# High-Performance Measure Details

**Measure Name**
Heat Pump Water Heater with Adequate Storage for Restaurants

**Use Category**
Commercial Kitchen Electrification

**Effective Date**
June 15, 2025

**End Date**
December 31, 2025

**Version**
2

**Measure Code**
LM402

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# Technology Summary

Heat pump water heaters with storage are an energy-efficient solution increasingly adopted by restaurants to meet their high hot water demands. Unlike traditional electric or gas water heaters, these systems use a heat pump to extract heat from the surrounding air and transfer it to the water in an insulated storage tank. This process significantly reduces energy consumption, often by 50% or more compared to conventional heaters, making it a cost-effective and environmentally friendly option. The stored hot water ensures a steady supply during peak restaurant hours, such as lunch and dinner rushes, when demand for dishwashing, cleaning, and food prep spikes.

The technology typically integrates a compressor, evaporator, condenser, and a large storage tank, tailored to the scale of commercial use. Advanced models may include smart controls to optimize performance, such as scheduling heating cycles during off-peak electricity hours or adjusting based on usage patterns. For restaurants, the combination of energy savings, reliable hot water availability, and potential rebates or incentives from utility providers makes these systems appealing.

# Alignment with CEDA Program Goals

The CEDA program supports the implementation of energy efficiency measures that support Code Readiness's 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 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, which can result in projects implementing measures to achieve greater energy savings, reduced emissions, and overall improved building performance. As more buildings specify and install heat pump water heating technologies in commercial food service facilities, this helps to increase the overall supply of heat pump water heating technologies 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

The inducement requirements listed below are intended to support the adoption of the above code technologies in the current market by increasing energy efficiency, decreasing costs, and decreasing carbon emissions. Projects receive inducements based on market impacts, savings, and influence.

Projects must provide the required supporting documentation specified below and satisfy one of the system-level design requirements to be eligible for an inducement.

## Inducement Requirements

- **System Design Requirements**
  - **Essential level**: Partial Electrification (Gas WH and HPWH with Thermal Storage)
    - The gas WH and HPWH system must supply 100% of the restaurant's DHW demand across all operational hours.
    - The gas and HPWH system must meet or exceed the energy efficiency standards of California's Title 24 through the performance compliance path. This means the combined DHW system (gas and HPWH components together) must demonstrate a

lower energy budget compared to the standard design baseline, which is typically either a gas instantaneous water heater or a fully electric HPWH.
        - The heat pump and storage tank must deliver water at a minimum of 120°F consistently to meet sanitation and operational needs, per California Plumbing Code requirements.
            - The thermal DHW storage tank must be sized to handle peak hot water demand (e.g., 80-120 gallons minimum, based on seating capacity and usage patterns), with insulation rated at R-12 or higher to limit standby heat loss.
    - **Premium level**: Full Electrification (HPWH System with Thermal Storage)
        - The restaurant must install a fully electric HPWH system with thermal DHW storage, supplemented by electric heating if needed, to meet 100% of its DHW needs without reliance on fossil fuels.
            - A backup electric resistance element (integrated or separate) may be included to ensure capacity during peak demand, limited to <20% of annual heating energy to maintain efficiency.
        - The heat pump must be sized to meet peak hot water flow rates as specified in the California Plumbing Code and manufacturer guidelines, ensuring no shortfall during maximum usage (e.g., lunch/dinner rushes).
        - The fully electric HPWH must meet Title 24 prescriptive requirements (e.g., Uniform Energy Factor ≥ 3.0) or demonstrate compliance via the performance path, outperforming the baseline energy budget.
        - Design the storage tank to supply peak hot water demand (e.g., 100-150 gallons minimum, based on restaurant size and usage), with insulation ≥ R-12 to reduce heat loss.
        - Electric hot water boosters (e.g., point-of-use units) must be installed for equipment requiring water above 120°F (such as commercial dishwashers needing 140°F+), ensuring compliance with health codes and equipment specifications.
- **Supporting Documentation Requirements**
    - Provide engineered, stamped, and permitted construction plans demonstrating compliance with all state and local jurisdiction requirements and regulations for installation and operation.
    - Provide a sequence of operations for the DHW system design.
    - Provide equipment submittals stamped and approved by the responsible engineer of record.
    - Provide equipment-cost information for the DHW system design.

# Code Readiness Objectives

The data collection effort should focus on achieving the following objectives:

- **Assess the Performance and Feasibility of HPWHs with TES**: Document the performance of HPWHs with TES in restaurant settings, considering factors such as climate zone and ambient temperature, humidity, and restaurant usage and hot water draw patterns.
- **Quantify Actual Energy Savings**: Measure and compare the energy consumption of restaurants using HPWHs with TES as the primary heating source against baseline scenarios using gas heaters.
- **Evaluate Cost-Effectiveness**: Gather data on the costs and savings associated with using HPWHs with TES, including installation, operation, maintenance, and energy bills.
- **Evaluate System Effectiveness**: Define applications where HPWHs with TES may not be a good fit or may need supplemental systems to meet loads.

## Site Metering Prerequisite

- Project must install a Building Automation System (BAS), Energy Management System (EMS), or similar building management system to facilitate the installation of advanced metering devices.
    - If selected for Code Readiness metering, equipment energy and performance data may be monitored at the site for a period of up to 12 months.

## Data Benefits

- Operational efficiencies of HPWHs with TES in restaurant applications.
- Efficiency and energy use of electric water heating and distribution systems in restaurants, including secondary temperature maintenance heating (depending on the configuration).
- Engineering configurations, temperature maintenance system details, and customization requirements.
- Product cost and availability of HPWHs with TES in CA.
- Costs of installation and avoided gas infrastructure costs.
- The data collected from this monitoring effort will provide a foundation for future research and analysis:
    - Investigate how performance varies across different restaurant sizes and types (e.g., fast food vs. fine dining), informing scalable system designs or modular storage solutions.
    - Quantify long-term energy savings and carbon footprint reductions across multiple sites, providing data to support sustainability claims and influence policy or incentive programs.
    - Analyze data to identify factors (e.g., air temperature, usage spikes) that most impact efficiency, guiding the development of next-generation heat pump designs with improved COP (Coefficient of Performance).
    - Benchmark heat pump water heaters against other technologies (e.g., gas, solar-assisted) using field data to highlight competitive advantages and areas for hybrid system development.

## Sample Data Points

A sample set of data points that would ideally be collected is provided below for reference. This list will be redeveloped for each project based on the infrastructure and the need for the monitoring effort.

| Data Points to Meter | Unit | Additional Specifications |
|---|---|---|
| HP Power | kW | Maximum and minimum values |
| Thermal Load Provided | BTU | Average and Peak Values |
| Operational Efficiency | COP | Efficiency is measured at each instance |
| Operational Efficiency | TMCOP | Efficiency of temperature maintenance |
| Supply Water Flow | GPM | Average |
| Supply Water Supply Temp | °F | Average |
| Supply Water Return Temp | °F | Average |
| Supply Water Load | BTU | Average |
| Secondary Water Flow | GPM | Average |
| Secondary Water Supply Temp | °F | Average |
| Secondary Water Return Temp | °F | Average |
| Secondary Water Load | BTU | Average |
| Pump(s) Power | kW | Average |
| Outdoor Temperature | °F | Measured at the heat pump or site |
| Outdoor Air Moisture Level | °F | Measured at the heat pump or site |
| Indoor Temperature | °F | Average |
| Building Mode (Occupied Unoccupied) | - | Flag indicating status |
| Storage Tank Temperature | °F | Average |

# