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Appendix A: Policies Supported by FY 2025-2026 Gas R&D Program Initiative Themes

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APPENDIX A:
Policies Supported by FY 2025-2026 Gas R&D Program Initiative Themes

Policies Supported by Gas System Decommissioning Theme

- California Public Utilities Commission (CPUC) Long-Term Gas Planning Rulemakings (R.20-01-007, R.24-09-012) establish policies, processes, and rules to ensure safe and reliable gas systems in California and to perform long-term gas system planning. The *2024 Joint Agency Staff Paper: Progress Towards a Gas Transition* (2024) outlines interagency coordination to develop strategic plans for reducing fossil gas demand and planning for the future of the gas system.
- CPUC Order Instituting Investigation I1702002 under Senate Bill (SB) 380 (Pavley, Chapter 14, Statutes of 2016) determines the feasibility of minimizing or eliminating the use of the Aliso Canyon gas storage facility in Los Angeles County while maintaining energy and electric reliability for the region.
- CPUC Adaptation Rulemaking (R.18-04-019) considers strategies to integrate climate change adaptation considerations into CPUC proceedings, beginning with (Phase 1) gas and electric utilities.
- Assembly Bill (AB) 3232 (Friedman, Chapter 373, Statutes of 2018) directed California Energy Commission (CEC) to develop a *California Building Decarbonization Assessment* (2021), which analyzes scenarios to reduce greenhouse gas (GHG) emissions by at least 40 percent by 2030 and identifies several strategies that will lead to significant GHG emission reductions.
- The *Final 2021 Integrated Energy Policy Report Volume III: Decarbonizing the State's Gas System* (Chapter 6) outlines factors affecting the reduction or retirement of gas assets and the need for long-term gas planning, including a comprehensive assessment of the overall needs of the gas system within the long-term context of climate goals as well as with respect to the weather impacts of climate change.
- SB 1221 (Min, Chapter 602, Statutes of 2024) requires CPUC to designate priority neighborhood decarbonization zones on the gas distribution system and to establish a voluntary program to facilitate the cost-effective decarbonization of priority neighborhood decarbonization zones, not to exceed 30 pilot projects across the state.
- SB 350 (De León, Chapter 547, Statutes of 2015) is a driving policy for advancing equity in California's clean energy transformation. As outlined in SB 350, the CEC co-established the Disadvantaged Communities Advisory Group (DACAG) with the CPUC to advise the CEC and the CPUC on ways to help Environmental and Social Justice (ESJ) communities benefit from proposed clean energy and pollution reduction programs, expand access to clean energy technologies, and receive affordable energy services.

Policies Supported by Building Decarbonization Theme

- AB 3232 (Friedman, Chapter 373, Statutes of 2018) directed CEC to develop a *California Building Decarbonization Assessment* (2021), which analyzes scenarios to reduce GHG emissions by at least 40 percent by 2030 and identifies several strategies that will lead to significant GHG emission reductions.
- Integrated Energy Policy Report Volume 1: Building Decarbonization (2021) includes recommendations to accelerate decarbonization of buildings in California.
- SB 1112 (Becker, Chapter 834, Statutes of 2022) requires the CEC, on or before December 31, 2023, to prepare and submit a report that describes any statutory changes necessary to improve access to federal funding for financing or investment solutions to provide zero-emission, clean energy, or decarbonizing building upgrades.
- The California Energy Code (Title 24, Part 6) is a component of the California Building Standards Code, updated every three years through the collaborative efforts of state agencies including the California Building Standards Commission and the CEC. The Code ensures that new and existing buildings achieve energy efficiency and preserve outdoor and indoor environmental quality through use of the most energy efficient technologies and construction.
- SB 1477 (Stern, Chapter 378, Statutes of 2018), titled Low-emissions Buildings and Sources of Heat Energy, requires the CPUC to develop, in consultation with the CEC, two programs (Building Initiative for Low-Emissions Development [BUILD] and Technology and Equipment for Clean Heating [TECH]) aimed at reducing GHG emissions associated with buildings.
- CPUC Long-Term Gas Planning Rulemakings (R.20-01-007, R.24-09-012) and *Joint Agency Staff Paper: Progress Towards a Gas Transition* (2024) outline interagency coordination to develop strategic plans for reducing fossil gas demand and planning for the future of the gas system.
- SB 1221 (Min, Chapter 602, Statutes of 2024) directs the CPUC to evaluate the costs and benefits of thermal energy networks and identify potential implementation barriers. Additionally, it authorizes CPUC to relieve the gas utilities' obligation to serve locations where a zero-emission energy alternative (including thermal energy network) pilot project has been implemented, if CPUC determines that adequate substitute energy service is reasonably available to support the energy end uses of affected gas customers.

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Appendix B: CPUC Resolution G-3484 Funding Encumbrance – Unspent Funds

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APPENDIX B:
CPUC Resolution G-3484 Funding Encumbrance – Unspent Funds

Per the CPUC's request in Resolution G-3592 and consistent with Resolution G-3484, Appendix B shows the research funds from FY 2014–2015 to FY 2023-2024 Gas Research and Development (R&D) Program budget plans *encumbered and unspent as of January 2025*. For each budget plan approved by CPUC, this appendix describes estimated allocations of funding among the Gas R&D research areas.

The CEC's Gas R&D program budget process allocates funding to CPUC-approved research areas/initiatives that are subsequently acted upon by developing specific projects selected through competitive solicitations. Encumbered Funds refer to funds that are committed to a specific project that has been approved at a CEC Business Meeting and for which the agreement package has been executed (signed by both parties). Funds Unspent refers to funds that have not been encumbered to an executed agreement (contract or grant), or previously encumbered funds that have become unencumbered because the agreement has been canceled or other reasons. Following CPUC's request in Resolution G-3555, the CEC will ensure that for any use of encumbered and unspent funds that the CEC requests for new projects, the request will identify the respective research areas for which the CPUC originally authorized the funding.

Proposed FY 2023-2024 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2023-24 Budget Plan ($M)	Total FY 2023-24 Funds Encumbered ($M)	Total FY 2023-24 Funds Unspent* ($M)
Building Decarbonization: Air Pollutant Exposure Assessment in California	7.00	2.00	5.00
Building Decarbonization: Networked Geothermal District Heating Study	5.64	0.00	5.64
Targeted Gas System Decommissioning	8.00	0.00	8.00
Comprehensive Programmatic Evaluation, Under G-3592	.960	0.00	.960
TOTAL	**21.60**	**2**	**19.60**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**FY 2023-24 Gas R&D Budget Plan was submitted to the CPUC on June 1, 2023, and is pending approval.*

Proposed FY 2023-2024 Gas R&D Supplemental Budget Plan Funds Encumbered as of January 2025

Research Area	Total FY 2023-24 Budget Plan ($M)	Total FY 2023-24 Funds Encumbered ($M)	Total FY 2023-24 Funds Unspent* ($M)
Building Decarbonization: Air Pollutant Exposure Assessment in California Residences	0.00	0.00	0.00
Building Decarbonization: Networked Geothermal District Heating Study	2.41	0.00	2.41
Targeted Gas System Decommissioning	4.13	0.00	4.13
Comprehensive Programmatic Evaluation, Under G-3592	0.00	0.00	0.00
TOTAL	**6.54**	**0**	**6.54**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**FY 2023-24 Gas R&D Budget Plan was submitted to the CPUC on June 1, 2023, and is pending approval.*

FY 2022-2023 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2022-23 Approved Budget Plan ($M)	FY 2022-23 Current Budget Plan ($M)*	Total FY 2022-23 Funds Encumbered ($M)	Total FY 2022-23 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Targeted Gas System Decommissioning	3.50	4.10	0.70	3.40	$3.4M Anticipated Solicitation to be Released FY 2025
Decarbonization of Gas End Uses	13.00	13.00	11.1	1.90	$1.9M Anticipated Solicitation to be Released in FY 2025
Energy Efficiency	1.50	1.50	1.50	0	
Gas Pipeline Safety and Integrity	0	3.00	2.99	0.007	*Unspent Funds for an Anticipated Supplemental Plan $7,772*

Research Area	CPUC FY 2022-23 Approved Budget Plan ($M)	FY 2022-23 Current Budget Plan ($M)*	Total FY 2022-23 Funds Encumbered ($M)	Total FY 2022-23 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Entrepreneur Development	3.60	0.00	0	0.00	
TOTAL	**21.60**	**21.60**	**16.30**	**5.30**	

