

High-Performance Measure Details

Measure Name Alternate Electric Process Heating for Industrial and Covered-Process Applications	Use Category Process Electrification
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Measure Code LM405	Measure Stage Early Adoption & High Priority Data Collection

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Technology Summary

Alternate electric process heating systems use electricity as the primary process heating energy source in place of conventional fossil-fuel-fired industrial or covered-process heating equipment. For CEDA, this measure supports electrification and decarbonization in new construction and major process-load applications where process heating would otherwise be served by natural gas, propane, fuel oil, or other on-site combustion systems. Eligible applications may include electric regenerative thermal oxidizers, electric thermal oxidizers, electric process ovens, electric curing systems, electric resistance process heating, or other non-combustion process heating technologies that are not otherwise addressed by a separate CEDA high-performance measure.

This measure matters for California decarbonization because industrial and process heating loads can be difficult to electrify, particularly where equipment is custom, process-integrated, high-temperature, or dependent on facility-specific operating schedules. New construction provides an important opportunity to coordinate electrical service capacity, process equipment selection, controls integration, ventilation and exhaust requirements, and utility infrastructure before project design is locked in. By supporting early adoption of alternate electric process heating, this HPM can help reduce on-site combustion, improve market understanding of industrial electrification pathways, and generate useful implementation and performance data for future Codes and Standards efforts.

Common real-world implementation gaps this HPM is designed to address include limited familiarity with electric alternatives to gas-fired process equipment; uncertainty around electrical service capacity and peak load impacts; incomplete comparison of gas-fired baseline and electric measure case options; lack of consistent process energy, cost, and operating data; custom equipment configurations that make standard eligibility review difficult; and insufficient planning for metering, controls access, and post-occupancy performance review. The measure is intended to support projects that can clearly identify the process heating scope, document the conventional fossil-fuel baseline being avoided or replaced, and provide enough design and cost information to support CEDA review.

This HPM is not intended to cover microwave, radio-frequency, dielectric, or similar electromagnetic volumetric-heating technologies where the primary process benefit is material-selective volumetric heating, drying, thawing, tempering, curing, pasteurization, sterilization, freeze drying, or related microwave/RF process treatment. Those applications are expected to be addressed under a separate CEDA high-performance measure for microwave heating and other electric drying technologies. Relevant standards and requirements may include, as applicable, NFPA 70, NFPA 86, UL 508A, OSHA requirements, local fire and building code requirements, air-quality permitting requirements, and manufacturer-specific installation and operation requirements.

Alignment with CEDA Program Goals

The CEDA program supports the implementation of energy efficiency measures that support Code Readiness' Long Term Tactical Plan (LTTP) to drive the goals of electrification, decarbonization, and load reduction.

Projects must meet one of the CEDA Inducement Requirements identified in the next section to receive an inducement on the equipment and will be evaluated for level of interest in metering to support Code Readiness Objectives.

This measure meets the CEDA program goals as follows:

- **Building partnerships with market stakeholders** by consulting on innovative technologies and best practices in energy efficiency which can lead to the development of more effective solutions and accelerate the adoption of new technologies. As teams adopt the measure, this increases the volume of engineers able to design the equipment, contractors capable of installing the equipment, and owners able to operate the equipment.
- **Increasing the supply of high-performance measures and all-electric buildings** by combining electrification with energy efficiency that can result in projects implementing measures to achieve greater energy savings, reduced emissions, and overall improved building performance. As more projects specify and install alternate electric process heating designs for industrial applications, this helps to increase the overall supply of alternate electric process heating systems in the market for others to use, including beyond new construction.
- **Increasing the demand for high-performance measures and all-electric buildings** by pushing for electrification that drives the need for technological advancements, supporting economic growth opportunities through innovation, and raising awareness of the benefits of electrification to increase consumer adoption. As demand in the market increases for newer technologies, the long-term benefit is increased demand for manufacturers and suppliers to provide additional options available in the market.
- **Advancing new high-performance measure technology** by raising public awareness about new technologies and their benefits, helping build acceptance and demand through market support advocacy efforts that can influence stakeholder decisions that enable technological innovation.
- **Providing Codes & Standards with projects of interest** to collect metered data that will inform future California energy codes.

CEDA Inducement Requirements

This measure is intended to address a market and implementation gap associated with electrifying industrial and covered-process heating loads that are commonly served by fossil-fuel-fired equipment. Process heating systems are often custom or semi-custom, closely integrated with production requirements, and influenced by site-specific operating schedules, utility infrastructure, safety requirements, and permitting constraints. As a result, project teams may have limited familiarity with electric alternatives, and qualifying systems may require additional design coordination, electrical infrastructure planning, vendor engagement, and documentation beyond conventional gas-fired process heating approaches.

This HPM supports alternate electric process heating systems that replace or avoid conventional on-site combustion for a defined industrial, agricultural, laboratory, manufacturing, or covered-process application. Eligible systems may include electric regenerative thermal oxidizers, electric thermal oxidizers, electric process ovens, electric curing systems, electric resistance process heating, or other qualifying non-combustion process heating technologies that are not otherwise addressed by a separate CEDA high-performance measure.

