and Abroad*. The EO includes a new initiative, Justice40, which states

			that 40% of the overall benefits from specific federal investments—**including energy efficiency, clean energy, clean water infrastructure, and training and workforce development—will be directed toward disadvantaged communities.**
The Center of Environmental Excellence	Practitioners Peer Exchange Environmental Justice Roadmap	**Peer exchange** of over 350 people. Created a roadmap identifying key issues, current state of practice, considerations, and benefits to practitioners for eight focus areas.	ESJ webinars, case study development, **increase technical assistance and coordination.** Strategies include **developing guidance on the consistency of data and information exchange;** researching how agencies are determining disproportionate impacts; and **developing guidance to reflect best practices and develop analytical tools to standardize evaluation of disproportionate impacts on environmental justice communities while allowing flexibility for project-specific information,** adapting methods to change demographic data, and exploring new methods of obtaining data.
NY City Environmental Justice Alliance	A Critical Decade for Climate, Equity, & Health	Nonprofit. Watchdog agency that works grassroots but is also at the "table." Discusses the climate justice movement gaining momentum at the local, state, and national level. Frontline communities are leading by example, confronting the global crisis at the **neighborhood level with projects that increase community resiliency** such as cooperative solar projects, local green industrial waterfront plans, coastal protection priorities, and food cooperatives.	Focus on three things: 1) reduce harmful GHG and localized emissions, 2) advance a Just Transition towards an inclusive, regenerative economy, and 3) **cultivate healthy and resilient communities. They use many maps in the reports**. They address COVID and infections as a climate problem linked to heat and rising temperatures. **Excellent Visions for the Climate and Community**

			Development Fund: 1) **provide career track jobs in the EE sector,** 2) improve public health by **reducing localized emissions** and improving indoor air quality; 3) **improve resilience of low-income tenants** to extreme temperatures, 4) **reduce energy burden** amidst rising utility costs, 5) **improve neighborhood economic activity, and** 6) **increase civic participation and leadership** in community development.
Universities			
UCLA	Making Justice40 a Reality for Frontline Communities; Lessons from State Approaches to Climate and Clean Energy Investments.	Identifies Opportunity Pathways: justice-driven frontline communities; community powered. Achieve transformational change and accountable change. **Institutionalize justice.**	Defined **five types of disparities**: pollution exposure, communities at high risk of climate change impacts, communities of color and low-income, working-class households impacted by the fossil fuel transition to a clean economy and low-income households that historically have benefited the least from clean tech and other environmental investments.
UC Berkeley, USC & Occidental College	Advancing Equity in California Climate Policy: A New Social Contract for Low-Carbon Transition	This report presents a Climate Policy Equity Framework to **assist California decision-makers interested in reducing greenhouse gas emissions in ways that promote economic, social, and environmental equity.** Suggests that policymakers, regulators, community groups, advocacy organizations, and business interests should develop a **"social contract"** to manage a transition to a low-carbon economy that both maximizes the benefits of low-carbon economic development and minimizes the risks to working people and disadvantaged	Climate equity defined. How can it be defined in a way that promotes both good jobs and prioritizes those communities that are hardest hit by climate change, multiple environmental hazards, and socioeconomic stressors? What **key criteria can then be used to develop and assess policies** such as renewable portfolio standards, incentives for energy retrofits, cap and trade, transit-oriented development, low carbon fuels and

		communities.	vehicle deployment, and much more?
Legislation			
AB 1532	Chapter 807: California Global Warming Solutions Act of 2006	Amend and add chapters relating to GHG emissions. Requires specific purposes and coming up with a 3-year plan on what that is.	Designates CARB charged with monitoring and regulating sources of emissions and GHGs. **Mapping: clean energy jobs, SB opportunities.**
AB 350	Clean Energy and Pollution Reduction Act of 2015	50% renewable energy by 2030, doubling energy efficiency savings by 2030, encourages widespread transportation electrification, integrated resource planning to reduce GHG emissions, and addressing barriers to low-income residents and disadvantaged communities.	Requires that **electricity sold to retail customers from eligible renewable sources be increased by 50% by Dec 31, 2030**.
SB 535	California Global Warming Solutions Act of 2006	Requires that a minimum of 25 percent of the available proceeds be allocated to projects that provide a benefit to disadvantaged communities; and at least 10 percent of the available proceeds were to be allocated to projects located within disadvantaged communities. Also required **identification of disadvantaged communities.**	An act to add Sections 39711, 39713, 39715, 39721, and 39723 to the Health and Safety Code, relating to climate change. The bill would require the Department of Finance, when developing a specified 3-year investment plan, to **allocate 25% of the available monies in the GHG Reduction Fund to projects that provide benefits to disadvantaged communities.**
SB 1018	Amendments by Committee on Budget and Fiscal Review	Amends several bills.	Established the Office of Education and Environment under CalEPA to **implement statewide environmental education programs and implement a unified education strategy on the environment for elementary and secondary schools in the state.** Bill established the office in the Department of Resources and Recovery instead.
AB 1550	Greenhouses Gases: Investment	**Increasing the percent of funds for projects located in disadvantaged communities**	Designates CARB charged with monitoring and regulating sources of

	Plan: Disadvantaged Communities	**from 10 to 25 percent.**	emissions and GHGs.
SB 43	Chapter 413 Electricity: Green Tariff Shared Renewables Program	Created the Green Tariff Shared Renewables Program to **allow consumers to purchase voluntarily electricity from renewable energy facilities** through major utility companies.	Requires participating utilities to file an application requesting approval of a **green tariff to implement a program enabling ratepayers to participate directly in offsite electrical generation facilities.**
HSC DIV 26	Health and Safety Code, DIV 26 Air Resources Part 2 State Air Resources Board	Communities identified by geographic, socioeconomic, public health, and environmental hazard criteria.	**Required CalEPA to identify disadvantaged communities for investment.**
AB 32	California Global Warming Solutions Act of 2006	Requires a sharp decrease in GHG emissions.	Required CA to reduce its GHG emissions to 1990 levels by 2020. **First program in the country to use a comprehensive, long-term approach to address climate change.**
SB 862	Committee on Budget and Fiscal Review: GHG: Emission Reduction	Amends many sections of various bills.	Established the Cal Recycle Greenhouse Gas Reduction Revolving Loan Program, which would authorize the Department of Resources Recycling and Recovery to **provide loans and grants to reduce greenhouse gas emissions** by promoting in-state development of infrastructure to process **organics and other recyclable materials into new value-added products.** The Department of Community Services and Development to develop and **administer the Energy Efficiency Low-Income Weatherization Program** and to expend moneys appropriated by the Legislature from the Greenhouse Gas Reduction Fund

			for the purposes of the program.

Appendix B – RD&D Annual Workshop Community Based Organization (CBO) Stipend Program

1. Background

In Resolution G-3573 approving the SoCalGas RD&D 2021 Research Plan[27], the CPUC stated that: "in developing future Research Plans, SoCalGas should consider offering small grants, participation stipends, or technical assistance to disadvantaged community stakeholders to encourage meaningful participation in the research development process."[28] This guidance was incorporated into the SoCalGas RD&D Equity Engagement Roadmap (EER). Specifically, the roadmap describes "Task 3: Establish a stipend program to encourage CBOs and other stakeholders to participate in the RD&D Public Workshop Under the theme Increase Community Engagement."[29] The EER was presented to internal and external stakeholders as part of the development process. Feedback from these stakeholders was incorporated into the final EER as described in section 4.7 of the EER.

2. CBO Stipend Notification and Identification Process

RD&D will provide information about the stipend program as part of the invitation process used to notify the public about the Annual RD&D Public Workshop. This process includes notification of the appropriate CPUC service lists. RD&D is tracking CBOs that participate in SoCalGas' Climate Advisory Group as part of Rulemaking 18-04-019 ("Adaptation OIR"). Furthermore, RD&D will adopt the appropriate best practices[30] described in the Community Engagement Plan (CEP) filed by SoCalGas and the other California IOUs as part of that rulemaking. Those CEPs are expected in 2024. RD&D also works with the SoCalGas Regional Public Affairs (RPA) team to leverage RPA's established relationships with CBOs throughout SoCalGas' service territory. RD&D also relies on feedback from participating CBOs and the broader set of RD&D stakeholders regarding identifying CBOs for the stipend program

3. CBO Stipend Eligibility

To apply for the RD&D Annual Workshop Stipend, an applicant must be one of the following types of entities:

- TYPE 1: California tax-exempt organizations under Section 501(c)(3) of the Internal Revenue Code.
- TYPE 2: Federally or non-federally recognized California Native American Tribes, as defined in Public Resources Code (PRC) Section 21073. PRC

[27] Resolution G-3573, March 18, 2021, page 9.
[28] The Commission is similarly exploring a CBO stipend program in the ESJ Action Plan which includes ESJ Action Item #1.2.2 "Consider Funded Community Based Organization (CBO) Program," page 30. (Available at: esj-action-plan-v2jw.pdf (ca.gov)).
[29] Research, Development and Demonstration Equity Engagement Roadmap, April 10, 2023, page 3.
[30] D.20-08-046 at Ordering Paragraph 5.

Section 21073 defines a California Native American Tribe as a Native American Tribe located in California that is on the contact list maintained by the Native American Heritage Commission for the purposes of Chapter 905 of the Statutes of 2004.

- TYPE 3: Tribal entities, including organizations incorporated under Tribal law and wholly owned by the Tribe, Tribal Section 17 Corporations, and Tribal utilities and authorities operated under Tribal law.

4. CBO Stipend Application Evaluation Criteria

Applications are evaluated based on several criteria and RD&D may request additional information to allow for proper evaluation including:

- Geographical Distribution – equitable representation across the large geography and diverse communities served by SoCalGas
- Functional Specialty – insight into ratepayers' energy, air quality, or decarbonization needs

5. CBO Stipend Requirements

After a CBO's application is approved, the CBO must complete all the following requirements relating to the Annual Public Workshop to obtain the stipend:

- Attend the RD&D Annual Public Workshop
- Provide written feedback on the Research Plan presented at the Annual Public Workshop
- Submit an invoice and any additional documentation required to process payment

6. CBO Stipend Amount

A standard stipend of $1,000 will be issued for a participating CBO that fulfills the requirements. This amount is based on the estimated time to participate in the RD&D Annual Public Workshop (five hours for attending the workshop itself and three hours to prepare for and submit written comments relating to workshop) at a standard compensation rate of $150.00 per hour.[31]
Stipends are issued as non-PO payments under the standard $10,000 limit and are recorded to the RD&D Program Administration budget under category 6: Stakeholder Communication, Engagement, and Outreach consistent with the administrative budget procedure developed for the CEC EPIC Program.[32]

[31] *See* CPUC Equity and Access (E&A) Grant Program, Grant Guidelines Rev. August 4, 2023, Eligible Activity Compensation, at 10. (Available at: ea-grant-guidelines_071023.pdf (ca.gov)).
[32] Joint EPIC Administrator Advice Letter on Administrative Cost, Docket Number: 20-EPIC-01, TN# 241275, Docketed 1/25/2022.