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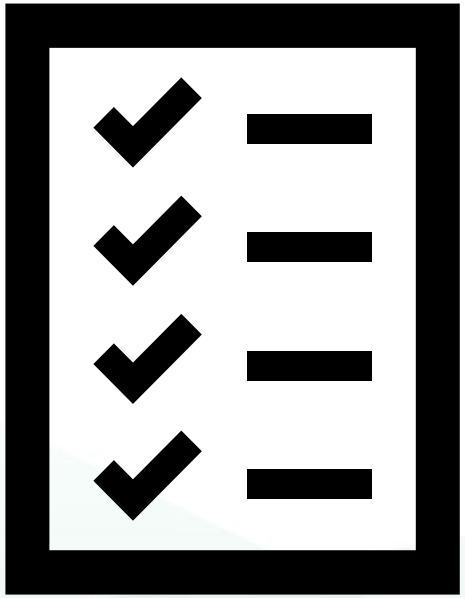
Item 12: Proposed Resolution Approving the *Gas Research and Development Program 2022 Annual Report*

October 12, 2022 Business Meeting

Misa Werner, Electric Transmission System Program Specialist
Energy R&D Division, Energy Deployment and Market Facilitation Office

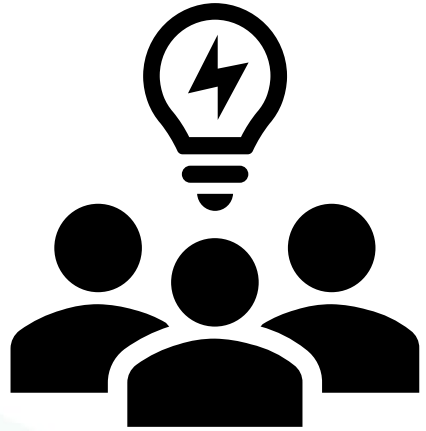
Benefits to Californians

- Increases public awareness about gas-funded technologies
- Synthesize information about innovative approaches to reduce consumption and GHG emissions



Gas R&D Annual Report Overview

- **Purpose:** Provides Legislature, CPUC, and public summary of CEC's Gas R&D Program, its impact, and ratepayer benefits
- Program Introduction
  - **Metrics**
  - **Investment Areas & Total Investment**
  - **Project Highlights**
  - Appendices



Gas R&D Program Metrics

- **>$311 million** in Gas R&D Program funds invested to date, ~300 projects
- Project recipients have attracted over **$6.1 billion in private investment** after being selected for an award – **20 times** the initial public investment
- **~71 percent of program funds have been invested in disadvantaged, low-income communities, or both** since 2016
- **20+ projects informed codes, standards, proceedings, or protocols** (adopted or under consideration)
- **~44 technologies or products have been commercialized** resulting from Gas R&D projects + many more moving toward commercialization.
- **>15,700 citations** have been made to publications referencing research results from CEC-funded Gas R&D projects (through September 2022).

Investment Areas & Total Investment*

- Entrepreneurial Ecosystem: $11.2 million **
- Building Decarbonization: $54.8 million
- Gas System Decarbonization: $20.3 million
- Industrial and Agricultural Innovation: $72.5 million
- Transportation: $64.3 million
- Resiliency, Health, and Safety: $87.7 million

*Time frame for totals by investment area is from program inception in 2004.

**This includes the Energy Innovation Small Grant Program, as well as the upcoming CalSEED gas program.

Building Decarbonization:
A Systems-Efficient Approach to Hospital Decarbonization

- GTI demonstrating **4 primary measures** = **cost-effective** and successful **reduction** in fossil gas use
- Project Goals and Estimates:

- Reduce annual gas consumption and site GHG emissions by at least **30**%
- Reduce annual electricity by about **25%**
- Achieve simple payback **< 7 years**
- Reduce **3,400 metric tons** of carbon emissions each year

Kaiser Baldwin Park (Source: Kaiser Permanente)

Building Decarbonization:

Getting Out of Hot Water: Reducing Gas Consumption in Existing Large Commercial Buildings

- CBE demonstrating, evaluating, scaling packages of nonproprietary, low-cost software control + measures to cut consumption
- High-cost retrofit items done as energy- and cost-efficiently as possible
- Cut energy waste in space heating, hot water distribution, and boiler operation
- Project Goals and Estimates:
  - annual gas consumption ↓ >60%
  - annual carbon emissions ↓ 250 metric tons
  - simple paybacks <7 years