Inducement eligibility is determined by compliance with the applicable **System Design Requirements** and **Supporting Documentation Requirements** below, with final eligibility verified through the CEDA review process. Incremental cost is expected to be project-specific and may be evaluated using the cost difference between the qualifying electric process heating system and the documented conventional fossil-fuel-fired process heating baseline. Program inducement may consider avoided therms, estimated energy impacts, emissions reduction potential, and Code Readiness data value, subject to CEDA review.

System Design Requirements

1. Essential Level: Alternate Electric Process Heating

- 1.1. The project shall provide a qualifying electric process heating system serving a defined industrial, agricultural, laboratory, manufacturing, or covered-process application.
- 1.2. The qualifying system shall use electricity as the primary process heating input for the eligible process heating scope.
- 1.3. The qualifying system shall replace, avoid, or materially reduce a conventional fossil-fuel-fired process heating baseline that would otherwise be used for the same process heating application.
- 1.4. The qualifying system shall be designed for the applicable process operating conditions, including relevant temperature range, heating capacity, throughput, operating schedule, ventilation or exhaust requirements, controls, and safety requirements.
- 1.5. Fossil-fuel-fired equipment shall not be used as the normal operating strategy for meeting the eligible process heating load. Any combustion-based backup, pilot, purge, safety, or supplemental system shall be separately identified and shall not serve as the primary process heating source for the qualifying scope.
- 1.6. The qualifying system shall comply with applicable electrical, fire, building, occupational safety, environmental, air-quality, and permitting requirements, as applicable to the specific process and equipment type.
- 1.7. The project shall coordinate electrical service capacity, panel or switchgear capacity, branch-circuit requirements, controls integration, and equipment location requirements necessary to support the qualifying electric process heating system.
- 1.8. The qualifying scope shall not include microwave, radio-frequency, dielectric, or similar electromagnetic volumetric-heating technologies intended to be addressed under a separate CEDA high-performance measure for microwave heating and other electric drying technologies.

2. **Premium Level: Metering-Ready Alternate Electric Process Heating**
 - 2.1. The project shall meet all Essential Level requirements.
 - 2.2. The qualifying system shall be designed to support future Code Readiness monitoring, if selected by PG&E or the CEDA program team.
 - 2.3. The project shall provide metering-ready design provisions for the qualifying process heating system, such as dedicated electrical panels, submetering points, BAS/EMS trend points, manufacturer control outputs, data ports, or other practical means of collecting equipment energy and operating data.
 - 2.4. The project team shall identify available operating data points that may support future performance review, such as equipment power, runtime, operating mode, process temperature, exhaust or process airflow, production schedule, throughput, setpoints, or other process-specific indicators, where available.
 - 2.5. The project team shall be willing to support Code Readiness follow-up if selected, which may include providing implementation feedback, design and cost context, operating insights, or case study support.

Supporting Documentation Requirements

For all qualifying projects, the following documentation shall be provided, as applicable to the project scope:

1. **Construction drawings or process design documents** identifying the qualifying electric process heating system, equipment location, electrical service connections, controls, and process served.
2. **Equipment submittals, manufacturer specifications, or vendor documentation** identifying the qualifying system type, electric input capacity, process heating capacity or throughput, operating temperature range, controls, and applicable safety or installation requirements.
3. **Narrative description of the eligible process heating application**, including the process served, operating schedule, expected production or throughput basis, and how the electric system will be used during normal operation.
4. **Basis-of-design documentation** describing the conventional fossil-fuel-fired process heating system that is being replaced or avoided, such as prior standard practice, owner/design team basis of design, vendor comparison, or other project-specific documentation.
5. **Electrical design documentation** showing that the qualifying electric process heating system has been coordinated with project electrical service, distribution equipment, panels, switchgear, controls, and other required infrastructure.
6. **Incremental cost documentation or cost basis information** sufficient to support CEDA review, such as vendor quotes, equipment cost comparisons, contractor estimates, or project-team cost narratives comparing the electric measure case to the conventional fossil-fuel-fired baseline.
7. **Documentation identifying** any combustion-based backup, pilot, purge, safety, or supplemental heating components, where applicable, and describing their intended role in system operation.
8. **For Premium Level projects**, documentation identifying the metering-ready design provisions, available data points, BAS/EMS integration, submetering locations, or other practical means of supporting future Code Readiness monitoring if selected by PG&E or the CEDA program team.

Incremental Measure Cost

The incremental measure cost (IMC) for this HPM is intended to support CEDA program calibration and inducement review for qualifying alternate electric process heating systems. It is not intended to serve as a contractor bid, procurement estimate, project pricing benchmark, or post-construction cost reconciliation tool. Actual project costs will vary based on process type, production schedule, thermal duty, equipment configuration, ventilation or exhaust requirements, controls, electrical service capacity, permitting requirements, and site-specific construction conditions.