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**FY 2022-23 Gas R&D Budget Plan, approved March 16, 2023, in part, by CPUC Resolution G-3592. CPUC modified the $3.6 million budget for Entrepreneur Development (CalSEED Initiative) and directed the CEC to submit a new proposal for reallocating the $3.6 million via a Tier 2 Advice Letter. CPUC approved CEC's request to reallocate $600,000 to Targeted Gas System Decommissioning and $3,000,000 to Gas Pipeline Safety and Integrity.*

FY 2021-2022 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2021-22 Approved Budget Plan ($M)	FY 2021-22 Current Budget Plan ($M)	Total FY 2021-22 Funds Encumbered ($M)	Total FY 2021-22 Funds Unspent ($M)
Energy Efficiency	6.10	6.10	6.10	0
Renewable Energy and Advanced Generation	4.00	4.00	4.00	0
Gas Infrastructure Safety and Integrity	4.00	4.00	4.00	0
Energy-Related Environmental Research	3.50	3.50	3.50	0
Transportation	4.00	4.00	4.00	0
TOTAL	**21.60**	**21.60**	**21.60**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

FY 2020-2021 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2020-21 Approved Budget Plan ($M)	FY 2020-21 Current Budget Plan ($M)	Total FY 2020-21 Funds Encumbered ($M)	Total FY 2020-21 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Energy Efficiency	3.00	3.00	1.77	1.23	$1.23m of remaining funds included in the Proposed FY 2023-24 Gas R&D Supple-mental Budget Plan – Building Decarbonization
Renewable Energy and Advanced Generation	4.00	4.00	4.00	0	
Gas Infrastructure Safety and Integrity	9.10	9.10	9.10	0	
Energy-Related Environmental Research	1.50	1.50	1.50	0	
Transportation	4.00	4.00	4.00	0	
TOTAL	**21.60**	**21.60**	**20.37**	**1.23**	

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

FY 2019-2020 Gas R&D Supplemental Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2019-20 Approved Supplemental Budget Plan ($M)	CPUC FY 2019-20 Supplemental Current Budget Plan ($M)	CPUC FY 2019-20 Supplemental Funds Encumbered ($M)	CPUC FY 2019-20 Supplemental Funds Unspent ($M)
Energy Efficiency	1.00	1.00	1.00	0
Renewable Energy and Advanced Generation	0	0	0	0
Gas Infrastructure Safety and Integrity	2.00	2.00	2.00	0
Energy-Related Environmental Research	2.00	2.00	2.00	0
Transportation	0	0	0	0

Research Area	CPUC FY 2019-20 Approved Supplemental Budget Plan ($M)	CPUC FY 2019-20 Supplemental Current Budget Plan ($M)	CPUC FY 2019-20 Supplemental Funds Encumbered ($M)	CPUC FY 2019-20 Supplemental Funds Unspent ($M)
Gas Small Grant Program	2.29	2.29	2.29	0
TOTAL	**7.29**	**7.29**	**7.29**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

FY 2019-2020 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2019-20 Approved Budget Plan ($M)	FY 2019-20 Current Budget Plan ($M)*	Total FY 2019-20 Funds Encumbered ($M)	Total FY 2019-20 Funds Unspent ($M)
Energy Efficiency	9.00	9.63	9.63	0
Renewable Energy and Advanced Generation	3.00	2.89	2.89	0
Gas Infrastructure Safety and Integrity	2.00	1.58	1.58	0
Transportation	6.60	6.50	6.50	0
Gas Strategic Plan (Cross-Cutting)	1.00	1.00	1.00	0
TOTAL	**21.60**	**21.60**	**21.6**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**The CEC reallocated $630,000 from the Renewable Energy and Advanced Generation, Gas Infrastructure Safety and Integrity and Transportation research areas to Energy Efficiency due to strong proposals in high-priority research areas.*

FY 2018-2019 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2018-19 Approved Budget Plan ($M)	FY 2018-19 Current Budget Plan ($M)*	Total FY 2018-19 Funds Encumbered ($M)	Total FY 2018-19 Funds Unspent ($M)
Energy Efficiency	6.00	9.32	9.32	0
Renewable Energy and Advanced Generation	3.00	0	0	0
Gas Infrastructure Safety and Integrity	5.60	5.60	5.60	0

Research Area	CPUC FY 2018-19 Approved Budget Plan ($M)	FY 2018-19 Current Budget Plan ($M)*	Total FY 2018-19 Funds Encumbered ($M)	Total FY 2018-19 Funds Unspent ($M)
Energy-Related Environmental Research	3.00	4.36	4.36	0
Transportation	4.00	2.31	2.31	0
TOTAL	**21.60**	**21.60**	**21.60**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**The CEC reallocated $3.32M from the Renewable Energy and Advanced Generation and Transportation research areas to Energy Efficiency due to strong proposals in high-priority research areas. The CEC reallocated $1.36M from the Renewable Energy and Advanced Generation research area to Energy-Related Environmental Research due to strong proposals in high-priority research areas.*

FY 2017-2018 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2017-18 Approved Budget Plan ($M)	FY 2017-18 Current Budget Plan ($M)*	Total FY 2017-18 Funds Encumbered ($M)	Total FY 2017-18 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Energy Efficiency	6.60	4.57	4.57	0	
Renewable Energy and Advanced Generation	4.00	4.00	4.00	0	
Gas Infrastructure Safety and Integrity	5.00	5.82	5.82	0	
Energy-Related Environmental Research	3.00	3.46	3.46	0	
Transportation	3.00	3.75	2.89	.87	*Unspent Funds for an Anticipated Supplemental Plan $865,642*
TOTAL	**21.60**	**21.60**	**20.73**	**.87**	

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**The CEC reallocated $2.03M from Energy Efficiency to Gas Infrastructure Safety and Integrity, Transportation, Energy-Related Environmental Research areas due to strong proposals in high-priority research areas.*

FY 2016-2017 Gas R&D Supplemental Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2016-17 Supplemental Approved Budget Plan ($M)	FY 2016-17 Supplemental Current Budget Plan ($M)*	Total FY 2016-17 Supplemental Funds Encumbered ($M)	Total FY 2016-17 Supplemental Funds Unspent ($M)
Energy Efficiency	.91	0	0	0
Renewable Energy and Advanced Generation	0	0	0	0
Gas Infrastructure Safety and Integrity	1.70	2.61	2.61	0
Energy-Related Environmental Research	2.70	2.70	2.70	0
Transportation	0	0	0	0
TOTAL	**5.31**	**5.31**	**5.31**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**The CEC reallocated $.91M from Energy Efficiency to Gas Infrastructure Safety and Integrity research area due to strong proposals in high-priority research areas.*

FY 2016-2017 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2016-17 Approved Budget Plan ($M)	FY 2016-17 Current Budget Plan ($M)*	Total FY 2016-17 Funds Encumbered ($M)	Total FY 2016-17 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Energy Efficiency	7.10	5.20	4.03	1.18	$1.18M from terminated projects included in Proposed FY 2023-24 Supplemental Budget Plan – Building Decarbonization
Renewable Energy and Advanced Generation	4.40	5.02	5.02		
Gas Infrastructure Safety and Integrity	4.00	3.87	3.87		

Research Area	CPUC FY 2016-17 Approved Budget Plan ($M)	FY 2016-17 Current Budget Plan ($M)*	Total FY 2016-17 Funds Encumbered ($M)	Total FY 2016-17 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Energy-Related Environmental Research	2.60	2.69	2.69		
Transportation	3.50	4.82	2.19	2.63	$2.63M from terminated projects included in the Proposed FY 2023-34 Gas R&D Supplemental Budget Plan – Targeted Gas System Decommissioning
TOTAL	**21.60**	**21.60**	**17.79**	**3.81**	

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**The CEC reallocated $1.9M from Energy Efficiency to Renewable Energy and Advanced Generation, Energy-Related Environmental Research, and Transportation research areas due to strong proposals in high-priority research areas. The CEC reallocated $.13M from Gas Infrastructure Safety and Integrity to Renewable Energy and Advanced Generation research area due to strong proposals in high-priority research areas.*

FY 2015-2016 Gas R&D Supplemental Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2015-16 Supplemental Approved Budget Plan ($M)	FY 2015-16 Supplemental Current Budget Plan ($M)	Total FY 2015-16 Supplemental Funds Encumbered* ($M)	Total FY 2015-16 Supplemental Funds Unspent ($M)
Energy Efficiency	0	0	0	0
Renewable Energy and Advanced Generation	0	0	0	0
Gas Infrastructure Safety and Integrity	1.50	1.50	1.50	0
Energy-Related Environmental Research	2.10	2.10	2.10	0

Research Area	CPUC FY 2015-16 Supplemental Approved Budget Plan ($M)	FY 2015-16 Supplemental Current Budget Plan ($M)	Total FY 2015-16 Supplemental Funds Encumbered* ($M)	Total FY 2015-16 Supplemental Funds Unspent ($M)
Transportation	0	0	0	0
TOTAL	**3.60**	**3.60**	**3.60**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**In Resolution G-3507 (June 25, 2015), the CPUC directed the CEC to prioritize gas research and development projects on climate change, drought, and gas safety. The CEC funded high-priority research areas when strong research proposals were received.*

FY 2015-2016 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2015-16 Approved Budget Plan ($M)	FY 2015-16 Current Budget Plan ($M)	Total FY 2015-16 Funds Encumbered ($M)	Total FY 2015-16 Funds Unspent ($M)	Actual or Anticipated Solicitation Release or Encumbrance
Energy Efficiency	7.10	7.10	7.10	0	
Renewable Energy and Advanced Generation	5.80	5.80	4.62	1.18	$1.18M included in FY 2019-2020 Supplemental Budget Plan
Gas Infrastructure Safety and Integrity	1.00	1.00	1.00	0	
Energy-Related Environmental Research	3.30	3.30	3.30	0	
Transportation	4.40	4.40	2.90	1.50	$1.5M included in FY 2023-2024 Supplemental Budget Plan
TOTAL	**21.60**	**21.60**	**18.91**	**2.68**	

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

FY 2014-2015 Gas R&D Budget Plan Funds Encumbered as of January 2025

Research Area	CPUC FY 2014-15 Approved Budget Plan ($M)	FY 2014-15 Current Budget Plan ($M)*	Total FY 2014-15 Funds Encumbered ($M)	Total FY 2014-15 Funds Unspent ($M)
Energy Efficiency	8.60	7.48	7.48	0
Renewable Energy and Advanced Generation	3.50	2.48	2.48	0
Gas Infrastructure Safety and Integrity	2.50	4.68	4.68	0
Energy-Related Environmental Research	3.00	3.62	3.62	0
Transportation	4.00	3.34	3.34	0
TOTAL	**21.60**	**21.60**	**21.60**	**0**

Amounts shown in table are in millions and rounded to the nearest $10,000.

Source: California Energy Commission

**The CEC reallocated funds from Energy Efficiency ($1.12M). Renewable Energy and Advanced Generation ($1.02M), and Transportation ($0.66M) research areas to Gas Infrastructure Safety and Integrity ($2.18M) and Energy-Related Environmental Research ($0.62M) research areas due to strong proposals in high-priority research areas.*

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Appendix C: List of Gas R&D Events

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APPENDIX C:
List of Gas R&D Events

February 2024:

- Workshop on Analytical Framework Results for Strategic Gas Infrastructure Decommissioning in Northern California, coordinated by CEC; E3 presented final results (PIR-20-009)

March 2024:

- Scoping Workshop: Location-Specific Gas System Decommissioning

April 2024:

- Pre-Application Workshop: Industrial Carbon Dioxide Utilization for Value Added Products (GFO-23-502)
- Pre-Application Workshop: Feasibility of Underground Hydrogen Storage in California (GFO-23-503)

July 2024:

- IEPR Commissioner Workshop: Energy Demand Forecast Methodology Updates, covering analytical approaches leveraging Gas R&D-funded advances in climate data to support demand forecasting (PIR-19-006, PIR-19-007)

October 2024:

- Community Workshop: Mindful Gas Decommissioning Study Workshop hosted by recipient, DNV-GL, to provide project updates and a beta tool demonstration and receive additional community input (PIR-22-002)
- Energy Transition Coordinating Council (ETCC) Summit, at which CEC staff presented on ERDD's hydrogen research portfolio (PIR-22-003, GFO-22-903, PIR-23-008, PIR-23-009, PIR-21-007, PIR-23-006, PIR-20-001)
- Environmental Justice Roundtable, hosted by CEC staff and attended by invited representatives of environmental justice organizations to discuss proposed initiatives for CEC's FY 2025-2026 Gas R&D Budget Plan

November 2024:

- CEC Climate Data and Analysis Working Group (C-DAWG) Meeting, covering research findings on extreme weather events and a quality-controlled weather data archive calibrated for California's electricity and natural gas sectors (PIR-19-006, PIR-19-007)
- CEC Healthy, Equitable Energy Transition (HEET) Working Group Meeting, covering a social science approach to the residential transition from gas to electric and the role of energy sufficiency

January 2025:

- Presentation to Disadvantaged Communities Advisory Group (DACAG) and discussion on Proposed Gas Research Initiatives for FY 2025-2026

February 2025:

- Staff Workshop on Proposed Gas Research Initiatives for FY 2025-2026
- SoCalGas Webinar, titled "Get to Know California's Gas R&D Programs," covering an overview of the Gas R&D Program including budget, research areas, community engagement, project selection process, and ratepayer benefits as well as two example projects (PIR-19-001, PIR-16-012).

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Appendix D: Public Comment and CEC Responses

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APPENDIX D:
Public Comment and CEC Responses

The California Energy Commission (CEC) appreciates the comments and questions received during and in response to a public workshop, meetings with California Public Utilities Commission (CPUC) subject matter experts (SMEs), Investor-Owned Utility (IOU) Gas R&D administrators, and meeting with the Disadvantaged Communities Advisory Group (DACAG) representatives on proposed initiatives for the fiscal year (FY) 2024-2025 Gas Research and Development (Gas R&D) Program Budget Plan. The stakeholder engagement events to support the development of this Budget Plan included the following:

- On August 12, 2024, CEC staff met with representatives from Southern California Gas Company (SoCalGas), Pacific Gas & Electric (PG&E), and Southwest Gas to gather feedback on the initial broad set of potential initiatives.
- On October 9, 2024, CEC staff met with representatives from SoCalGas, Sempra, and PG&E to gather further feedback on the selected proposed initiatives included in the 2025-2026 Budget Plan.
- On October 11, 2024, CEC staff convened an Environmental Justice Roundtable.
- On December 23, 2024, CPUC SMEs provided written feedback on the proposed initiatives.
- On January 17, 2025, CEC staff met the full DACAG to present the proposed budget plan.
- On February 7, 2025, CEC staff held a public workshop and invited additional written public comments on the proposed research initiatives.

Based on feedback received throughout this process, CEC staff elected to exclude a previously proposed initiative on Scaling Technology to Decarbonize California's Gas Sector in the FY 2025-2026 Budget Plan and redirected the associated funds. However, the comments and responses for that initiative are included here for completeness. For a summary of this proposed initiative, see the Public Workshop slides linked in Appendix C.

A summary of the comments provided and CEC staff responses for each proposed research initiative are provided in the following sections:

IOU Coordination and Feedback

At the 2024 meetings with IOUs, CEC answered clarifying questions and received helpful utility perspectives on research needs that informed the selection and preparation of the proposed

initiatives. Following these IOU meetings, SoCalGas and PG&E also provided written comments. The comments and CEC responses are summarized below by initiative:

Social Science Research for Gas Decommissioning in the Mid- and Long-Term

- **SoCalGas Comment Received:** SoCalGas recommended any work done through this initiative be informed and guided by the previous CEC projects that assessed gas decommissioning in Environmental and Social Justice (ESJ) communities in Northern and Southern California. The ongoing Southern California-focused gas decommissioning study was co-funded by SoCalGas and overseen by the RAND Corporation. The results of this recent Southern California study, which have not yet been published by CEC, should help guide any follow-on research regarding gas decommissioning. The CEC also previously worked with PG&E on a targeted gas decommissioning study focused on Northern California. A few of the challenges identified by that study include:
    - The geographic scale for targeted electrification and gas decommissioning will be limited by the gas utilities' pipeline replacement rate and by the feasibility of decommissioning sections of the gas system without negatively affecting reliability for remaining customers.
    - The obligation to serve (Public Utilities Code Section 4515) makes gas decommissioning projects very challenging to develop at any significant scale.
    - Better data and planning tools are needed to support identification of candidate sites for targeted electrification and gas decommissioning.
    - Supporting community priorities requires that some customers may prefer to keep certain gas equipment due to comfort, familiarity, or bill impacts, and that some customers may prioritize lead, mold, or asbestos remediation before electrification.
    - The project team recommended focusing first on delivering near-term benefits through energy efficiency, remediation, and electrification, based on customer needs. Gas decommissioning would not occur until a later phase after customer trust is built and upgrades are made that support electrification readiness.

  These challenges can inform both mid- and long-term research to advance targeted gas decommissioning with an objective of delivering net benefits to ratepayers. Decommissioning gas system infrastructure investments should be pursued with an understanding of its broader context and impacts. The CPUC Gas Order Instituting Rulemaking (OIR) Phase 3 Ruling Joint Agency Whitepaper astutely notes, "The transition off fossil gas poses risks to affordability, safety, reliability, and the gas workforce. The transition away from fossil fuels must balance these risks and protect vulnerable residents." Work supported by the CEC in this area will benefit from coordination with the CPUC's Gas Planning OIR (R.20-01-007) and its forthcoming successor proceeding.[1] SoCalGas recommends that the CEC should consider evaluating the cost and effectiveness of the community outreach efforts more broadly and assess

[1] In October 2024, CPUC opened R.24-09-012, "Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Safe and Reliable Gas Systems in California and Perform Long-Term Gas System Planning."

what lessons can be learned. While not an exhaustive list, the CEC could consider the following questions:

  - What is the inventory of benefits the communities requested? How would the CEC rank the benefits and determine which benefits should be implemented for a given project? Are the benefits requested repeatable across the breadth of the pipeline system? When should benefits be delivered to the communities? What is the cost to implement the benefits? What percentage of a project's budget should be allocated toward community benefits? How should the benefits be tracked?

- **CEC Response:** CEC staff appreciate these comments from SoCalGas and will consider prior Gas R&D funded research, including the two efforts mentioned above, in developing future work. The Social Science Research initiative is intended to contribute to a more comprehensive understanding of the planned transition from fossil gas, generating results that help bridge energy system planning, policy and programs, decommissioning efforts, and fair, empirically-centered assessments of associated environmental, economic, and social impacts. In doing so, it is intended to inform and help manage impacts on gas system operations and safety, impacts on gas sector workforce, and the distribution of benefits, costs, and risks across California's ratepayers. Building from this understanding, it will also provide a range of recommendations and tools that contribute to reinforcing benefits, reducing any negative impacts, and proceeding equitably. Projects funded under this initiative will be coordinated with CPUC Rulemaking R.24-09-012 and with the CEC's Order Instituting Information Proceeding on Decarbonizing the Gas System.

- **SoCalGas Comment Received:** The 2022 California Air Resources Board (CARB) Scoping Plan calls for both hydrogen and renewable natural gas (RNG) to be blended into existing gas pipelines as part of a set of actions in the Scoping Plan Scenario to drastically reduce greenhouse gas (GHG) emissions from Assembly Bill (AB) 32 sectors. Thus, SoCalGas recommends that the CEC consider how this opportunity can be maximized in alignment with State climate goals. A recent report from the Boston Consulting Group also calls for California to maximize existing fossil gas infrastructure to promote affordable decarbonization. Specifically, leveraging existing infrastructure to deliver clean molecules allows California to realize the benefits of previous ratepayer investments and maximize the value of the existing energy system. In addition, available technologies such as fuel cells and linear generators should be evaluated for their ability to leverage the existing gas system to enable electrification of buildings with beneficial impacts on reliability and resiliency. These technologies could be deployed in areas where there may be challenges to meeting increasing electric demand through the grid, and these potential solutions should be appropriately considered when evaluating targeted gas decommissioning opportunities.

- **CEC Response:** CEC staff appreciate the importance of considering a range of alternatives to conversion from fossil gas, as well as considering alternatives to full gas system decommissioning that support the state's goals. More generally, projects funded under this initiative will attend to understanding local conditions, use and user needs,

comparative economic impacts, opportunities for greater affordability and ratepayer benefit, and technological opportunities and characteristics. They will thus be designed to accommodate consideration of varied technological possibilities and recognition of favorable opportunities for developing their potential as aligned with state goals.

Pilot Projects to Advance Gas Decommissioning

- **SoCalGas Comment Received:** Similar to the Gas Decommissioning research above, any work done through this initiative should be informed and guided by the previous CEC projects that assessed gas decommissioning in ESJ communities. While the Southern California results have not yet been published by the CEC, the Northern California study results (listed above) should be considered in the development of pilot projects. SoCalGas recommends pilot projects should be done in coordination with the upcoming successor to the Gas Planning OIR. The Northern California study report points to utility modeling being key to conducting a successful pilot, which suggests that utility engagement in these pilots will be crucial to their success.
- **CEC Response:** CEC staff appreciate these recommendations and will utilize previous and ongoing studies as well as Senate Bill (SB) 1221's zonal maps for decommissioning in proposed pilot projects to help inform the pilot location selection processes.

Social Science Research for Gas Decommissioning in the Mid- and Long-Term and Pilot Projects to Advance Gas Decommissioning

- **PG&E Comment Received:** At PG&E, we have a dedicated team to support energy transition, including electrification. The way we approach electrification is to target upcoming distribution pipeline replacement projects. This was the approach that E3 recommended as part of the CEC-funded project, "Analytical Framework Results for Strategic Gas Infrastructure Decommissioning in Northern CA." Instead of replacing the system, we evaluated the system for conversion to electrification. The main considerations for conversion are 1) cost-effectiveness 2) capacity 3) customer willingness to convert. We haven't had many issues with electric capacity because the load has been relatively small. For cost-effectiveness, we evaluate how much the project is to replace the asset and if it's less than how much it would cost to electrify, then we cover those costs. Number 3 is the main reason customers don't convert. Some of the challenges shared with us are mainly customer acceptance, even if we cover the costs to electrify. Customer feedback:
    - Gas preferred for cooking
    - Electric rate (expensive)
    - Lack of motivation to spend time to electrify
    - Life events (divorce, death, fire)
    - Property devaluation concerns

  In addition, because of the obligation to serve every customer, the system we aim to electrify, must agree to electrify. We can't decommission a system, where a customer still wants to keep their gas service.

The CEC project referenced above was very helpful in how we can decommission the gas system cost effectively. I think there's a lot of learnings there that can be applied to future projects, especially with the community outreach findings. For potential projects, and this probably relates to the conversion experience, we should focus more on the customers and what they want. Some questions come to mind:

  - How do we convince the customer to convert to electricity?
  - What hurdles can we remove so that the impact to their lives is minimal?
  - How do we provide the same cooking experience with electric as we do with gas?
  - How do we decrease electric rates and costs for customers who electrify?
  - How do we engage the communities better, so that they're informed, educated, and more willing to convert?

- CEC Response: CEC staff appreciate PG&E's comments on the gas decommissioning initiatives and look forward to learning from and coordinating with PG&E's energy transition team. The proposed decommissioning research is split into two initiatives, one addressing the longer-term trajectory of a transition from gas, and the second addressing challenges in decommissioning at the segment- and neighborhood-scale. These two initiatives are complementary but have different emphases. The details PG&E provided are addressed separately for each of these two initiatives below.

  Staff are familiar with the E3 study and the approach of targeting properties based on distribution pipeline conditions as well as other infrastructural and community conditions (e.g., partly laid out in CPUC's Staff Proposal on Gas Distribution Infrastructure Decommissioning Framework) and agree that E3's study will be very useful for informing research resulting from these initiatives. Research funded under these initiatives will consider "obligation to serve" and the challenges of getting all customers to agree to convert from gas in all selected decommissioning areas. "Obligation to serve" may be further explored through implementation of SB 1221.

  This first gas decommissioning initiative, Social Science Research for Gas Decommissioning in the Mid- and Long-Term, is oriented to decommissioning and decarbonization in mid and longer terms, ten to thirty years out, building on and informing pilot projects (such as pursued in the second initiative) and current baseline or "early adopter" electrification. This research would use empirical data collection and analysis to find ways to make the conversion from gas more compelling even in the absence of changes in how "obligation to serve" is defined, including making conversion from gas a preferable choice when replacing equipment at end of life, or otherwise improving the value proposition of conversion. This initiative is intended to empirically inform a suite of prerequisites for a successful transition away from gas, including understanding and improving post-installation results for those who convert, avoiding poor results for those who do not convert, supporting an adequate workforce, and helping ensure energy resilience and affordability for all ratepayers by influencing technology designs, supply chain ecosystems, communication approaches, programs,

and infrastructure planning based on what can be learned and predicted from experience.

Staff appreciate the customer feedback list that PG&E staff provided above. Staff recognize the difficulties that energy efficiency upgrade efforts have historically faced and that even fully funding upgrades does not solve all issues. Staff also appreciate the conversion experience research questions that PG&E listed, and agree that more research attention is needed to reduce frictions to conversion while helping ensure positive experiences post-installation for equipment performance and costs.

The second initiative, Pilot Projects to Advance Gas Decommissioning, aims to demonstrate decommissioning at street segment or neighborhood scales. These pilots will consider and leverage previous and ongoing efforts, such as existing site-selection framework tools, census or pre-evaluated sites, and SB 1221 implementation for gas conversion. The pilots will provide real world data on performance, costs, and challenges. Additionally, information resulting from these pilots can inform models, templates, and best practices for future decommissioning efforts. Successful demonstrations can also help to build customer confidence, fostering higher levels of consent within neighborhoods, counties, and cities and encouraging them to pursue similar decommissioning efforts.

