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**Statewide Gas Emerging Technologies (GET) Program**

**2025 Annual Research Plan – V1.5**

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# Background

In 2019, the California Energy Commission (CEC) released the California Energy Efficiency Action Plan (EE Action Plan) which is the state’s “roadmap for an energy-efficient and low-carbon future for buildings. Energy efficiency is a key piece of California’s efforts to lessen the impacts of climate change[[1]](#footnote-2)” The EE Action Plan was prepared in response to legislative actions to double energy efficiency savings in electricity and natural gas end uses relative to a 2015 baseline by January 2030 (SB 350). Based on the CEC’s assessment, California is expected to fall 28 percent short of the 2030 natural gas savings goal.

Technology plays a distinct role in the energy efficiency landscape as greater adoption of higher efficient equipment will help close the natural gas savings shortfall. The Statewide Gas Emerging Technology (GET) Program is the primary vehicle to identify and prioritize technology research efforts. Through GET, emerging and/or underutilized technologies are evaluated to better understand their operating characteristics, efficiency performance, market barriers, etc. with the goal of moving promising technologies up the market adoption curve thus increasing their prevalence in the market.

California is actively looking at ways to decarbonize the “gas grid” to meet California state’s carbon neutrality goal. A step in this process is the introduction of hydrogen into the existing gas pipeline network. The expectation is that the future gas needs will be satisfied using a low percentage hydrogen blend that does not compromise pipeline safety and that end-use equipment will still meet efficiency performance expectations with these blended fuels. However, the impacts on both existing and new equipment need to be quantified to better understand operating characteristics.

Concurrent with the adoption of new technologies, is the need to understand market barriers, including those that are the result of the new technology, as well as any that already exist for current similar technologies. Because these technologies, even the emerging ones, are in many cases competing against electric technologies that are being deployed for electrification, understanding the differences between the electric and gas technologies, including the differences in source greenhouse gas (GHG) generation and site indoor air quality (IAQ) issues, becomes more critical than comparing single fuel technologies. Over the course of recent project activities, it was found that other local and statewide regulations on emissions affect the availability of emerging gas-fired technologies (e.g., Air Quality Management District regulations on NOx, California Air Resources Board regulations on emissions, local “gas-bans” etc...). The impacts of these regulations on emerging technologies evaluated through GET need to be considered.

Recently, in addition to the ongoing discussions on electrification and decarbonization, there were significant policy directions that could significantly impact the future of natural gas-fired space and water heating technologies in California. These policies fall under three (3) general categories; Gas Energy Efficiency (EE) measures, Air Quality Codes & Standards, Building Efficiency Codes & Standards. The policy directions are as follows:

* Gas EE Measures:
  + In April 2023, the California Public Utilities Commission (CPUC) released decision D.23-04-035 that eliminates non-exempt (measures that burn gas and yield gas savings)[[2]](#footnote-3) and non-cost-effective gas energy efficiency measures in most residential and new construction programs. This decision also ordered a research and stakeholder process to develop a Viable Electric Alternative (VEA) Technical Guidance Documents which are likely to be used for phasing out gas incentives later on for gas burning measures. The outcome of the VEA activity has not been released but is expected in Q4 of 2024. The working groups and other aspects of this decision are addressing the following:
    - Electrification cost impacts and allocation by end use.
    - Cost calculator that will be used to project customer costs relative to electrification.
    - Criterion and process for determining VEA's and the subsequent elimination of existing and potential new gas measures. It is this space that is most relevant for the GET program’s focus as existing measure viability will determine where to apply the ongoing research efforts.
* Cost Effectiveness
  + The California State Assembly recently approved AB 3264 which requires additional reporting from EE programs. The original bill might have placed requirements on EE programs to meet a cost-effectiveness threshold, but it was amended before it was passed to remove cost-effectiveness requirements. California Governor Newsom subsequently issued Executive Order N-5-24 on October 30, 2024 which orders the California Energy Commission (CEC) to examine all electric rate-payer funded programs that may be unduly adding to electric rates and requests the CEC to take immediate action to sunset underperforming or underutilized programs or shoes costs exceed the value and benefit to electric ratepayers. Both legislative actions do not directly affect gas EE measures but demonstrate the legislative landscape in California is concerned about utility costs in general.
* Air Quality Codes & Standards
  + In September 2022, the California Air Resources Board (CARB) approved the “Proposed 2022 State Strategy for the State Implementation Plan” that will set a zero-emission standard for space and water heaters to go into effect in 2030[[3]](#footnote-4). It is unclear if zero emissions include CO2 but probably include NOx at a minimum. While this plan was voted on and approved by CARB, the details have not yet been determined. Also, it was found during the 2022 research that existing Air Quality Management District (AQMD) regulations requiring Ultra-Low NOx emissions on water heaters impact participation of storage water heaters in EE programs.
  + On March 15, 2023, the Bay Area Air Quality Management District approved new rule amendments to phase out sales and installations of gas furnaces and gas water heaters that emit NOx from 2027 – 2031.
  + South Coast Air Quality Management District (SCAQMD) has many control measures in their 2022 Air Quality Management Plan which require transitions to Zero and Near-Zero emissions technologies in commercial and residential buildings for stationary combustion sources, appliances, and restaurant cooking equipment. These affect the following SCAQMD rules: 1109.1, 1110.2, 1117, 1134, 1135, 1147.1, 1150.3, and 1179.1.
    - Rule 1146.2 is an example of an amended rule affected by a control measure. On June 7, 2024 the South Coast Air Quality Management District approved an amendment to rule 1146.2 which requires zero Nox and CO emissions for water heaters and pool heaters on a phased schedule. The earliest compliance data is January 1, 2026 for instantaneous water heaters (≤200,000 btu/hr) in new buildings and the latest compliance date is January 1, 2033 for high temperature units in existing buildings.
* Building Efficiency Codes & Standards
  + - Updates to Title 24 2025 were adopted on September 11, 2024. Code updates focused on:
      * Requiring solar thermal pool heating for single family, multifamily, and hotel/motel pool applications except where at least 60% of the thermal energy comes from on-site renewable energy or site recovered energy
      * Using heat pumps for space heating and water heating in single family residences and locking out supplemental (electric or gas-fired) heating above certain outdoor air temperatures.
      * Encouraging electric ready buildings for water heating and cooking.
      * Updating photovoltaic and battery storage standards.
      * Updating space conditioning system controls requirements for nonresidential buildings.
      * Updating ventilation requirements in multifamily buildings to improve air quality.
      * The standards allow for flexibility in taking alternative but equally efficient approaches for space heating and water heating which means gas-fired heat pumps could still be a viable option to use to meet Title 2025 standards[[4]](#footnote-5).