Because this HPM applies to custom and semi-custom industrial process heating applications, a single fixed \$/kW, \$/MMBtu/h, \$/cfm, or \$/building-area value is not recommended. Eligible projects may include electric regenerative thermal oxidizers, electric thermal oxidizers, electric process ovens, electric curing systems, electric resistance process heating systems, or other qualifying non-combustion process heating technologies. These systems may vary widely in operating temperature, duty cycle, heat recovery, exhaust flow, production throughput, and electrical infrastructure needs. As a result, the most appropriate implementation approach is to calculate IMC on a project-specific basis and normalize the result by annual avoided fossil-fuel energy.

For this HPM, the recommended normalization unit is **\$/annual therm avoided**, calculated using the documented incremental cost of the qualifying electric process heating system divided by the annual therms of fossil-fuel input avoided by the measure. This normalization is preferred because it ties the cost basis directly to the primary program value of the measure: avoiding on-site fossil-fuel combustion for an identified industrial or covered-process heating load. It also accounts for operating hours and process utilization, which can vary significantly across industrial applications and are not captured by peak equipment capacity alone.

Base Case

The base case is the conventional fossil-fuel-fired process heating system that would otherwise be used to serve the same process heating application. The base case shall be based on project-specific documentation, such as prior standard practice, owner or design-team basis of design, vendor comparison, project design alternatives, or manufacturer information for the fossil-fuel-fired equipment that was replaced or avoided.

Representative base-case systems may include, but are not limited to:

1. Gas-fired regenerative thermal oxidizer;
2. Gas-fired thermal oxidizer;
3. Gas-fired process oven, curing oven, dryer, furnace, or kiln;
4. Gas-fired boiler or furnace serving a process heating load;
5. Other fossil-fuel-fired process heating equipment serving the same eligible process scope.

The base case shall reflect the same functional process requirements as the measure case, including applicable process temperature, thermal duty, production throughput, operating schedule, exhaust or ventilation requirements, destruction efficiency or product quality requirements, and permitting or safety constraints.

Measure Case

The measure case is the qualifying electric process heating system that meets the HPM requirements. The measure case shall use electricity as the primary process heating input for the eligible process heating scope and shall replace, avoid, or materially reduce a conventional fossil-fuel-fired process heating baseline.

For the **Essential Level**, the measure case is the qualifying electric process heating system and directly associated equipment, controls, safety systems, electrical infrastructure, and process integration required to serve the eligible process heating load. Representative measure-case systems may include, but are not limited to, electric

regenerative thermal oxidizers, electric thermal oxidizers, electric process ovens, electric curing systems, electric resistance process heating systems, or other qualifying non-combustion electric process heating technologies not otherwise addressed by a separate CEDA high-performance measure.

For the **Premium Level**, the measure case includes all Essential Level measure-case components, plus the metering-ready design provisions and controls or data-access features needed to support future Code Readiness monitoring if selected by PG&E or the CEDA program team. Premium Level provisions may include dedicated metering or submetering locations, BAS/EMS trend points, manufacturer control outputs, data ports, communications interfaces, controls programming, sensor points, or other practical means of collecting equipment energy and operating data.

Any combustion-based backup, pilot, purge, safety, or supplemental heating component shall be separately identified. Fossil-fuel use associated with those components shall be excluded from avoided therms unless the project team demonstrates that the fuel use is not part of normal process heating operation.

IMC Values and Normalization

Because eligible systems under this HPM are custom or semi-custom industrial process heating applications, the final IMC shall be determined using project-specific documentation where available. A single fixed \$/kW, \$/MMBtu/h, \$/cfm, or building-area value is not recommended because system cost can vary significantly based on process type, operating temperature, throughput, duty cycle, heat recovery, exhaust or ventilation requirements, controls, electrical infrastructure, and site-specific installation conditions.

For this HPM, the preferred normalization basis is **\$/annual therm avoided**, calculated using the documented incremental cost of the qualifying electric process heating system divided by the annual fossil-fuel input avoided by the measure. This normalization aligns the cost basis with the primary program value of the HPM: reducing or avoiding on-site fossil-fuel combustion for a defined process heating load. It also accounts for operating hours and process utilization, which are critical for industrial applications and are not captured by peak equipment capacity alone.

The final documented IMC shall be calculated as:

$$\text{Documented IMC} = \text{Measure Case Installed Cost} - \text{Base Case Installed Cost}$$

For the Essential Level:

$$\text{Essential Level Documented IMC} = \text{Essential Level Measure Case Installed Cost} - \text{Base Case Installed Cost}$$

For the Premium Level:

$$\text{Premium Level Documented IMC} = \text{Premium Level Measure Case Installed Cost} - \text{Base Case Installed Cost}$$

Where the Premium Level includes additional metering-ready design provisions, BAS/EMS integration, controls programming, data-access features, or other Code Readiness monitoring support provisions, the incremental premium cost may also be identified as:

$$\text{Premium Level Adder} = \text{Premium Level Measure Case Installed Cost} - \text{Essential Level Measure Case Installed Cost}$$

The normalized documented IMC shall be calculated as:

$$\text{Normalized Documented IMC} = \text{Documented IMC} \div \text{Annual Therms Avoided}$$

Where annual therms avoided means the annual fossil-fuel input avoided by the qualifying electric process heating system, expressed in therms per year. One therm equals 100,000 Btu. Where the baseline fuel is not natural gas,

the baseline fuel input shall be converted to therm-equivalent units using the fuel heating value documented by the project team or an accepted engineering reference. Where the measure case retains combustion-based backup, pilot, purge, safety, or supplemental heating, avoided therms shall be calculated net of any fossil-fuel use that remains part of normal operation for the eligible process heating scope.

