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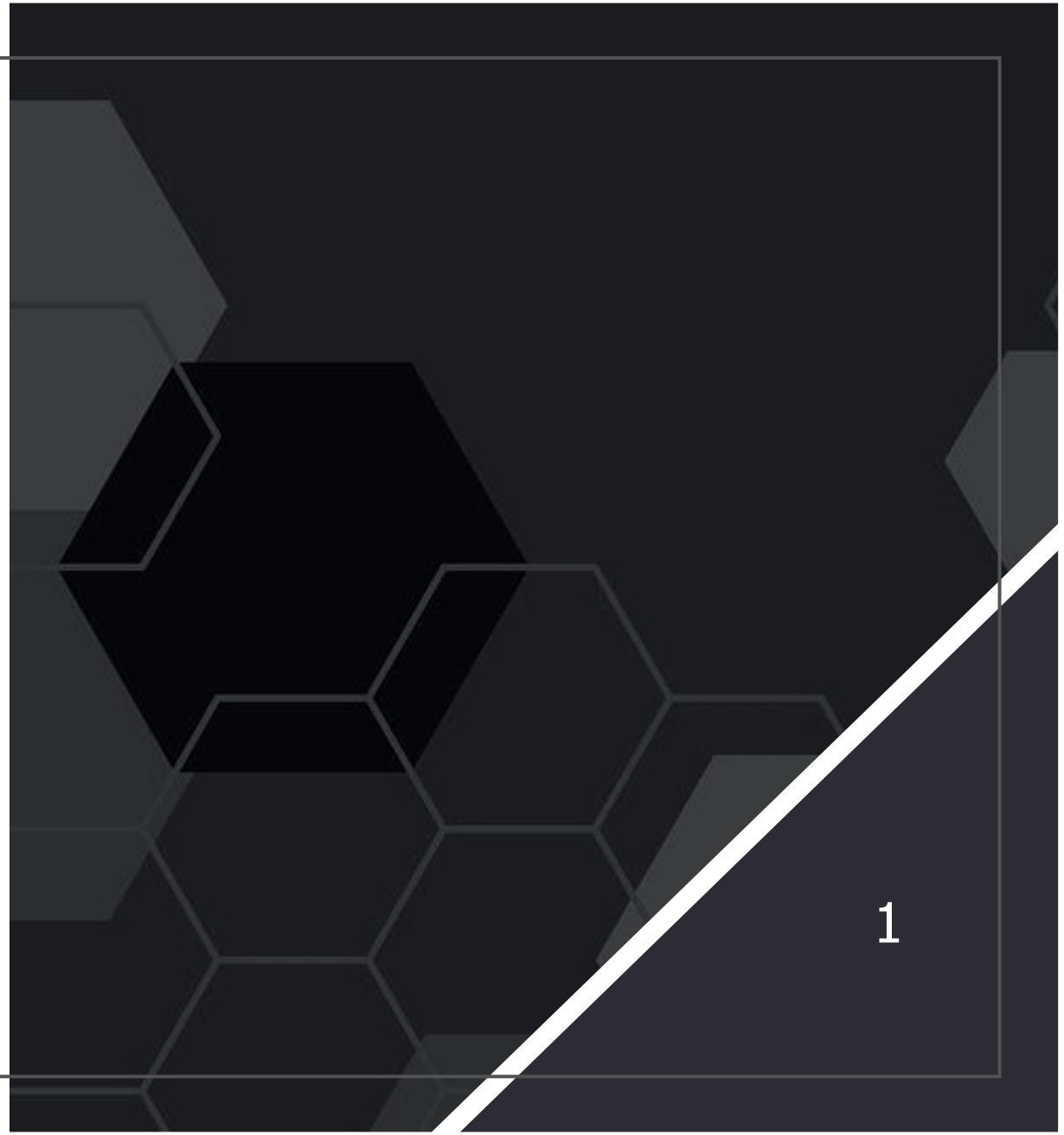
FY 2021-2022 Proposed Natural Gas Research Initiatives

DACAG Meeting
January 22, 2021

Energy Research & Development Division



Natural Gas R&D Plan Intro

- The CEC administers the R&D plan with CPUC oversight. Annually, the CEC submits an investment plan and funds projects consistent with the plan.
- Research and development specific to natural gas done in the public interest to support the transition to clean energy, greater reliability, lower costs, and increased safety for Californians
- "Directed towards developing science or technology, and 1) the benefits of which accrue to California citizens, and 2) are not adequately addressed by competitive or regulated entities."
- $24 million annually, funded by a surcharge on natural gas consumption in CA
- Natural Gas R&D projects:
  - Focus on energy efficiency, renewable energy and advanced clean generation, energy transmission and distribution, energy-related environmental protection, and transportation.
  - Support state energy policy.
  - Provide complementary communitywide benefits including, but not limited to, job creation, improved air quality, and economic stimulation.

Natural Gas R&D Plan Development

- Identify research gaps to address and propose initiatives through:
  - Discussion with utilities, public stakeholders, state and federal governmental agencies, other CEC programs
  - Roadmaps
  - Public meetings and research ideas submitted by the public
- Energy research priorities are guided by policy directives
- Need clearly identified natural gas ratepayer benefits
- Research projects are selected through competitive solicitations

Schedule

Date	Task	Status
12/04/20	**Distribute outreach survey**	**Completed**
12/28/20	**Survey responses due**	**Completed**
01/08/21	Coordination meeting with CPUC staff	Completed
01/22/21	**DACAG meeting**	**Scheduled**
01/29/21	**Public workshop**	**Scheduled**
02/05/21	**Public comments due**	
Early March	Start routing final budget plan	
03/29/21	Post R&D plan	
03/30/21	Formal submission	

Outreach Survey

DACAG and Community Member Survey on Natural Gas R&D Initiatives for 2021

- 20 question survey
- Shared with >2100 people via
  - DACAG Newsletter
  - DACAG-EPIC Subcommittee
  - Empower Innovation link
  - Tribal Liaison
  - CEC Diversity List Serve
- 19 responses
  - Including: CBOs, Environmental Justice groups, non-profits, tribal reps, local government, and DACAG members

Survey Results

Q19 Which goals are you and your organization most interested in achieving from implementing projects in your community?

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	IMPORTANT	FAIRLY IMPORTANT	VERY IMPORTANT
A) **Reduce greenhouse gas and other air emissions** resulting from the combustion of natural gas in buildings and industries through increased energy efficiency.	2	0	0	2	**6**
B) **Reduce natural gas energy cost in residential and commercial buildings** with advanced energy efficient and low-carbon technology solutions.	2	2	0	2	**3**
C) **Reduce natural gas safety hazards** caused by leaks or other vulnerabilities in natural gas infrastructure(e.g., reducing emissions from pipelines and underground storage facilities).	2	1	1	2	**4**
D) **Develop and commercialize renewable gas** (i.e, Biogas, Renewable Hydrogen, Low-Carbon Methane) for use in buildings and industry.	**4**	1	0	2	2
E) Develop and commercialize **renewable gas** use as an alternative to diesel in **medium- and heavy-duty vehicles.**	**3**	1	0	**3**	**3**

Survey Results

Q20 Please include additional comments or information you think would be useful to us. – Key Comments Below

- The **cost of prohibiting gas stoves in new buildings must be taken into account**. Induction stoves are expensive, have limited life span, and require special cookware**. Government needs to drive down cost either through manufacturer tax breaks or offer grants to residents.**
- …agree **that renewable hydrogen fuel is a good option for transportation--**the key is giving drivers options**.**
- Frontline communities in CA largely support **direct and immediate investments in zero emissions** and are adamantly **opposed to continued funding and siphoning of resources into fossil fuels, including NG and RNG**.
- The overall purpose of the survey is a little difficult to decipher**. Energy efficiency programs can and should be implemented while eliminating natural gas as a fuel source.** Eliminating the use of natural gas or other GHG producing technologies should be the first priority**.**

Proposed Research Initiatives

Research Initiative Development

FY 2021-22 Natural Gas proposed research initiatives are framed around ***decarbonization***.