The 2025 Annual Research Plan sets forth the priority technology areas that will be investigated in 2025. These areas were selected to align with California’s strategic goals and focus on the end-uses and customer segments that offer the greatest potential for energy savings. As with the prior research plan, there are certain programmatic limits to research areas. The following areas are not in scope for GET:

* Net power generation
* The utility side of the meter (“In front of the meter”)
* Early R&D (typically less than TRL 8)
* Projects that do not save therms or do not help overcome barriers to saving therms
* Technologies that use non-IOU supplied gas (i.e., propane)

Natural gas usage across the three gas Investor-Owned Utilities (IOUs) – Pacific Gas and Electric (PG&E), San Diego Gas and Electric (SDG&E) and Southern California Gas Company (SoCalGas) – varies widely. For example, more than 60 percent of gas usage in PG&E territory occurs within the industrial customer base while industrial customers in SDG&E territory only account for 5 percent of gas usage. Table 1 shows gas usage by customer segment for each IOU[[5]](#footnote-6).

**Table 1.** Natural Gas Usage by Customer Segment

|  |  |  |  |
| --- | --- | --- | --- |
| Customer Segment | PG&E | SDG&E | SoCalGas |
| Commercial | 8% | 22% | 8% |
| Public | 1% | 16% | 3% |
| Industrial | 66% | 5% | 25% |
| Agricultural | 5% | 1% | 2% |
| Residential | 20% | 57% | 52% |

Gas usage within these segments varies but is generally comprised of water heating, space heating, process heating, and cooking equipment. Table 2 provides Gas Energy Use Intensities by building type using the Commercial End Use Survey (CEUS) 2022. Table 3 provides the fuel shares from gas-consuming end-uses from CEUS 2022 data. The 2022 CEUS data does not provide gas or electric energy intensity by end-use like the 2006 data did. Table 4 provides Unit Energy Consumption data as reported in the 2019 Residential Appliance Saturation Survey.

**Table 2.** Commercial Natural Gas Energy Floorspace, Intensities, and Usage by building type using CEUS 2022 data Appendix K[[6]](#footnote-7).

|  |  |  |  |
| --- | --- | --- | --- |
| Building-type | Floorspace (ksqft) | Gas Energy Intensity (kBTU/sqft) | Gas Usage (Therms) |
| College | 340,848 | 56.17 | 191,468,382 |
| Food Stores | 228,538 | 57.42 | 131,225,728 |
| Health Care | 430,830 | 61.75 | 266,053,842 |
| Lodging | 443,933 | 33.91 | 150,520,296 |
| Miscellaneous | 1,595,232 | 32.68 | 521,248,748 |
| Office, Large | 1,243,531 | 18.02 | 224,051,256 |
| Office, Small | 729,221 | 18.41 | 134,268,858 |
| Ref. Warehouse | 137,044 | 3.56 | 4,882,188 |
| Restaurant | 211,663 | 206.73 | 437,560,506 |
| Retail | 1,038,308 | 7.13 | 74,011,836 |
| School | 648,977 | 10.50 | 68,152,446 |
| Warehouse | 1,142,342 | 4.10 | 46,871,192 |
| All Commercial | 8,190,467 | 27.47 | 225,031,528 |
| All Office | 1,972,752 | 18.16 | 35,832,011 |
| All Warehouse | 1,279,385 | 4.05 | 5,175,338 |

**Table 3. C**ommercial Gas Consuming End Uses from 2022 CEUS Appendix K[[7]](#footnote-8)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| End Use | Planning Area | Sector | Percent Floorspace with End Use | Gas Fuel Share | Saturations (Gas) |
| Cooking, Major | Statewide | All Commercial | 4% | 69% | 2% |
| Cooking, Minor | Statewide | All Commercial | 96% | 1% | 1% |
| Heating | Statewide | All Commercial | 76% | 69% | 53% |
| Water Heating | Statewide | All Commercial | 95% | 58% | 55% |
| Cooking, Major | Statewide | College | 1% | 74% | 1% |
| Cooking, Minor | Statewide | College | 89% | 2% | 1% |
| Heating | Statewide | College | 98% | 86% | 85% |
| Water Heating | Statewide | College | 98% | 77% | 75% |
| Cooking, Major | Statewide | Food Stores | 4% | 68% | 3% |
| Cooking, Minor | Statewide | Food Stores | 100% | 1% | 1% |
| Heating | Statewide | Food Stores | 81% | 63% | 51% |
| Water Heating | Statewide | Food Stores | 99% | 67% | 66% |
| Cooking, Major | Statewide | Health Care | 2% | 72% | 1% |
| Cooking, Minor | Statewide | Health Care | 100% | 2% | 2% |
| Heating | Statewide | Health Care | 99% | 81% | 80% |
| Water Heating | Statewide | Health Care | 100% | 88% | 88% |
| Cooking, Major | Statewide | Lodging | 1% | 64% | 1% |
| Cooking, Minor | Statewide | Lodging | 100% | 1% | 1% |
| Heating | Statewide | Lodging | 99% | 57% | 56% |
| Water Heating | Statewide | Lodging | 100% | 90% | 90% |
| Cooking, Major | Statewide | Miscellaneous | 1% | 59% | 1% |
| Cooking, Minor | Statewide | Miscellaneous | 94% | 2% | 2% |
| Heating | Statewide | Miscellaneous | 67% | 70% | 47% |
| Water Heating | Statewide | Miscellaneous | 93% | 59% | 55% |
| Cooking, Minor | Statewide | Office, Large | 99% | 1% | 1% |
| Heating | Statewide | Office, Large | 92% | 86% | 78% |
| Water Heating | Statewide | Office, Large | 100% | 62% | 62% |
| Cooking, Minor | Statewide | Office, Small | 95% | 1% | 1% |
| Heating | Statewide | Office, Small | 91% | 56% | 51% |
| Water Heating | Statewide | Office, Small | 93% | 49% | 46% |
| Heating | Statewide | Ref. Warehouse | 18% | 23% | 4% |
| Water Heating | Statewide | Ref. Warehouse | 96% | 32% | 31% |
| Cooking, Major | Statewide | Restaurant | 100% | 71% | 71% |
| Cooking, Minor | Statewide | Restaurant | 100% | 2% | 2% |
| Heating | Statewide | Restaurant | 90% | 65% | 58% |
| Water Heating | Statewide | Restaurant | 100% | 79% | 79% |
| Heating | Statewide | Retail | 79% | 58% | 46% |
| Water Heating | Statewide | Retail | 89% | 41% | 36% |
| Cooking, Major | Statewide | School | 4% | 61% | 2% |
| Cooking, Minor | Statewide | School | 100% | 4% | 4% |
| Heating | Statewide | School | 98% | 74% | 73% |
| Water Heating | Statewide | School | 100% | 72% | 72% |
| Heating | Statewide | Warehouse | 29% | 51% | 15% |
| Water Heating | Statewide | Warehouse | 91% | 30% | 27% |

**Table 4.** Average AnnualResidential Unit Energy Consumption (therms) by End Use using 2019 RASS data Table 33[[8]](#footnote-9)

| Building Type | Water Heating | Space Heating | Pool/Spa Heating | Dryer | Cooking |
| --- | --- | --- | --- | --- | --- |
| Single Family | 258 | 189 | 200 | 11 | 25 |
| Townhome | 257 | 83 | 179 | 19 | 22 |
| 2-4 Unit Apt. | 246 | 69 | 210 | 18 | 24 |
| 5+ Unit Apt. | 248 | 53 | 177 | 17 | 21 |
| Mobile Home | 253 | 144 | 220 | 17 | 19 |

The data in Tables 1 through 4 show the greatest gas usage within the miscellaneous, restaurant, and healthcare building types. The end-use with the highest saturation of natural gas is water heating in lodging, health care and colleges.