For **early-stage CEDA screening, budgeting, and inducement earmarking**, when project-specific cost documentation is not yet available, this HPM may use the following provisional screening-level IMC proxies:

Essential Level: \$10 per annual therm avoided

Premium Level: \$15 per annual therm avoided

The Premium Level screening proxy includes the Essential Level screening proxy plus a \$5 per annual therm avoided adder intended to represent the additional cost and program value associated with metering-ready design, controls integration, data-access coordination, and Code Readiness monitoring support provisions.

The preliminary screening IMC shall be calculated as:

Essential Level Preliminary Screening IMC = Annual Therms Avoided × \$10/annual therm avoided

Premium Level Preliminary Screening IMC = Annual Therms Avoided × \$15/annual therm avoided

These screening values are intended only as early-stage program planning placeholders. They are not contractor bids, project cost estimates, guaranteed inducement amounts, final incremental measure costs, or post-construction cost reconciliation values. The screening proxies should be replaced with project-specific cost documentation when vendor quotes, contractor estimates, basis-of-design cost comparisons, or verification-stage cost information become available. If project-specific costs are used to establish the documented IMC, the screening proxy shall not be added on top of the documented cost basis.

For CEDA implementation, **the program may use the screening-level IMC proxies to reserve or estimate preliminary inducement amounts** before final cost documentation is available. Final inducement review shall remain subject to applicable CEDA program rules, project caps, cost documentation, avoided therms, estimated energy impacts, emissions reduction potential, Code Readiness data value, and CEDA review.

The following cost components may be included in the IMC calculation where they are directly attributable to the qualifying electric process heating scope and are not claimed under another CEDA measure:

1. Qualifying electric process heating equipment;
2. Fossil-fuel-fired base-case equipment used for comparison;
3. Customer-side electrical distribution equipment directly required for the qualifying system;
4. Process controls, safety controls, and equipment integration directly required for the qualifying system;
5. Installation, startup, commissioning, and vendor integration costs directly associated with the qualifying system;
6. Heat recovery, exhaust, ventilation, or process integration components that are integral to the qualifying electric process heating system and not otherwise required by the base case;
7. For Premium Level projects, metering-ready design provisions, BAS/EMS integration, submetering provisions, data-access interfaces, controls programming, sensor points, or other practical provisions needed to support future Code Readiness monitoring if selected.

The following cost components should be excluded unless specifically approved by CEDA:

1. Production capacity expansions not required to serve the same process heating load;
2. Building-wide electrical upgrades not directly attributable to the qualifying system;
3. Utility-side infrastructure costs unless specifically included in the approved project cost basis;
4. Maintenance, repair, or replacement costs not associated with the eligible process heating scope;
5. Costs claimed under another CEDA high-performance measure;
6. Non-energy process improvements that cannot be reasonably separated from the electric process heating measure.

Sources

IMC values are informed by a combination of project-specific cost documentation, publicly available technical references, industry cost guidance, and program experience. For this HPM, the following sources are recommended for cost-basis support and reviewer context:

- [U.S. EPA, *Air Pollution Control Cost Manual*, Chapter 2: Incinerators and Oxidizers.](#)
- [U.S. EPA, *Cost Reports and Guidance for Air Pollution Regulations*.](#)
- [U.S. Department of Energy, *Process Heat Basics*.](#)
- [E3, *Decarbonizing Industrial Heat: Measuring Economic Potential and Policy Mechanisms*.](#)

Code Readiness Objectives

This measure supports CEDA's Code Readiness efforts by encouraging early adoption of alternate electric process heating systems and collecting implementation, cost, operational, and performance information from industrial and covered-process applications. Industrial process heating is highly project-specific and can be difficult to electrify because equipment is often custom, process-integrated, high-temperature, and dependent on production schedules, safety requirements, air-quality requirements, and available electrical infrastructure. Field experience from qualifying projects can help identify where electric process heating is technically feasible, cost-relevant, and suitable for broader market adoption or future Codes and Standards consideration.

This HPM is intended to help PG&E and the CEDA program better understand how alternate electric process heating systems are designed, installed, commissioned, and operated in real projects. The measure is also intended to identify the practical barriers that project teams encounter when replacing or avoiding fossil-fuel-fired process heating systems, including electrical service constraints, controls integration, permitting, vendor availability, operating cost considerations, and documentation needs.

Projects may be evaluated for potential Code Readiness monitoring or follow-up based on project size, technology type, data availability, program priorities, and willingness of the project team to support data collection. Where a project is selected for monitoring, the final metering and data collection plan will be tailored to the specific process, technology, site access, available BAS/EMS points, safety requirements, and program objectives.