Networked Geothermal Heat Pumps

- **SoCalGas Comment Received:** As the CEC develops this initiative, there are several foundational questions to consider: Which locations in California are best suited for deploying networked geothermal + ground source heat pumps (NG + GSHPs)? What scale is required to bring cost into parity with existing natural gas service? What is the potential market size for NG + GSHPs? Is there a metric that can capture the potential for gas utility skill set transferability? What existing infrastructure has the potential to be repurposed for use in NG + GSHPs? How will the deployment of NG + GSHPs impact California net peak load and overall energy demand? What is the environmental impact of utilizing NG + GSHPs (e.g., groundwater quality, carbon emissions, material use, energy efficiency, land use, permitting, local air quality, and jobs) and how does it compare to existing gas service? What are the incremental costs and benefits of NG + GSHPs compared to air-source heat pumps and/or high efficiency gas appliances? SoCalGas is supportive of the CEC exploring future ways to leverage the state's gas system infrastructure and the IOUs' workforce and expertise to support a future decarbonized California.
- **CEC Response:** CEC staff appreciate the expressed support, comments, and questions from SoCalGas, which are complementary to the objectives of the first phase of this initiative. Staff will consider these questions and others as phase 1 is further scoped and refined.
- **PG&E Comment Received:** For awareness, the Eversource project required a pump house to push and pull the fluid. They were lucky to have approval from the fire department to use their land. Also, not all the customers bought into the geothermal

pilot. There were still some customers that maintained their gas service next to a customer that had geothermal. From a cost-effectiveness standpoint, the gas main is still present and needs to be maintained. We'll have to consider the number of customers and portion of main to be decommissioned, to maintain cost-effectiveness.

- **CEC Response:** Examining network geothermal pilots in other jurisdictions, such as the Eversource pilot in Massachusetts, is a critical element of this research initiative. Research funded under this initiative will need to take into consideration and understand this previous work, insights, and lessons learned, and how they may be leveraged or adapted for California. CEC staff recognize there is still uncertainty around the economics of networked geothermal, especially in the California context. This initiative aims to address some of those uncertainties. On December 16, 2024, CEC staff met with PG&E staff to further discuss networked geothermal and welcome opportunities for additional coordination.

Scaling Technologies to Decarbonize California's Gas Sector

- **SoCalGas Comment Received:** As CEC develops this initiative, there are several foundational questions to consider at the regional and state level: What are the existing challenges (e.g., permitting, zoning, access to infrastructure, taxes, and labor laws) that impede full-scale production in California and how do they compare to those in other American and global markets? What incentives or benefits are available (e.g., workforce, geology, and infrastructure) to promote manufacturing in California and how do they compare to those in other American and global markets? What new incentives could be created to attract advanced manufacturing to California? For example, could tax breaks, streamlined permitting processes, or subsidies for green technologies be introduced or expanded upon? Given existing challenges, incentives and California's resources, which technologies are best suited for manufacturing in California? What is the potential impact (e.g., monetary, workforce, logistics, and cost) of proposed changes to incentives on future manufacturing potential? Understanding these factors may help determine optimal locations and/or technologies to focus on for scaling up. SoCalGas recommends the CEC consider renaming this initiative "Advancing Manufacturing of Low-Carbon Energy Technologies in California." The current program name suggests that its focus is to research to decarbonize industrial processes, but the program description implies that the program is instead aimed at scaling up the manufacturing capacity of new near zero-carbon and clean energy technologies in the state.
- **CEC Response:** The CEC has deferred this initiative, in part to gather more information and feedback, and will continue to consider this feedback as the initiative is further refined for consideration in future investment plans. There will also be additional opportunities to provide feedback on any future proposed initiatives in the investment planning process.

Environmental Justice Roundtable

On October 11, 2024, CEC staff hosted an environmental justice (EJ) roundtable with invited representatives from EJ organizations in California. CEC staff are grateful for the time and feedback from these EJ representatives and detail below how their feedback helped shape initiatives.

Social Science Research for Gas Decommissioning in the Mid and Long Term

- **EJ Representative Comment Received:** Several comments emphasized the need for neighborhood-scale gas decommissioning studies to understand the burden on low-income households and how to ensure that the costs of the remaining system are not burdening disadvantaged communities. Addressing obligation to serve as an additional barrier was also discussed.
- **CEC Response:** All three initiatives support neighborhood-scale decarbonization efforts. Research under the Social Science Research initiative is expected to contribute to equity planning, including by research that estimates the degree and societal distribution of potential energy cost effects associated with gas decommissioning. Staff recognize the importance of understanding the obligation to serve in this space and are working to determine what role the Gas R&D program may play on this issue.

Pilot Projects to Advance Gas Decommissioning

- **EJ Representative Comment Received:** One participant raised that they have done building electrification projects in which the community was primarily Spanish-speaking renters and that they were not provided with the same resources as homeowners and cautioned that renters face additional barriers.
- **CEC Response:** CEC staff appreciate that these issues were raised. A portion of the proposed decommissioning initiatives will investigate preferences, diverse needs, and actor dynamics and behaviors, including landlord-renter resolutions prior to zonal decommissioning at scale. Some solutions to renter-landlord incentive misalignments may remain largely in the policy realm. Additionally, pilot demonstrations will prioritize community engagement to ensure that community input is provided throughout the process. CEC staff recognize that effective community engagement must be tailored to meet the unique needs of each community.

Networked Geothermal Heat Pumps

- **EJ Representative Comment Received:** Concern around water usage, particularly in terms of overall use if widespread adoption occurs.
- **CEC Response:** CEC staff appreciate this comment, and the concern raised. Initial research has proven promising to mitigate this concern. Water usage in closed-loop Ground Source Heat Pumps and Networked GHPs is minimal. Furthermore, this technology can potentially replace water-intensive heating and cooling options, especially for large buildings with cooling towers, thereby offering considerable water

savings for the state. According to the Building Decarbonization Coalition,[2] in Los Angeles County alone, an estimated 2.5 billion gallons of water each year is consumed by cooling towers. The same study surveyed 10 existing geothermal energy networks in the United States and Canada and reported 18 to 46 percent reduction in water consumption, saving 11,000 to 77,000 liters per heating/cooling ton. Water use and potential savings will be studied in the suitability and benefits of this technology in California.

Scaling Technology to Decarbonize California's Gas Sector

- **EJ Representative Comment Received:** Would prefer to see non-combustion technologies and thought given to how we can prevent duplication of the current gas system (i.e. with hydrogen system).
- **CEC Response:** The CEC has deferred this initiative, in part to gather more information and feedback, and will continue to consider this feedback if the initiative is considered in future investment plans. Research funded by the Gas R&D Program seeks to reduce local air pollution and generate benefits for communities. CEC looks forward to continued engagement with EJ representatives to ensure the Gas R&D Program avoids harms and improves benefits for ESJ communities, including better understanding concerns around funding certain technology options.

CPUC Subject Matter Expert Feedback

On December 23, 2024, CPUC SMEs provided written feedback on the proposed initiatives and requested further discussion on the Scaling Technology to Decarbonize California's Gas Sector initiative. The CEC appreciates the helpful comments and recommendations from CPUC staff.

Pilot Projects to Advance Gas Decommissioning

- **CPUC written comment received:** CPUC staff support this initiative and recommend considering increased funding and/or seeking match funding.
- **CEC Response:** The funding level for this initiative was increased by $2 million by reallocating funding from the Scaling Technologies to Decarbonize California's Gas Sector initiative, which CEC is deferring for consideration in a future investment plan.

Networked Geothermal Heat Pumps

- **CPUC written comment received:** CPUC staff support this initiative and recommend that the initiative includes existing projects inside and outside of California as part of the literature review.
- **CEC Response:** CEC staff have included this recommendation in the initiative description.

[2] Besic, Ashley. Building Decarbonization Meets Water Conservation: The Potential of Thermal Energy Networks to Cool Buildings & Save Water. Building Decarbonization Coalition, July 2024. https://buildingdecarb.org/resource/water-smart-buildings

DACAG Meeting Comment Summary and CEC Response

The CEC presented the proposed FY 2025-2026 Gas R&D Program Budget Plan to the DACAG at a monthly DACAG meeting on January 17, 2025. At the meeting, CEC staff presented an overview of the Gas R&D Program and development process and summaries of the proposed initiatives that CEC is planning to include in the proposed FY 2024-2025 Gas R&D budget plan. The CEC appreciates the helpful questions and comments from DACAG members on the proposed FY 2025-2026 Gas R&D budget plan. Below is a summary of DACAG member comments and CEC staff responses organized by initiative:

Social Science Research for Gas Decommissioning in the Mid- and Long-Term

- **DACAG Comment Received:** It would be great to get data on actual savings to updated modeled/projected bill impacts.
- **CEC Response:** CEC staff appreciate this comment and will consider it as a possible research outcome for this initiative.