Primary areas:

- Indoor Air Quality
- Industrial Decarbonization
- Hydrogen
- Decommissioning
- Safety and Integrity

1. Hydrogen and Natural Gas Blending for Industrial End-Use Applications

Description: Identify and demonstrate industrial applications and processes where natural gas use can be replaced with blended natural gas and hydrogen, which may be a cost-effective way for industry to reduce CO_2 emissions.

- Determine the maximum upper limit of hydrogen that can be safely blended with minimal or zero equipment modifications
- Explore equipment retrofits that could enable safe use of higher hydrogen amounts
- Demonstrate at pilot or full-scale use of blends in industrial process equipment
- Determine effect of blending hydrogen on NOx emissions

Goal: Reduce greenhouse gas (GHG) emissions from natural gas fueled industrial process heating and high-temperature processes that are difficult or costly to electrify or otherwise decarbonize.

Equity Considerations: Many industrial facilities are in under-resourced communities. Inform implementation of hydrogen blending to reduce or avoid increasing criteria air pollutants (NOx) and their associated health affects in these communities.

2. Industrial Carbon Capture & Utilization

Description: Improve the energy efficiency and economics of existing and emerging technologies that capture CO2 and convert it into higher-value commodities.

- Develop a roadmap for carbon capture and utilization (CCU) in California's industrial sector
- Establish an energy baseline of existing CCU technologies
- Increase effectiveness of capturing and purifying carbon dioxide
- Develop novel chemical and biological conversion technologies or improve existing ones

Goal: Reduce greenhouse gas (GHG) emissions from natural gas fueled industrial process heating and high-temperature processes that are difficult or costly to electrify or otherwise decarbonize.

Equity Considerations: Many industrial facilities are in under-resourced communities.

3. Technologies for Monitoring Ground Movement Around Pipelines and Mitigating Natural Force Damages

Description: Develop and demonstrate remote sensing and monitoring technologies and mitigation strategies to reduce the risk of potential damages due to natural force damages.

- A "whole system approach" from data collection to integration with utility integrity management system and risk assessment tools
- Advance technology and commercial readiness level by optimizing device performance, improving cost effectiveness, and demonstrating the technologies at full-scale in the field

Goal: Enable utilities and pipeline operators to conduct real-time, continuous, and comprehensive monitoring of ground movement around pipelines and mitigate the risk of natural force damages, service disruption, and GHG emissions.

Equity Considerations: Under-resourced communities are usually more vulnerable to natural disasters. This research will pilot engineering measures in place to protect these communities from being negatively impacted by natural force damages.

4. Technology Development and Demonstration for Plastic Pipeline Repair and Integrity Improvement

Description: Development and demonstration of technologies to assess, repair, and prevent damages to plastic pipes widely used in natural gas mains and service lines.

- Technologies for early notification of potential risks
- Robotic internal inspection and repair technologies
- New and cost-effective technologies to repair plastic pipe damages
- Technologies to measure the performance of repaired plastic pipe systems
- Emerging technologies that minimize or avoid service interruption during pipeline repair

Goal: Improve the safety and integrity of California's natural gas plastic pipelines and prevent pipe failures, gas service interruption, and leaks while reducing maintenance costs.

Equity Considerations: The research will enhance the safety, reliability and resiliency of gas service including in disadvantaged and low-income communities, which are more vulnerable to natural gas incidents such as gas leaks, pipe ruptures and explosions.

5. Developing and Demonstrating Hydrogen-Based Power Generation Systems

Description: Development and demonstration of power generation technologies that can run efficiently on high blends of hydrogen in the fuel stream.

- Advance and demonstrate generation system efficiency, emissions reductions (GHG and NOx), and safe operation (e.g., operating without leaks, maintaining system integrity); with applications for small-scale to large-scale systems
- Demonstrate integrated production of hydrogen-rich fuel from renewable gas and power generation.