Code Readiness study objectives may include:

- Characterize the technical feasibility of alternate electric process heating systems across industrial, agricultural, laboratory, manufacturing, and covered-process applications.
- Evaluate the electric load profile, operating schedule, peak demand impact, and load flexibility potential of qualifying electric process heating systems.
- Compare actual or expected electric process heating operation to the conventional fossil-fuel-fired baseline that would otherwise serve the same process.
- Document project-specific implementation barriers, including electrical infrastructure needs, equipment availability, controls integration, permitting, construction sequencing, and operator training.
- Assess whether system design, metering readiness, controls access, and operational data are sufficient to support future performance validation.
- Develop cost and market data to improve future incremental cost assumptions, screening values, and inducement calibration for industrial process electrification.
- Identify process types, equipment configurations, and operating conditions that may be strong candidates for future code development, utility program support, or additional field research.
- Support future Codes and Standards work by improving understanding of electrified process heating performance, energy impacts, emissions reduction potential, grid impacts, and implementation readiness.

Code Readiness Site Monitoring

If selected for Code Readiness monitoring, equipment energy consumption and process system performance may be monitored on-site for a period of up to 24 months. To support performance evaluation and data collection, projects shall provide reasonable access for the installation and operation of metering, sensors, and communication equipment.

Projects equipped with a Building Automation System (BAS), Energy Management System (EMS), or equivalent platform should enable integration of advanced metering devices through the existing system to facilitate data collection and remote access. For projects without a BAS or EMS, the Code Readiness team may install temporary

stand-alone data loggers, sensors, and communication equipment as needed to monitor system performance for the duration of the monitoring period.

Instrumentation may be installed or supplemented, where necessary, to measure key system and equipment parameters sufficient to evaluate system performance and operational characteristics. All monitoring equipment will be temporary and installed in a manner that minimizes disruption to normal building operations.

Data Benefits

Data collected through this measure can help inform future California Codes and Standards activities, utility program design, and market support strategies for industrial process electrification. Because industrial process heating loads vary widely by process type and operating schedule, field data can provide important insight that is not available from equipment specifications alone. Data may be used to evaluate avoided fossil-fuel use, electric demand impacts, load shape, operating costs, implementation barriers, controls performance, and the degree to which qualifying systems can reliably meet process requirements.

The data may also support development of future guidance on cost-effective electrification pathways, metering-ready design practices, baseline documentation, electrical infrastructure planning, and performance metrics for custom industrial process heating systems. For Premium Level projects, metering-ready design provisions can improve the ability of CEDA and Code Readiness teams to collect higher-quality data if the project is selected for monitoring or case study development.

Preliminary Sample Data Points

The following table identifies representative data points that may be useful for Code Readiness review or monitoring. Not every data point will apply to every project. Final data collection requirements, if any, will be determined based on the qualifying technology, process served, site constraints, available data sources, and program priorities.

Data Category	Preliminary Sample Data Points	Potential Data Benefit
System identification	Equipment type, manufacturer, model, rated electric input, process heating capacity, operating temperature range, applicable process served	Confirms technology type and supports comparison across applications
Electric energy use	Interval kWh, real-time kW, peak kW, demand profile, load factor, standby energy use	Characterizes energy consumption, demand impacts, and operating profile
Operating schedule	Daily/weekly schedule, seasonal operation, batch or continuous operation, runtime hours, standby/preheat periods	Supports normalization of energy use and assessment of load flexibility
Process throughput	Production rate, batch count, units processed, mass or volume processed, process duration	Enables energy use to be normalized to production or process output
Process operating conditions	Process setpoints, actual process temperature, inlet/outlet temperatures, exhaust temperature, airflow, pressure, humidity or moisture conditions where applicable	Evaluates whether the electric system meets process requirements
Fossil-fuel baseline	Baseline equipment type, baseline fuel, estimated annual fuel use, baseline operating schedule, baseline capacity or throughput	Supports avoided therms, emissions impact, and IMC review
Remaining combustion use	Backup fuel use, pilot fuel use, purge fuel use, supplemental heat use, combustion runtime, intended operating role	Confirms whether fossil-fuel use remains limited to non-primary operation

Data Category	Preliminary Sample Data Points	Potential Data Benefit
Controls and modes	Operating mode, enable/disable status, setpoints, staging, alarms, fault status, BAS/EMS points, local controller data	Identifies control strategies and common operational issues
Heat recovery or regenerative performance	Regenerator temperatures, heat recovery status, exhaust temperature, preheat temperature, recovery effectiveness, purge cycle status, where applicable	Supports evaluation of electric RTOs, oxidizers, and systems with integral heat recovery
Electrical infrastructure	Electrical service capacity, dedicated panel or circuit, voltage, amperage, transformer or switchgear coordination, submetering location	Documents infrastructure needs and grid-readiness considerations
Metering readiness	Dedicated meter, submeters, BAS/EMS trend points, data ports, manufacturer outputs, communications interface, data resolution	Supports future Code Readiness monitoring or case study development
Environmental or process compliance data	Destruction/removal efficiency, exhaust flow, stack temperature, permit-related operating parameters, where applicable	Confirms that electrification does not compromise process or air-quality requirements
Cost and implementation data	Base-case cost, measure-case cost, electrical infrastructure cost, controls cost, installation cost, commissioning cost, vendor integration cost	Supports future IMC refinement and program calibration
Implementation feedback	Design challenges, construction challenges, vendor availability, permitting issues, operator training needs, lessons learned	Helps identify market barriers and future guidance needs

Code Reference

This HPM does not establish a separate code compliance pathway or replace applicable permit, safety, environmental, or equipment-listing requirements. Qualifying projects must comply with all applicable state and local codes, permitting requirements, air-quality requirements, equipment safety standards, and authority having jurisdiction (AHJ) requirements.