As shown in Figure 1, the Draft 2023 Potential & Goals study shows the greatest near-term energy savings potential from behavioral/retrocommissioning/operational (BRO) measures, process heating improvements, water heating equipment and whole building retrofits. The potential for process heating is diminished over the longer term but largely offset by an increase in potential for space heating and whole building retrofits.

**Figure 1:** Gas Energy Efficiency Potential (2020-2032)

A screenshot of a graph

Description automatically generated

In D.21-09-037, the CPUC provided direction that energy efficiency portfolios will be evaluated on a new metric of Total System Benefit (TSB). As shown in Figure 2, energy efficiency potential as measured by TSB provides a similar conclusion as in Figure 1 with whole building retrofits, water heating equipment and process heating providing the highest overall level of benefit.

**Figure 2:** Gas TSB Potential (2020-2032)

A graph of different colored bars

Description automatically generated with medium confidence

The Potential & Goals Study identifies many measures within these end-use categories that have the highest potential for energy savings through 2030 as listed in Table 4.

**Table 5:** Measures with High Potential for Therm Savings (2022-2030)

|  |  |  |  |
| --- | --- | --- | --- |
| Commercial | Industrial | Residential | Other |
| Ozone Laundry System | Heat Recovery | Tankless Water Heater | Generic Custom Measures |
| Energy Star Fryer | Boiler Controls | HERS | Strategic Energy Management |
| Condensing Gas Boiler | Insulation | ZNE Building | Building Operator Certification |
| Water Pipe Insulation |  | Water Heating Controls |  |

Many of these technologies are further documented as priority items in the Technology Priority Maps (TPMs)[[9]](#footnote-10).

# GET Program Vision

GET’s vision is to investigate natural gas energy efficiency technologies that have the added potential to enact a positive impact on global climate change and achieve statewide greenhouse gas emissions reduction targets. GET achieves its vision in a collaborative fashion engaging technology developers and other relevant stakeholders to align California’s gas IOUs needs with manufacturer product development efforts and ultimately deliver energy-saving technologies to the market that deliver customer value.

# Purpose of the Research Plan

The Annual Research Plan acts as a research roadmap for the coming year’s projects under the GET program. The Annual Research Plan is used to identify strategic research needs that are appropriate for investment by California’s gas utility customers. The plan identifies key research needs and solicits information from the GET Technical Advisory Group (TAG) as guidance to ensure the plan has industry involvement. The 2025 Plan has five overarching goals that balance the long-term impacts of the EE Action Plan with the near-term impacts of EE savings potential. Using the plan as a roadmap to guide 2025 activities, individual Project Plans will be developed for discrete projects that support each goal area. The goal for the 2025 Plan is to initiate eight (8) emerging technology projects.

# Development of the Plan

The 2022 Annual Research Plan was the inaugural plan for the GET Program. The plan was informed by pre-existing information such as the current gas TPMs, the 2020-2021 Research Project Summaries prepared by Utilization Technology Development, NFP[[10]](#footnote-11) and input provided by the GET Program team. This information was compared against California legislative and policy direction to identify near-term technology opportunities that aligned with the state’s climate change agenda.

The 2023 Annual Research Plan was revised based upon the 2022 research that was completed or was still in progress and additional input from the TAG and GET Program team over the course of 2022.

The 2024 Annual Research Plan was refined based upon findings from several market studies and further scanning and screening activities in the industrial, agricultural, and cross-cutting sector.

Several 2024 goals and objectives were removed from the 2025 Annual Research Plan because further analysis showed specific technologies were not a good fit for the limited GET program funding and/or development phase (TRL). Some of these may return in subsequent years once they are more market ready. Additionally, many goals which were not removed remain the same as in 2024 due to delays in customer recruitment and/or contracting which delayed field installations.

# Managing the Plan

The Annual Research Plan is a living document that is updated each calendar year. Typically, the plan is prepared in Q4 with feedback solicited from the TAG and other stakeholders, and the final draft is issued in January. The current version of the plan (2025 V1.0) will be posted on the [GET program website](https://cagastech.com/).

# 2022-2024 Research Outcomes & Findings

Between 2022 and 2024 (to-date), research was undertaken in the following areas (this includes completed and active projects):

* Cooking Equipment: (1) project
* HVAC: (3) projects
* Miscellaneous: (2) projects
* Process Loads: (5) projects
* Water Heating: (17) projects
* Whole Building: (5) projects

Final reports are posted at: [Home | Emerging Technologies (ca-etp.com)](https://ca-etp.com/). For further information on these findings, see the final project reports expected in 2024. These will be posted on [Projects | Emerging Technologies (ca-etp.com)](https://ca-etp.com/projects-public).