Boiler and Variable-Air-Volume Retrofits at the Genentech Building, South SF. (Source: CBE)

Gas System Decarbonization / Industrial & Agricultural Innovation: Small Combined Cooling, Heating, and Power System With Innovative and Quick-Response Thermal Energy Storage

- Developed/demonstrated CCHP-TES packaged system for commercial sectors
- Novel integration of low-cost molten sulfur
  - Adds flexibility, allows electricity/steam production at different times
- High-efficiency operation: **stores high-temp waste heat** for cooling **or** power generation
- Reduce peak demand and interact with the grid to provide dispatchable power and essential services
- <u>Completed Project Metrics Achieved:</u>
  - 85.4% thermal efficiency
  - **Annual gas savings of $7,000–$9,000**
  - Reduced capital cost
  - Payback period <9 years,
  - Building annual GHG emissions ↓30–40 tons

Element 16 successfully commissioned the CCHP-TES system at its own commercial facility in Arcadia, CA. (Source: Element 16 Technologies, Inc.)

Transportation: A Design and Feasibility Study of a Fuel Cell-Powered Commercial Harbor Craft

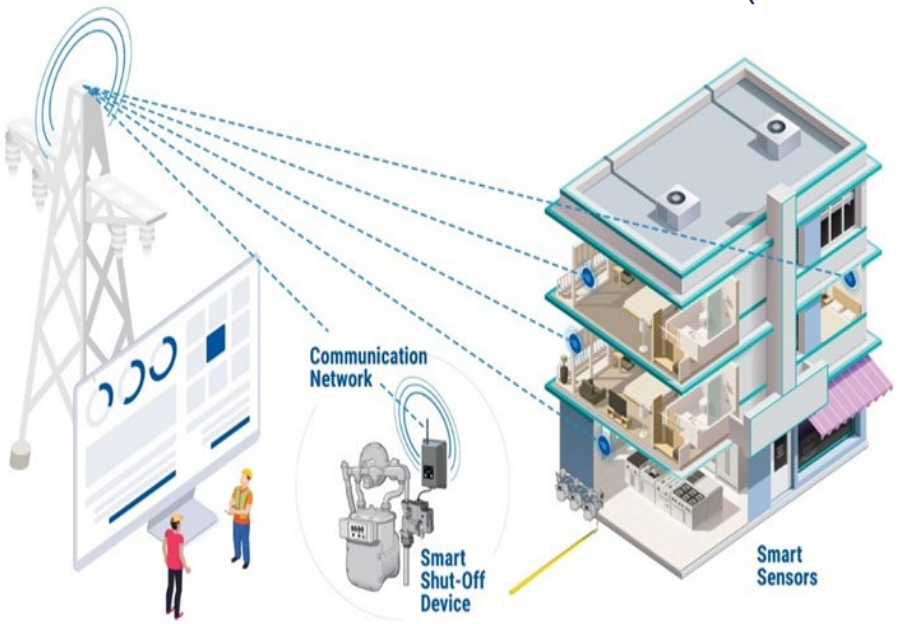
- CALSTART developing a hydrogen fuel cell-powered tugboat design for future deployment at the Port of Los Angeles
- Addressing safety, technical, economic challenges
- Displacing a single diesel tugboat:
  - ↓4,100 kg of NOx,
  - ↓ 260 kg of PM,
  - ↓ 1,900 metric tons of CO_2 emissions per year
- Completed initial vessel design and regulatory map. Seeking follow-on funding to build the vessel.

Hydrogen Fuel Cell Tugboat Rendering (Source: Crowley)

Resiliency, Health, and Safety:
Smart Shutoff Technology for Homes & Businesses

- GTI developed/testing a smart shutoff safety system to safeguard customer-owned gas lines
- Smart sensors, a gas shutoff device, and communication layers integrated into a system that monitors and detects hazards
- System automatically sends alerts or terminates gas flows & informs utility, customers
- Demonstrating in a lab, residential building, restaurant

(Source: GTI)



Targeted Project Metrics and Estimates:

>60 billion standard cubic feet → potential annual methane emissions reduction from installing 450,000 systems

$500 → the cost per system

$9 billion → estimated market for this tech by 2024

Staff Recommendation

- Approve *Gas Research and Development Program 2022 Annual Report*