Because this measure applies to custom and semi-custom industrial process heating systems, the applicable code requirements will vary by technology, process served, fuel baseline, exhaust or ventilation configuration, hazardous material classification, electrical infrastructure, and local air district permitting requirements. The references below identify the most relevant code families and standards for early project screening and CEDA review.

Applicable Codes and Standards

CODE	APPLICABLE CODE REFERENCE	EFFECTIVE DATE	CODE REVIEW DATE
2025 California Energy Code, Title 24, Part 6	§100.0(e)2F; §§120.6, 140.9, and 141.1, as applicable to covered processes. Title 24, Part 6 establishes the California Energy Code framework for covered processes, but this HPM is intended to support beyond-code electrification of process heating applications where a direct prescriptive electric process-heating baseline is not established.	January 1, 2026	June 2026
2025 California Electrical Code, Title 24, Part 3	Applicable California Electrical Code / NFPA 70 requirements for electrical service, feeders, branch circuits, overcurrent protection, grounding and bonding, disconnecting means, industrial equipment, control panels, and hazardous/classified locations, as applicable. Specific articles shall be verified based on final equipment and electrical design.	January 1, 2026	June 2026
2025 California Mechanical Code, Title 24, Part 4	Applicable requirements for exhaust systems, ventilation, equipment installation, fuel gas piping, process piping, combustion air, and related mechanical systems, where applicable. Specific sections shall be verified based on the process, equipment type, and any remaining combustion-based backup, pilot, purge, or supplemental systems.	January 1, 2026	June 2026
2025 California Fire Code, Title 24, Part 9	Applicable fire and life-safety requirements for industrial processes, hazardous materials, fire protection, emergency shutdown, equipment clearances, access, and operational permits, as applicable. Specific sections shall be verified with the local fire authority and project AHJ.	January 1, 2026	June 2026

CODE	APPLICABLE CODE REFERENCE	EFFECTIVE DATE	CODE REVIEW DATE
NFPA 86, Standard for Ovens and Furnaces	NFPA 86-2023, as applicable to industrial ovens, furnaces, dryers, thermal oxidizers, oxidizer systems, and other heated process enclosures. This standard is relevant for fire and explosion hazard mitigation, safety controls, operating requirements, purge requirements, and protection of heated industrial process equipment.	Current Edition	June 2026
UL 508 / UL 508A	UL 508, Standard for Industrial Control Equipment, and UL 508A, Standard for Industrial Control Panels, as applicable to industrial control equipment, control panels, electrical enclosures, and related control assemblies. Applicability shall be verified based on equipment listing, panel fabrication, and AHJ requirements.	Current Edition	June 2026
Cal/OSHA, California Code of Regulations, Title 8	Applicable General Industry Safety Orders and Electrical Safety Orders, including §3203 Injury and Illness Prevention Program, §3314 Control of Hazardous Energy / Lockout-Tagout, §5155 Airborne Contaminants, and Electrical Safety Orders, as applicable. Additional Title 8 requirements shall be verified based on the process, hazards, and equipment type.	Current Edition	June 2026
Applicable Local Air District Rules and Permits	Applicable local air district authority-to-construct, permit-to-operate, new source review, emissions, toxic air contaminant, and BACT/TBACT requirements, as applicable. Requirements shall be verified with the applicable local air district, such as BAAQMD, SCAQMD, or other jurisdictional air district.	Current Rule Edition	June 2026
California Title 20 Appliance Efficiency Regulations / Federal Equipment Standards	Title 20, §§1601–1608, and applicable federal equipment efficiency standards, where regulated components are included in the qualifying system. These requirements are generally component-specific and may apply to motors, fans, pumps, controls, or other regulated equipment, rather than the custom process heating system as a whole.	Current Edition	June 2026

Eligible Climate Zones, Building Types, and Project Scopes

Eligible Climate Zones

This high-performance measure is eligible in **California Climate Zones 1-16**, subject to CEDA program eligibility, project-specific review, applicable utility service territory requirements, and confirmation that the project includes a qualifying electric process heating scope. Climate zone is not expected to be the primary eligibility driver for this HPM because process heating loads are typically driven by production requirements, process schedules, equipment operation, and industrial or covered-process needs rather than outdoor ambient conditions.