One change we are making for 2025, is to have more “agile” research projects that are short paper studies to evaluate the potential for specific technologies and/or approaches before we launch broader projects to quantify them. In many cases, these research topics may not be known ahead of time, although where known, we plan to include them here.

# 2025 Research Goals

The 2025 Annual Research plan includes new and ongoing research into the following technology areas: water heating, HVAC, foodservice, industrial/agriculture process, and cross-cutting equipment.

## Water Heating Technologies

Goal 1 and 2 from the 2022 and 2023 Research Plans were both for water heating technologies. The 2022 and 2023 research yielded extensive information on the gaps in existing and emerging technologies as well as the readiness of the emerging technologies.

Work on the 2024 goals has continued and the 2025 goals for this technology area remain the same. The goals are separated because the objectives and outcomes for underutilized existing technologies (Goal 1) versus emerging technologies (Goal 2, Goal 3, Goal 4) are very different.

### Goal 1.1: Improve adoption of existing water heating technologies in multiple market segments

There are several existing water heating technologies offered in EE programs which have historically seen low participation, and there are some measure offerings that have potential gaps in energy impacts. One specific gap is the lack of gas savings for the measure SWWH022: Smart Pump, Residential. Additionally, the GET Team experienced many delays in customer recruitment to achieve the objectives in Goal 1, so this goal and its objective remains in 2025 the same as it was in 2024.

#### Objectives

1. Perform field studies of existing water heating EE offerings in the multifamily sector where there is a data gap for being able to claim gas savings for controls measures (e.g., Smart Pump)

### Goal 1.2: Provide data for updated and new measure offerings of emerging water heating technologies

The water heating technologies that had been selected for further investigation in 2022 were:

* Gas-Fired Absorption Heat Pump Water Heater & Combi
* Gas-Fired Adsorption Heat Pump Water Heater
* Gas-Fired Thermal Compression Heat Pump Water Heater & Combi

In 2022, The manufacturers for the Gas-Fired Adsorption Heat Pump Water Heater and Thermal Compression Heat Pump Water Heater & Combi were working with other entities to develop, test and study their equipment. It was determined in 2023 by the GET Team that the GET program will remain appraised of developments with these two technologies but would not move forward with testing at that time as it could be redundant to testing being done by other organizations and is earlier in TRL than what the program focuses on. In 2024, the start-up developing the Gas-Fired Adsorption Heat Pump Water Heater was ready to engage with the GET program for some Beta laboratory testing. Therefore, the technologies selected for further investigation in 2025 are:

* Gas-Fired Absorption Heat Pump Water Heater & Combi
* Gas-Fired Adsorption Heat Pump Water Heater

There are two (2) manufacturers with commercially available Gas-Fired Absorption Heat Pump Water Heaters in the United States as of 2023 and the GET program has projects to test both in the lab and the field. There is one manufacturer with a Gas-Fired Adsorption Heat Pump Water Heater that is at TRL (6) and the GET program will test this unit in a lab.

Initial research in 2022 indicated the need for performance curve data for current equipment available in the U.S. market, installation configuration and cost data, maintenance requirement information, contractor training, contractor & customer awareness campaigns, and CO2 load shapes for these technologies. The GET program has been collecting data to generate performance curves in 2023-2024 and will continue to do so in 2025.

The gas-fired absorption heat pump water heater has an existing Measure Package (MP) SWWH033 for only the multifamily (MF) sector. This measure package will require updates based on field study as well as inclusion of other market segments/building types. The goal of this effort is to support the expansion of this existing Measure Package for additional building types and development of new measure packages for combination systems and other system types (adsorption and thermal compression).

With increased trials of natural-gas hydrogen blends being conducted both in the United States and in other countries, the program has recognized the need to start looking at the impacts of these blends. While there is laboratory testing of safety and burner efficiency using these blends, the impacts that these blends have on overall system performance in blends up to about 30% hydrogen have limited test data that can be applied to potential measures and/or applications. In 2024 and expanding in 2025, the program will collect lab data from these technologies to complement existing natural gas only data.