Pilot Projects to Advance Gas Decommissioning

- **DACAG Comment Received:** How does this initiative relate to Senate Bill 1221?
- **CEC Response:** CEC staff are coordinating with CPUC to ensure this gas decommissioning research complements and informs SB 1221 and vice versa, where feasible.

Networked Geothermal Heat Pumps

- DACAG member expressed excitement about this initiative.
- **DACAG Comment Received:** DACAG member raised concerns about the cost-effectiveness of networked geothermal heat pumps and asked if this initiative plans to compare the technology with air source heat pumps? How well would this technology work in more urban areas and locations that require retrofits (particularly, as many disadvantaged communities fit this description)? Are there particular areas targeted with this study?
- **CEC Response:** According to recent research by the National Renewable Energy Laboratory, the efficiency and economic favorability of thermal energy networks in general directly correlate with population density.[3] This is likely due to the diversity of loads (simultaneous cooling and heating in the network) that enhance efficiency as well as loop cost reduction due to shorter lengths at denser locations. However, a California-specific study of networked GHPs and their performance comparison with established technologies (both economically and in terms of non-economic metrics) will be further explored as part of this initiative. Phase 1 of the initiative will investigate a range of

[3] Simpson, J. G., Beckers, K. F., Acero Allard, D., Chen, Y., Das, P., Ho, J., ... & Sharma, S. (2024). *National Modeling of Geothermal District Energy Systems with Ambient-Temperature Loops Using dGeo* (No. NREL/CP-5700-90324). National Renewable Energy Laboratory (NREL), Golden, CO (United States). https://www.osti.gov/servlets/purl/2476296

questions including those above and should result in a prioritized list of potential target areas for pilot demonstrations.

Scaling Technologies to Decarbonize California's Gas Sector

- No comment

DACAG members provided general comments about workforce considerations and recommended encouraging as much data transparency as possible.

Public Workshop and Written Public Comment Summary and CEC Responses

The CEC appreciates the thoughtful comments from the public received in response to CEC's February 7, 2025, Gas R&D Workshop, where staff presented proposed initiatives for the FY 2025-2026 Gas R&D Program Budget Plan. The CEC requested comments at the workshop and via notifications on the CEC website, subscription lists, and docket. A summary of the workshop and written comments and CEC's responses is provided below. Please note that for brevity, footnotes included in public comments are not included in this summary.

Social Science Research for Gas Decommissioning in the Mid- and Long-Term

- **Public Comment Received:** Members of the public expressed interest and shared relevant resources for this initiative, including community outreach efforts conducted for LA100.[4]
- **Public Comment Received:** Several public comments suggested potential research areas related to barriers to transitioning from gas end uses, including the impacts of Public Safety Power Shutoffs (PSPS) on an electrified system, updating infrastructure or electrical wiring and panels, and the combination of multiple barriers.
- **CEC Response:** CEC staff appreciate the recommended research areas, which closely align with the goals of this initiative. Staff recognize the complexity of "barriers," and have adopted frameworks that recognize the relationships between social routines and associated technologies and materials, thus providing a more sociotechnical systems-oriented approach to making conversion from gas attractive and viable.[5] Staff also recognize the critical importance of energy resilience in decisions about conversion from fossil gas and its impacts on the energy resilience experiences of users and on the electricity system overall. The research perspective adopted in funded research will speak to integrating and/or coordinating gas decommissioning with energy resilience planning locally, regionally, and statewide.
- **Submitted via written comment from Earthjustice:** Earthjustice supports the CEC's social science research initiative, which will explore barriers to electrification,

[4] LA100 Study. Los Angeles Department of Water and Power. https://www.ladwp.com/strategic-initiatives/clean-energy-future/la100-equity-strategies/100-renewable-energy-study

[5] For an introduction to the rational of applying a social practices perspective to energy use and changes in energy use, see Shove, Elizabeth, and Gordon Walker. 2014. "What Is Energy For? Social Practice and Energy Demand." *Theory, Culture & Society* 31 (5): 41–58. https://doi.org/10.1177/0263276414536746 (also available here: https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=45ece422090c0171cda45d50b5dd1820b2431f81).

provide location-specific data, and inform efforts to promote fuel-switching and address barriers. Barriers and solutions that the CEC should explore within this research initiative include:

- Structural or infrastructure constraints: CEC social science research examining customer attitudes, experiences, and awareness around these structure or infrastructure-related barriers could be useful to determine whether customers are being unnecessarily deterred from pursuing electrification due to upgrade costs or misconceptions about upgrade costs.
- Multifamily residential and renter barriers: In addition to the structural and infrastructure-related constraints discussed above, multifamily buildings may have additional physical barriers to adoption of central systems in existing buildings, and building-wide electrification of all units may result in substantial increases in load that might be more likely to trigger infrastructure upsizing than that of a single family home. This research should look into barriers specific to multifamily residential properties as distinct from single-family homes, including mixed-use buildings that have both commercial and residential units. Further, the CEC should look into barriers, benefits, attitudes, and impacts of electrification among residential renters.
- Up-front costs and bill impacts: Research about equipment affordability, market share, installation costs, and availability could be useful to paint a clearer picture of how substantial these barriers are and how they can be mitigated. Additionally, research regarding bill impacts of electrification in different utility service territories and under different rates can inform efforts to reform rates or offer new rates that can mitigate operational cost impacts of electrification. It could also be useful to gather data about public perceptions and misgivings regarding bill impacts to compare with the data about how big the impacts actually are. Finally, the CEC should seek data about the age of appliances in California homes, with this data linked to the buildings' locations. This kind of data would dovetail well with the SB 1221 maps to identify areas that would be good targets for zonal electrification projects if appliance replacements are imminent in numerous homes.
- Resilience concerns and potential resilience benefits: for example, research could look at frequency, location and duration of PSPS events and the impacts on operation of both electric and gas infrastructure, as well as gathering feedback on Californians' experiences with gas and electric system impacts during emergencies and equipment choices they have made in response. In addition to impacts, the research should explore the potential for battery-equipped electrification technologies to provide resiliency during power shutoffs.
- Customer attitudes and unfamiliarity with technologies: Demonstration and educational offerings can be useful to address this roadblock when it comes to customers with misconceptions or a general lack of information about a given technology, removing or mitigating the preference for a gas product simply because they are already familiar with it or because gas has performed better for

them than older, outdated electric products. There are also cultural barriers regarding residential and commercial cooking... this research initiative should seek to connect with communities for whom this is a concern and... develop solutions and ideas for products that can meet culturally diverse cooking needs.

- **CEC response:** CEC staff appreciate the detailed input from Earthjustice. The topics and considerations mentioned are well aligned with the types of investigation covered in the initiative, which focuses on reflecting and analyzing the ground-level realities that affect gas use, capacity and motivations to convert from gas use across the supply chain from technology innovation to consumer choice, and the implications of conversion in terms of energy costs, energy resilience, equity, and impacts, including user satisfaction. Staff also appreciate the need to consider the detailed physical, economic, and pragmatic conditions that affect capacity and propensity to convert from gas, including in multifamily buildings, as well as the multiple actors (e.g., owners, renters, vendors, manufacturers, and building managers) that play a role in energy equipment decisions and their outcomes. This initiative is intended to identify relevant dynamics of equipment installation and replacement decisions, and to inform a range of factors – including technological characteristics and technical performance, pricing, regulations, policy interventions, and communications – that might affect these decisions and their outcomes.

Pilot Projects to Advance Gas Decommissioning

- **Public Comment Received:** How would transition strategies address current advantages associated with propane powered appliances?
- **CEC Response:** CEC staff responded in the workshop that this initiative will consider a range of low-carbon technologies for replacing fossil gas.
- **Public Comment Received:** Several public comments focused on site selection for pilot projects, asking how this initiative will build off of prior CEC-funded studies on gas decommissioning. Other comments raised concern about data availability on gas distribution infrastructure asset locations and conditions and the lack of data needed for project success.
- **CEC Response:** CEC staff appreciate these recommendations and will utilize data from previous and ongoing studies as well as resources resulting from SB 1221, such as zonal maps. The zonal maps developed are anticipated to include information on potential gas distribution pipeline replacement projects to inform pilot project site selection.
- **Public Comment Received:** Is California's gas decommissioning timeline related to the gas decommissioning timeline of other US states and/or nations?
- **CEC Response:** Several states are exploring various approaches to a gas transition and are working on different timelines.[6] CEC staff are tracking current efforts across

[6] Natural Resources Defense Council, Progress Report: How States are Kicking Gas

other states as well as internationally and will explore opportunities for exchanging information, such as data, best practices, and lessons learned.