Goal: Increase hydrogen adoption and reduce the use of and emissions from natural gas in power generation.

Equity Considerations: Fossil fuel generators are typically in under-resourced communities. Contribute to the state's clean electricity goals and improve local air quality through reductions of natural gas combustion byproducts (NOx) that present health risks.

6. Quantify Exposures to Indoor Pollutants in Multi-Family Homes that Cook with Natural Gas or Alternatives

Description: Address critical gaps in our understanding of health impacts of cooking with residential natural gas and possible benefits of electric cooking appliances, including:

- Exposure assessment of California residents to NO2 in residential environments;
- Assessment of indoor exposures to PM2.5 associated with cooking and characterization of the chemical constituents, size distribution, or other attributes that factor into health impacts.

Goal: Inform a more realistic assessment of health implications from exposures to pollutants associated with residential cooking and assessing health benefits of decarbonization measures. May inform low-cost strategies for monitoring PM and ventilation in residential kitchens.

Equity Considerations: Research will focus on health-damaging pollutants in multi-family homes in low income and disadvantaged communities, with an emphasis on capturing exposures of those most vulnerable to air pollution exposures (e.g., children, elderly).

7. Location-Specific Analysis of Decommissioning to Support Long-Term Gas Planning

Description: Deliver location-specific analysis of promising candidate sites for decommissioning (e.g., those with known pipe integrity and corrosion issues), examining the implications of decommissioning on the remaining gas system.

- Prioritize examining natural gas decommissioning and electrification opportunities in under-resourced communities.
- Scope and approach to inform effective and equitable implementation of strategic pruning.

Goal: Bridge the gap between high-level gas system planning and local decommissioning pilots, providing stakeholders with a valuable tool for assessing the technical and economic feasibility of decommissioning specific segments of the gas system.

Equity Considerations: The proposed analysis will focus on examination of natural gas decommissioning opportunities, including in under-resourced communities. The overarching goal is to inform an equitable and cost-effective gas system transition.

8. Advanced Hydrogen Refueling Infrastructure Solutions for Heavy Transport

Description: Develop and demonstrate advanced hydrogen refueling station components and systems for high-capacity stations to support heavy transport applications transitioning to hydrogen fuel cell technology (e.g., heavy-duty fuel cell electric vehicles).

- Demonstrate innovative station designs with on-site production, integrated use with other sectors to drive scale, and/or use of chemical hydrogen carriers to reduce distribution costs.
- Reduce dispensing costs, support larger vehicles, and improve infrastructure reliability.

Goal: Increase availability of low-cost hydrogen to help decarbonize difficult-to-abate end-uses. Develop reliable, low-cost, and high-capacity hydrogen fueling infrastructure to expand heavy-duty fuel cell electric vehicle adoption and station deployment in California.

Equity Considerations: Expanding availability of hydrogen fueling infrastructure will improve air quality and zero-emission transportation accessibility, especially in under-resourced communities that are heavily impacted by these mobile sources.

Open Discussion

Discussion: Draft Research Initiatives

Energy Efficiency

1. Hydrogen and natural gas blending for industrial end-use applications
2. Industrial Carbon Capture and Utilization

Natural Gas Infrastructure Safety & Integrity

3. Technologies for Monitoring Ground Movement Around Pipelines and Mitigating Natural Force Damages
4. Technology Development and Demonstration for Plastic Pipeline Repair and Integrity Improvement

Renewable Energy and Advanced Generation

5. Developing and Demonstrating Hydrogen-Based Power Generation Systems

Energy-related Environmental Research

6. Quantify Exposures to Indoor Pollutants in Multi-Family Homes that Cook with Natural Gas or Alternatives
7. Location-Specific Analysis of Decommissioning to Support Long-Term Gas Planning

Transportation

8. Advanced Hydrogen Refueling Infrastructure Solutions for Heavy Transport