Lab testing of the Gas-Fired Absorption Heat Pump Water Heater was completed in 2024, and one field study for the same unit will be completed in Q1 2025. Several other field studies for the Gas-Fired Absorption Heat Pump Water Heater are in process or in the pipeline, and the objectives for those tests remain the same as 2024. The GET program will also be testing a second Gas-Fired Absorption Heat Pump Water Heater unit in the lab and has added testing with Hydrogen blends to the testing objectives. The 2025 objectives are listed below:

#### Objectives

1. Create steady state and dynamic performance curves for gas-fired heat pump technologies via lab work by collecting data from natural gas and hydrogen blends
2. Generate operational understanding of gas heat pump technologies as required for the measure package update and to better understand system sizing, real time operational issues, and provide an understanding of hourly CO2 emissions from realistic operating patterns.
3. Gather gas-fired heat pump system design sizing, and installation cost data.
4. Gather other information on gas-fired heat pumps to facilitate technology transfer to EE programs such as:
   1. Typical applications
   2. Typical installation configurations
   3. Typical maintenance requirements
   4. Required installation and maintenance contractor training
   5. Case studies of successful field studies
5. Create CO2 hourly load shapes for gas-fired heat pumps relative to electric heat pumps.

### Goal 1.3: Provide modeling support and analysis for emerging water heating technologies

Measure Package (MP) SWWH033 was created to document deemed savings values for the existing gas-fired absorption heat pump water heater uses. When this measure package was developed, several modeling tools were used to estimate savings because no one tool had the capability of modeling gas heat pumps explicitly. Additionally, the DEER building prototypes that were used were developed in eQuest (DOE2.1), are outdated, and have now been replaced.

In 2023, the gas air-cooled heat pump object for EnergyPlus was released. Additionally, the residential and commercial building prototypes used in the eTRM were updated to Energy Plus, which will facilitate improved modeling of these systems. The GET program has two projects underway to use the gas air-cooled EnergyPlus object with data collected through the laboratory. These projects have uncovered some bugs in the EnergyPlus object and have spurred conversations about how to use the object to accurately model real-life hot water systems (DHW and space heating)- especially in multifamily environments. Current efforts will continue into 2025, and another objective to disseminate best practices when using the EnergyPlus object was added for the 2025 research plan.

In addition, there are several expected policy and code changes that will influence market adoption combined with efforts by the North American Gas Heat Pump Collaborative (NAGHPC) to further push these new emerging technologies. An understanding of these combined impacts at scale would help policy makers better understand the impacts of any proposed policy changes.

There were delays in field and lab study initiation so the objectives in this goal remain the same as 2024.

#### Objectives

1. Facilitate testing of the GTI developed EnergyPlus air cooled gas absorption heat pump model with field and lab data.
2. Utilize field and lab test data to calibrate the GTI developed EnergyPlus model.
3. Use NREL’s Restock to project scale impacts in California due to existing, emerging technologies and code gas savings and emissions through 2030.
4. Provide outreach on the availability of modeling tools and potential impacts.
5. Disseminate best practices for using the gas air-cooled heat pump object in DHW, space heating, and combination applications in EnergyPlus models

### Goal 1.4 Analyze potential for GAHP applications for Pool heating

The GET program has a project underway to address this goal, but since it is not complete, the objectives remain unchanged from the 2024 plan. Pool heating has traditionally been provided with gas fired heaters and/or solar water heaters as these are low-cost options. There are now several new technologies to heat pools – GAHPs, electric heat pumps (EHPs), and hybrid gas-electric units. There is an opportunity to explore if these make sense technically, cost effectively and operationally. This may be a good pairing with GAHP supply temperatures. Additionally, the time-of-day emissions relative to electric heat pumps and or hybrid units is of interest.

#### Objectives

1. Review available technologies and understand potential barriers to implementation.
2. Review available technologies and do some initial analysis of their viability in this application.
3. Perform analysis to understand potential design scenarios, including GAHP and solar/GAHP applications to assess their viability.
4. Perform an analysis to compare emissions for GAHP vs EHPS to understand timing and impacts due to time-of-day use.
5. Initiate field work to quantify real time operation and challenges associated with this application.

## HVAC

The 2024 HVAC goals included the study of additives for hydronic space heating as well as the study of “Combi” (water and space heating) systems that would be targeted to multifamily and/or small commercial applications. There were delays in site recruitment in 2024, so the goals for both Goal 2.1 and 2.2 remain unchanged from 2024 (Goal 2.2 is Goal 2.3 from the 2024 Research Plan).

### Goal 2.1: Validate energy savings from hydronic space heating fluid additives

The GET program has a field study underway test a hydronic space heating fluid additive that claims to save 10% or more on boiler energy use by increasing the heat transfer effectiveness from the fluid piping to the heating air. This project is expected to be completed in Q3 2025, so the objectives remain the same as 2024.

#### Objectives

1. Validate energy savings from the fluid additive from field testing.
2. Based upon output from this study, determine how this potential measure could be used in existing programs and what additional support is needed (measure package development, custom calculation tool, etc.).