Eligible Building Types

This HPM applies to **nonresidential, industrial, agricultural processing, laboratory, manufacturing, research, and covered-process facilities** where a qualifying electric process heating system replaces, avoids, or materially reduces a conventional fossil-fuel-fired process heating system. Eligible applications may include facilities with process exhaust treatment, production heating, curing, baking, drying, thermal treatment, materials processing, or other process heating loads that are not otherwise addressed by a separate CEDA high-performance measure.

Eligible building and facility types may include, but are not limited to:

1. Manufacturing and industrial facilities;
2. Biotech, pharmaceutical, and research laboratory facilities;
3. Semiconductor, cleanroom, and advanced manufacturing facilities;
4. Food and beverage production facilities;
5. Agricultural processing facilities;
6. Warehouse, distribution, or production facilities with qualifying process heating loads;
7. Public, institutional, or commercial facilities with covered-process or industrial-type process heating applications;
8. Other nonresidential facilities with qualifying electric process heating systems reviewed and approved by CEDA.

Eligibility is based on the qualifying process heating scope, not the overall building occupancy classification alone. Projects with mixed-use, laboratory, office, warehouse, or production areas may qualify where the eligible electric process heating system is clearly identified and separately documented.

This HPM is not intended to cover microwave, radio-frequency, dielectric, or similar electromagnetic volumetric-heating technologies that are expected to be addressed under a separate CEDA high-performance measure for microwave heating and other electric drying technologies. This HPM is also not intended to cover standalone industrial or high-temperature heat pump systems, including hydronic hot-water, steam-generating, or process-loop heat pump systems, where those systems are addressed by a separate CEDA high-performance measure.

Eligible Project Scopes

This HPM is primarily intended for new construction projects where electrical service capacity, process equipment selection, controls integration, ventilation or exhaust systems, safety requirements, and permitting can be coordinated during design. New construction is expected to provide the strongest opportunity for successful implementation because industrial process electrification often requires early coordination of equipment loads, electrical infrastructure, process layout, and utility service requirements.

Eligible project scopes may include:

1. **New construction projects** that install a qualifying electric process heating system in place of a conventional fossil-fuel-fired process heating system;
2. **Additions or expansions** that include new process heating equipment and avoid new fossil-fuel-fired process heating capacity;
3. **Major renovations, tenant improvements, or process buildouts** where a qualifying electric process heating system is incorporated into the project design;
4. **Major process equipment replacement projects** where the project replaces, avoids, or materially reduces fossil-fuel-fired process heating for the same process application;
5. **Process-line modifications or production-area upgrades** where the qualifying electric process heating system is separately identifiable and supported by project-specific design and cost documentation;
6. **Premium Level projects** that include metering-ready design provisions, BAS/EMS integration, submetering provisions, or other practical means of supporting future Code Readiness monitoring if selected by PG&E or the CEDA program team.

Eligible scope is limited to the qualifying electric process heating system and directly associated equipment, electrical infrastructure, controls, safety systems, exhaust or process integration components, and metering-ready provisions needed to serve the eligible process heating application. Costs or equipment claimed under another CEDA high-performance measure may not be double-counted under this HPM.

Retrofit, alteration, or replacement projects may be considered where the project can demonstrate that the qualifying electric process heating system is technically feasible, electrically coordinated, and replacing or avoiding a conventional fossil-fuel-fired process heating baseline. Routine maintenance, like-for-like equipment replacement, or minor controls updates that do not materially electrify a process heating load are not eligible under this measure.

Measure Exclusions

The following applications are not eligible under this measure:

1. Process heating systems that do not replace, avoid, or materially reduce a conventional fossil-fuel-fired process heating baseline.
2. Process heating systems where fossil-fuel-fired equipment remains the normal operating strategy for serving the eligible process heating load. Combustion-based backup, pilot, purge, safety, or supplemental systems may be allowed only where separately identified and not used as the primary process heating source for the qualifying scope.
3. Microwave, radio-frequency, dielectric, or similar electromagnetic volumetric-heating technologies intended to be addressed under a separate CEDA high-performance measure for microwave heating and other electric drying technologies.
4. Standalone microwave/RF-based drying, thawing, tempering, freeze-drying, curing, pasteurization, sterilization, or material-treatment applications where the primary qualifying technology is electromagnetic volumetric heating.
5. Standalone industrial or high-temperature heat pump systems, including hydronic hot-water, steam-generating, or process-loop heat pump systems, where those systems are addressed by a separate CEDA high-performance measure.
6. Standard HVAC, service water heating, refrigeration, or building comfort-conditioning systems that are eligible under another CEDA high-performance measure and do not serve a qualifying industrial or covered-process heating load under this measure.

7. Routine maintenance, repair, controls tuning, burner replacement, or like-for-like equipment replacement projects that do not materially electrify a process heating load.
8. Production capacity expansions, process-line upgrades, or product-quality improvements that cannot be reasonably separated from the qualifying electric process heating scope.
9. Projects where the qualifying electric process heating system is installed only for temporary, pilot, demonstration, backup, or emergency use and is not intended to serve the eligible process heating load during normal operation.
10. Projects that cannot provide sufficient documentation to identify the qualifying electric process heating system, the process served, the conventional fossil-fuel-fired baseline being replaced or avoided, and the applicable cost basis for CEDA review.
11. Projects that claim the same equipment, electrical infrastructure, controls, metering provisions, or process integration costs under another CEDA high-performance measure.