- **Submitted via written comment from SoCalGas:** SoCalGas supports the initiatives the CEC has proposed and requests that the CEC assess gas system decommissioning research in coordination with SB 1221. There may be opportunities for combining the research dollars from the CEC Gas R&D program with the work conducted in the SB 1221 pilot program, which will allow for a deeper understanding of outcomes from real world scenarios
- **CEC Response:** CEC staff appreciate this recommendation and will be working with CPUC to identify how to position gas decommissioning research to be useful to efforts under SB 1221.
- **Submitted via written comment from Biovind:** In response to the question "what are the top criteria to consider in gas decommissioning pilot site selection," Biovind recommends that site selection for decommissioning pilots explicitly integrate comprehensive corrosion and equity assessments combined with predictive modeling, alongside other technical feasibility and cost criteria. Doing so would directly support SB 1221's intent by ensuring that pipelines with higher likelihood of failure are identified and prioritized. Such an approach would not only protect public safety but also allocate ratepayer funds to where they can have the greatest impact, retiring riskier assets and reducing future maintenance costs.

  Corrosion is a primary factor undermining pipeline integrity. Many older gas distribution systems, often composed of decades-old steel pipelines, are particularly susceptible. Corrosion accelerates deterioration, increasing the probability of leaks and posing significant safety and environmental risks. Importantly, these corrosion-prone pipelines frequently serve disadvantaged or underserved neighborhoods that historically bear disproportionate pollution burdens and often lack the resources for timely infrastructure upgrades.

  Decommissioning efforts would benefit from a standardized, risk-based framework that integrates corrosion detection, predictive modeling, and equity considerations in determining pilot site selection. Key elements of this approach would include:

  - Collect historical data on pipeline integrity and equity-related data such as socioeconomic indicators to help select pilot project areas.
  - Perform baseline integrity surveys by deploying emerging corrosion monitoring and detection technologies to assess corrosion risk in pipelines across varied regional conditions.
  - Integrate equity and corrosion assessment data into innovative predictive risk models.
  - Generate tailored recommendations and a scalable framework for prioritization and implementation.

A well-structured, data-driven approach to gas pipeline decommissioning will support the achievement of California's energy transition goals safely, equitably, and cost-effectively. By guiding pipeline retirement decisions with robust predictive risk modeling, corrosion detection, and equity considerations alongside other technical feasibility and cost criteria, the CEC can ensure that decommissioning initiatives benefit all residents while minimizing financial and environmental risks.

- **CEC Response:** CEC staff appreciate these recommendations and will consider them as this initiative is further refined during the solicitation scoping process. Additionally, staff will be working with the CPUC to position the gas decommissioning research to inform and support efforts related to SB 1221.
- **Submitted via written comment from Earthjustice:** Earthjustice supports Initiative 2, which seeks to establish pilot projects for zonal decommissioning of the gas distribution system. Comments recommend that CEC should build on existing work (from E3 and RAND) by moving forward with pilots identified in those studies. Earthjustice supports the use of the SB 1221 mapping tool to identify additional opportunities and potential sites for pilots but cautions that the timeline for development will be long and recommends the CEC not wait to identify new sites before moving forward.

  In response to the question "besides electricity, what other clean energy sources should we consider as safe and effective fossil gas alternatives," Earthjustice recommends that the CEC should not pursue hydrogen and biomethane, as they cannot be considered safe and effective replacements for fossil gas for the majority of customers.
- **CEC Response:** CEC Staff appreciate Earthjustice's support of the Pilot Projects to Advance Gas Decommissioning initiative. Projects funded under this initiative will consider existing research and emerging experience in a range of low-carbon technologies and leverage work under SB 1221 where feasible.

Networked Geothermal Heat Pumps

- **Public Comment:** Several questions from the public centered around the cost of the technology and the high expense of pilot projects.
- **CEC Response:** In the workshop, CEC staff responded that the utility business model takes into account these upfront costs by amortizing through rates over time. Additionally, peer-to-peer loads (one building's waste heat can be another building's used heat) can be taken into account while building the business model. Cost effectiveness and business model will be considered in the Phase 1 research study.
- **Public Comment:** Resources were shared including NREL's work on geothermal,[7] PG&E's initiative in San Jose connecting datacenters to nearby housing to provide energy and heat, American Geophysical Union's headquarters in Washington D.C.,

[7] https://www.nrel.gov/geothermal/

which taps into Washington D.C.'s municipal wastewater systems to create a heat exchange, and a related funding call from the Department of Defense.

- **CEC Response:** CEC appreciates the information shared by stakeholders and will incorporate it into the scoping and refining of phase 1 of this initiative.
- **Submitted via written comment from SoCalGas:** Building and operating district heating systems driven by ground-source heat pumps is not a part of the gas system's core mandate to deliver gas in a safe, reliable, affordable way. However, SoCalGas supports this initiative as an example of the role Gas R&D programs must play in an otherwise heavily regulated energy utility system. Gas R&D programs should act as incubators for innovative ideas, potential future utility applications or activities, and strategies aimed at affordably decarbonizing our gas infrastructure and delivering benefits to our ratepayers. These programs should focus on investigating, studying, and testing new approaches to provide valuable insights to our stakeholders and guide future investment decisions. Geo-networked heat pumps are a promising decarbonization technology being studied across the United States. CEC should take note of other studies, pilots, and demonstrations being conducted. For example, National Grid said this month it has abandoned a planned geothermal system in Lowell, Massachusetts, due to higher-than-expected costs. CEC could benefit from understanding the lessons learned of that project and other studies to inform their Gas R&D research initiatives. Despite these efforts outside of California, SoCalGas agrees with CEC that "California -specific research [is] needed to assess, demonstrate potential of thermal energy networks." California has a distinct set of climate zones, geological conditions, demographics, and economic constraints that must be considered in this research.
- **CEC Response:** CEC staff appreciates SoCalGas's support and comments regarding this initiative. Staff agree it is important to monitor and understand related studies in other jurisdictions to leverage lessons learned and identify outstanding research gaps. For example, regarding National Grid's cancellation of the planned pilot in Lowell, Massachusetts, the utility spokesperson cited rising supply costs and "underground geologic conditions in Lowell that made the infrastructure more costly," while committing to continue the other pilot in Boston.[8] This instance highlights the importance of the first phase of this initiative, through which a wide range of investigations, including geologic, scale, and population density, will be conducted to inform pilot selection and design.
- **Submitted via written comments from Lawrence Berkeley National Laboratory (LBNL):** In response to the question "what metrics are suitable in evaluating and comparing existing technologies and networked GHPs," LBNL comments that the following metrics are suitable:
    - Energy supply chain security and energy price stability.

[8] https://www.wbur.org/news/2025/02/06/national-grid-cancels-networked-geothermal-lowell

- GHG emissions and green premium (e.g., cost of saved CO2 relative to other technologies).
- Lifecycle costs and investment costs relative to alternate systems.
- Opportunity of Networked Geothermal Heat Pumps to provide utility scale load flexibility.
- Reduction of electricity use and level of service provided during resilience events (e.g., brown-out or heat wave).

- **Submitted via written comments from LBNL:** In response to the question "what outcomes of a successful networked GHP demonstration might encourage community support for gas decommissioning," LBNL recommends:
  - Ability to modularly build out systems as capital becomes available.
  - Ease of design rules for thermal system design (operating temperature) and control design (modularity and robustness of control, and ability to shift loads).
  - Robustness to technology changes, such as inserting of new storage technologies into a system over its lifetime, sometimes referred to "resilience to technology changes."
  - Resilience to extreme climate events (heat waves, cold snaps).
- **CEC Response:** CEC staff appreciate the specific and relevant comments from LBNL. Staff have incorporated a number of the suggested recommendations and will consider others as the initiative is further refined in the solicitation scoping process.
- **Submitted via written comments from Earthjustice:** Earthjustice supports the CEC exploring feasibility of networked geothermal heat pumps in California and recommends building off the research and experiences of existing efforts in other states. Earthjustice also recommends use of SB 1221 maps to identify potential sites for near- and medium-term networked GHP pilots.
- **CEC response:** CEC staff appreciate the recommendation from Earthjustice and will ensure the use of the SB 1221 maps in the pilot selection process.