### Goal 2.2: Explore the application of combi systems in California

There are multiple systems that have been studied for domestic hot water heating applications only; however, the same technologies can also be leveraged for both space heating and cooling, hence the name “combi” systems. These are mostly proposed for residential applications but could be applied for commercial applications as well. This goal remains unchanged for 2025 because there have been delays in recruitment for a combination system utilizing a gas-fired heat pump technology.

#### Objectives

1. As part of field-testing work planned for water heating, quantify applications where the GAHP systems serve more loads than just water heating.
2. Explore related applications and requirements for these systems to be applied in multifamily and commercial applications.

### Goal 2.3: Explore Gas Furnace Optimization Measures

There currently are no California deemed measures for furnace tune-ups or right sizing in either the residential or commercial sectors. With a large based of installed base of furnaces, there is the potential to optimize the existing equipment by performing tune-ups to ensure the burners, ignition and airflow are properly adjusted and/or right size replacement furnaces.

#### Objectives

1. Review prior collected data and regulatory decisions to determine if there is adequate data and policy allowance for developing deemed measure(s) for tune-ups and/or right sizing. ACCA 5 or other consensus standards may be leveraged.
2. Based upon the outcome of number one, scope additional field study to support the development of a measure package.

## Commercial Foodservice

Goal 3 from the 2022 Research Plan was related to residential cooking and commercial foodservice. A market characterization study for commercial foodservice (CFS) was launched and has been completed. The GET program decided not to pursue further testing of CFS technologies from that market study. However, a new goal has been identified to gather data to examine the GHG intensities of commercial cooking equipment.

### Goal 3.1: Analyze GHG Intensity of Gas-Fired Cooking Equipment

Title 24 2025 CASE studies include proposed measures that would require commercial kitchens to be electric-ready. The avoided cost calculator (ACC) shows that the marginal grid-emissions are higher in the evening hours than the morning hours. Therefore, the GET program has added a goal to examine the load profiles of commercial kitchen equipment and compare them to the grid-emissions profiles and noting potential peak grid impacts for electrification.

#### Objectives

1. Gather field data on commercial kitchen cooking equipment load profiles.
2. Compare emissions for gas-fired commercial cooking equipment to electric-fired commercial cooking equipment.
3. Gather information to determine whether or not to launch a broader CFS study.

## Industrial and Agriculture Processes

Scanning and screening work was initiated in 2022 to identify emerging technologies in this sector and is still on-going. In 2023, the GET program completed market assessment projects to identify and focus on underutilized boiler add-on measures. Additional market study projects were launched in 2023 for several potential agriculture and process applications but have been delayed due to lack of customer and SME input. Promising technologies were and or soon will be identified from these projects and further field testing is planned. Additionally, scanning and screening in this sector revealed other technologies for which additional testing is planned. 2024 had many challenges in getting information for this area, so we have left these goals in place with few changes.

### Goal 4.1: Scope and test natural gas end-use process in the industrial and agriculture sectors

This is a revised goal from the 2022 research plan to address new potential technologies we have identified and possibly to try again to launch a steam trap monitoring field testing project after multiple challenges in getting industry participation but re-inspired by hearing one customer who’s internal pilot had failed.

#### Objectives

1. Complete efforts to scan and screen emerging technologies that address process loads.
2. Identify technologies and controls that can provide “off the shelf” “deemed” high efficiency solutions to existing applications especially for small industrial and agriculture customers. These may include one or more of the following:
   1. Dual condensate return boilers
   2. Ceramic boiler heat exchangers
   3. Underutilized add-on technologies (steam trap monitoring) or new style of venturi steam traps may allow for a deemed or hybrid custom solution
   4. Process controls
   5. Thermal imaging
   6. Explore one of five different potential new measures identified in the CEA segment, which includes additional research and/or field work on rootzone heating.
3. Identify the needed steps and gaps to support new measures.
4. Initiate as needed fieldwork to fill in existing gaps.

### Goal 4.2: Improve product/operational efficiency of natural gas end-use process in the industrial, agriculture sectors

There are multiple process technologies that are being studied in 2023. In addition to looking for new technologies, we are aware of an industrial GAHP for process loads that would be a good candidate for field testing and evaluation. As part of this new goal, we plan to target one or more emerging or underutilized technologies to demonstrate their effectiveness.

#### Objectives

1. Prioritize a process improvement project that could leverage new/underutilized technologies to improve process efficiency.
2. Assess viability of these potential solutions.
3. Scope work with customer and/or vendors.
4. Do groundwork to launch a field study.