CEDA program administrators reserve the right to determine whether claimed measures constitute overlapping scope for the same equipment, controls integration, or monitoring infrastructure.

Reviewer Checklist

HPM Reviewer Checklist: LM405 – Alternate Electric Process Heating – V1.2

Checklist Description: This checklist captures the elements that must be present in the project design to be eligible for the high-performance measure inducement or consideration for additional site metering.

Project Name: _____ **Review Date:** _____

Assessment: _____ **Notes:** _____

- Approved
- Not approved

Reviewer: _____ **Signature:** _____

High-Performance Measure Requirements	Comments
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System Design Requirements

Essential Level: Alternate Electric Process Heating

- Does the project provide a qualifying electric process heating system serving a defined industrial, agricultural, laboratory, manufacturing, or covered-process application? (§1.1)
- Does the qualifying system use electricity as the primary process heating input for the eligible process heating scope? (§1.2)
- Does the qualifying system replace, avoid, or materially reduce a conventional fossil-fuel-fired process heating baseline for the same process heating application? (§1.3)
- Is the qualifying system designed for the applicable process operating conditions, including relevant temperature range, heating capacity, throughput, operating schedule, ventilation or exhaust requirements, controls, and safety requirements? (§1.4)
- Is fossil-fuel-fired equipment excluded as the normal operating strategy for meeting the eligible process heating load? (§1.5)
- Are any combustion-based backup, pilot, purge, safety, or supplemental systems separately identified and not used as the primary process heating source for the qualifying scope? (§1.5)
- Does the qualifying system comply with applicable electrical, fire, building, occupational safety, environmental, air-quality, and permitting requirements, as applicable to the specific process and equipment type? (§1.6)
- Has the project coordinated electrical service capacity, panel or switchgear capacity, branch-circuit requirements, controls integration, and equipment location requirements for the qualifying electric process heating system? (§1.7)
- Is the qualifying scope free of microwave, radio-frequency, dielectric, or similar electromagnetic volumetric-heating technologies intended to be addressed under a separate CEDA HPM for microwave heating and other electric drying technologies? (§1.8)

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Premium Level: Metering-Ready Alternate Electric Process Heating

- Does the project meet all Essential Level requirements? (§2.1)
- Is the qualifying system designed to support future Code Readiness monitoring, if selected by PG&E or the CEDA program team? (§2.2)
- Does the project provide metering-ready design provisions, such as dedicated electrical panels, submetering points, BAS/EMS trend points, manufacturer control outputs, data ports, or other practical means of collecting equipment energy and operating data? (§2.3)
- Has the project team identified available operating data points that may support future performance review, such as equipment power, runtime, operating mode, process temperature, exhaust or process airflow, production schedule, throughput, setpoints, or other process-specific indicators, where available? (§2.4)
- Is the project team willing to support Code Readiness follow-up if selected, including implementation feedback, design and cost context, operating insights, or case study support? (§2.5)

Supporting Documentation Requirements

- Were construction drawings or process design documents provided identifying the qualifying electric process heating system, equipment location, electrical service connections, controls, and process served? (§SD-1)
- Were equipment submittals, manufacturer specifications, or vendor documentation provided identifying the qualifying system type, electric input capacity, process heating capacity or throughput, operating temperature range, controls, and applicable safety or installation requirements? (§SD-2)
- Was a narrative description provided for the eligible process heating application, including the process served, operating schedule, expected production or throughput basis, and how the electric system will be used during normal operation? (§SD-3)
- Was basis-of-design documentation provided describing the conventional fossil-fuel-fired process heating system that is being replaced or avoided? (§SD-4)
- Was electrical design documentation provided showing that the qualifying electric process heating system has been coordinated with project electrical service, distribution equipment, panels, switchgear, controls, and other required infrastructure? (§SD-5)

HPM Reviewer Checklist: LM405 – Alternate Electric Process Heating – V1.2

- Was incremental cost documentation or cost basis information provided sufficient to support CEDA review? (§SD-6)
- Was documentation provided identifying any combustion-based backup, pilot, purge, safety, or supplemental heating components, where applicable, and describing their intended role in system operation? (§SD-7)
- For Premium Level projects, was documentation provided identifying metering-ready design provisions, available data points, BAS/EMS integration, submetering locations, or other practical means of supporting future Code Readiness monitoring if selected by PG&E or the CEDA program team? (§SD-8)

Version History Log

Version	Effective Date	End Date	Change Description
1	October 31, 2023	June 07, 2026	N/A
1.2	June 08, 2026	Active	Updated measure to current CEDA HPM format; clarified eligible alternate electric process heating scope, Essential and Premium requirements, IMC screening approach, Code Readiness objectives, exclusions, and reviewer checklist for version 1.2 release.

The version identified as 'Active' is the current published version and remains in effect until superseded by a subsequent published version. CEDA may update, replace, or retire High-Performance Measures without prior notice. End dates are assigned to prior versions once superseded.