Scaling Technology to Decarbonize California's Gas Sector

- **Public Comment:** Support for manufacturing pilot systems is of tremendous benefit including providing access to various industry technology experts to assist in that transition.
- **Public Comment:** Efficient recovery and reuse of low-level waste heat can reduce energy use without adding carbon footprint. Manufacturing support is needed for such new technologies to be commercialized and deployed.
- **Submitted via written comment from SoCalGas:** During the Gas R&D workshop, the CEC specifically noted it is targeting low carbon fuels. These low carbon fuels include renewable natural gas (RNG) produced from waste as well as fuel-flexible generation technologies such as linear generators that can run on natural gas, RNG, ammonia, and hydrogen. SoCalGas supports this initiative and the technologies the CEC

is targeting for scale up. In addition, SoCalGas RD&D projects often support new technology startups or ventures that would be well positioned to leverage this kind of scale up funding program. For example, SoCalGas RD&D recently completed a demonstration of the H2 SilverSTARS system, which produced hydrogen from RNG to help fuel SunLine's fleet of 17 hydrogen fuel cell electric buses. This technology could be well positioned to take advantage of CEC funds to support scaled manufacturing in California. In addition, CEC should investigate its authority to provide this funding in the form of a royalty agreement to recover funds from successful recipients. This type of contract structure would mitigate the risk of loss for ratepayer funds.

- **CEC Response:** CEC staff appreciate the comments from attendees. Regarding royalties, the Electric Program Investment Charge program includes the potential for royalties collection in its standard terms and conditions and has established a process to assess and recover royalties, if applicable. CEC will consider the inclusion of royalties in Gas funded R&D..

- **Submitted via written comments from Earthjustice:** Earthjustice supports the CEC's efforts to find solutions to reduce GHG emissions from hard-to-electrify industrial use cases. However, as discussed above, the CEC should be wary of lifecycle impacts of fuels like biomethane and hydrogen, which industry participants often greenwash as "clean fuels" despite the environmental impacts of their production. Given the CEC's commitment to centering equity in these research initiatives, as well as Initiative 4's goals of reducing criteria air pollutants in addition to GHGs and reducing impacts to ESJ communities, including Tribal communities, it is critical that this initiative not be used to advance technologies or fuels whose production or use harm those already overburdened communities. Earthjustice encourages the CEC to use this research initiative to advance industrial electrification technologies that need market support as well.

- **CEC Response:** CEC staff appreciates Earthjustice's comment highlighting a continued focus on equity within this initiative. Technologies funded under an initiative like this would be carefully researched to reduce GHG and criteria air pollutant emissions, deliver cost savings, create manufacturing jobs, and reinforce safety and energy reliability for California ratepayers and justice communities.

Written comment submitted by SoCalGas also included support for additional research areas, described below:

- **Submitted via written comment from SoCalGas:** In light of these [South Coast AQMD proposed rule requiring zero-emission appliances in new buildings and replacements & US DOE Secretarial Order promoting affordability and consumer choice in home appliances] recent developments and the growing acknowledgment about the need to address affordability, consumer choice, and grid reliability, it is in the public interest that the CEC consider R&D for ultra-low-NOx gas appliance technologies so that this technology can be commercially ready in the event that the courts rule against Rule 1146.2 and find it illegal to allow only electric heating equipment for manufacture and sale in California. SoCalGas has begun conducting research on low temperature catalytic

combustion, a promising technology that could have very low NOx and CO emissions and is applicable for residential stovetops with ovens and for space and water heating. Additional research should be conducted in this area to help the technology reach commercialization.

- **CEC Response:** CEC staff look forward to continued engagement with IOUs on research ideas for future Budget Plans and to do so in a way that builds on, but is not duplicative of, efforts funded by the other Gas R&D administrators.

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Appendix E: FY 2025-2026 Gas R&D Plan Equity Framework Topic Definitions

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APPENDIX E:
FY 2025-2026 Gas R&D Plan Equity Framework Topic Definitions

The FY 2025-2026 Gas R&D Budget Plan includes the application of the Disadvantaged Communities Advisory Group (DACAG) Equity Framework. The five key equity principles have been adapted to apply to the Gas R&D Program and Electric Program Investment Charge (EPIC Program).

Health and Safety

CEC will direct investments to optimize the health and well-being of California's most vulnerable communities by advancing clean energy technologies that lead to health benefits and positive impacts, build resiliency, address climate change vulnerabilities, and reduce climate and air-quality-related healthcare costs. For example, advancements in building envelopes and low-carbon cooling technologies will reduce exposure to climate change impacts, such as wildfire and extreme heat. Disadvantaged communities will benefit from reduced emissions from advancements in transportation electrification, as well as innovations in load flexibility that can reduce and eliminate the need to run fossil fuel-powered peaker plants.

Access and Education

Accessibility is the extent to which cleantech products and services are usable and available to people from the widest range of backgrounds and capabilities. The CEC strives to remove barriers to clean energy technology adoption, as identified in the SB 350 Barriers Report and by relevant stakeholders. This is accomplished through technology demonstration and deployment (TDD) in under-resourced communities, addressing community priorities, supporting relationship-building and partnerships among diverse members of the public, ensuring meaningful community engagement with community-based organizations as key project partners, and investing in diverse businesses. CEC will address access and education through projects and program administration by (1) enhancing inclusivity by focusing on targeted outreach, meaningful engagement, and knowledge dissemination; (2) ensuring that technologies are applicable to community interests and responsive to local needs; and (3) supporting the sharing of culturally relevant and sensitive project information and educational materials for participating communities. Tracking and evaluating progress of such efforts will ensure that these interventions are successful.

Financial Benefits

CEC investments will lead to technological advancements that generate financial benefits and cost savings while centering affordability and rate impacts. For example, improved energy efficiency and load flexibility will result in gas and electric bill savings; advancements in resilience from energy storage technologies will help reduce financial impacts to ratepayers

facing grid reliability issues; and manufacturing advancements will reduce the costs and accelerate the scaling of clean energy technologies. In addition, CEC EPIC and Gas R&D funding has a solid history of expanding community investment by attracting significant additional public and private funding and building capacity for future clean energy project developments and affordability and other benefits. CEC Gas R&D and EPIC investments will prioritize financial benefits in under-resourced communities to improve energy equity.

Economic Development

CEC investments will support economic development by:

- Funding applicants who are committed to diversity, equity, and inclusion and local workforce development.
- Investing in manufacturing, entrepreneurship, job creation, and training that support workforce development pathways to high-quality careers in California.
- Encouraging hiring for low-income, disadvantaged, and under-represented populations (including women, re-entry, veterans, EJ communities, among many others).
- Supporting small and diverse business development and contracting.

For example, through support of the entrepreneurial ecosystem, the CEC seeks to grow the Gas R&D and EPIC-relevant talent pool and provide critical support at all stages of the technology development pipeline to accelerate and expand clean energy benefits. TDD projects and manufacturing initiatives support job growth, on-the job training, and workforce development and include opportunities in regions facing high rates of unemployment and underemployment.

Consumer Protection

As a technology R&D program, the Gas R&D program does not directly address consumer protection; thus, consumer protection was not included in the Equity Matrix (Table 2). Rather, through investments that work to advance clean energy technologies, the Gas R&D program is supporting consumer protection by demonstrating, de-risking, scaling, and accelerating the affordability, accessibility, and other benefits from the adoption of emerging clean energy technologies.

Direct and Indirect Benefits

Direct impacts are expected as a direct result of project implementation. For example, occupant health benefits are expected due to indoor air quality improvements from TDD projects that include electrification of gas appliances. Similarly, economic development benefits are expected from geothermal energy projects that hire local workers and support workforce development.

Indirect impacts are expected more broadly outside of project implementation. For example, indirect health benefits are expected from a project that funds the technological advancements of an induction cooktop that will improve indoor air quality but does not include a demonstration.

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Appendix F: Estimated Administrative Costs

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APPENDIX F:
Estimated Administrative Costs

Based on analyses conducted on FY 2022-2023 Gas R&D Program administration, an estimated breakdown of Gas R&D Program administration costs is provided below. The FY 2022-2023 Gas R&D Program administration continues to provide a cost basis as it is the most recent plan that has been fully approved. Once more recent plans have been approved, this analysis will be updated.

Program Administrative Cost Budget Item	Fiscal Year 2025-2026 ($)
Investment Plan Development	$229,669
Project Planning and Initiation	$504,031
Project Oversight and Governance	$695,214
Stakeholder Communication, Engagement, and Outreach	$116,697
Regulatory Support Compliance	$229,669
Internal Management Coordination	$76,970
Program and Process Coordination and Improvement	$63,121
Administrative Activities	$81,565
Supervision and Personnel	$271,928
Training and Development	$131,136
Total	**$2,400,000**