## Cross-Cutting

Numerous technologies have emerged as having applicability to multiple sectors and/or end use technologies. In 2023, a new category was created to capture those. As some of the products have lower TRLs, the GET program has re-focused on products that are at TRL 8 or higher and have updated this goal accordingly. The list below summarizes some of the technologies warranting greater focus in 2025:

1. Ultra Low NOx and Low NOx Burners: Goal 3 of the 2022 Research Plan included objectives that were related to Low-NOx burners. A study completed for low-NOx burners in 2023 found that burners are applicable to multiple sectors and end uses and they should have their own category. These have the potential to both reduce NOx and related emissions, but also slightly increase the efficiency of the device. Different variants can run with pure hydrogen and/or nearly eliminate NOx. Successful testing of an Ultra Low NOx Burner this was completed in 2024, but we will likely have some follow-up work including addressing running these burners with pure hydrogen and/or hydrogen blends and assessing the viability of their application in boiler retrofits for EE programs.
2. Carbon Capture: While much of the effort for carbon capture is being looked at for industrial-scaled projects or industrial power generation, which is out of scope for GET, there are technologies that focus on carbon capture for demand side uses. In some cases, these take extra energy to remove the captured carbon, while in others, they have an energy efficiency component in addition to carbon capture. They can also produce useful by-products. These projects were delayed for various reasons, but the hope is to launch these in Q1 of 2025.
3. Hydrogen Blending: Hydrogen blending has the potential to decrease GHG emissions for gas-fired appliances without the immediate need to replace the appliances. This is not technology-specific so it has been placed in this cross-cutting section. One pertinent question for Hydrogen-blending is the overall Total System Benefit (TSB) for equipment firing blends of Natural Gas and Hydrogen.

### Goal 5.1: Reduce the emissions of gas-fired equipment

Ultra Low NOx and Low NOx burners are used across the water heating, space heating, CFS and industrial sectors to reduce or eliminate emissions. More information is needed to understand what role the GET program can play to further advance these technologies.

#### Objectives

1. Scope technologies that can reduce the emissions of gas-fired HVAC equipment.
2. Determine the technology readiness level of each technology.
3. Determine to which end-uses each technology may apply.
4. Determine which technologies require further testing and analysis.
5. Perform field testing to quantify emissions reductions and energy efficiency improvements.

### Goal 5.2: Quantify Carbon Capture Technologies

There is at least one technology that is commercially available and is intended to reduce carbon and increase energy efficiency of a boiler system. There are other technologies that may also provide demand side GHG reduction in this field as well. There is little data on field performance in terms of efficiency gains and carbon reduction. GET could facilitate a greater understanding of this technology.

#### Objectives

1. Scan and review the full list of applicable technologies in this space.
2. Determine technology readiness level of each technology.
3. Quantify potential for EE savings.
4. Quantify potential for carbon reduction and product barriers.
5. Understand the dynamics of the supply chain for these approaches.
6. Perform field testing to quantify in-field performance.

### Goal 5.3: Quantify TSB impacts for Hydrogen Blending

Existing appliances can utilize blends of Natural Gas and Hydrogen up to about 30% without needing any modifications. This reduces their emissions without adding an extra cost to replace the appliance. However, there is a cost to create and blend the Hydrogen into the Natural Gas pipeline. This goal was added to start quantifying the TSB impacts of burning Hydrogen -blended Natural Gas in consumer appliances.

#### Objectives

1. Estimate costs to blend Hydrogen into the SoCalGas, SDG&E, and PG&E pipeline
2. Estimate emissions to burn Hydrogen-blended Natural Gas in existing appliances
3. Quantify TSB impacts from burning Hydrogen-blended Natural gas in existing appliances

1. <https://efiling.energy.ca.gov/GetDocument.aspx?tn=231261&DocumentContentId=62916> [↑](#footnote-ref-2)
2. An “exempt” gas measure is one that does not burn natural gas but still has natural gas savings. For example, insulation. [↑](#footnote-ref-3)
3. https://ww2.arb.ca.gov/sites/default/files/2022-08/2022\_State\_SIP\_Strategy.pdf [↑](#footnote-ref-4)
4. <https://www.energy.ca.gov/sites/default/files/2024-09/2025_California_Energy_Code_Fact_Sheet_ada.pdf> [↑](#footnote-ref-5)
5. PG&E, SDG&E and SoCalGas Energy Efficiency Business Plans, 2017 [↑](#footnote-ref-6)
6. <https://www.energy.ca.gov/sites/default/files/2024-02/Appendix%20K%20-%20Results%20at%20Building-type%20and%20End-Use%20Levels_ada.xlsx> [↑](#footnote-ref-7)
7. See Note 8 [↑](#footnote-ref-8)
8. https://www.energy.ca.gov/sites/default/files/2021-08/CEC-200-2021-005-ES.pdf [↑](#footnote-ref-9)
9. <https://cagastech.com/sites/default/files/TPM%20Redacted%207-10-23.xlsx> [↑](#footnote-ref-10)
10. [↑](#footnote-ref-11)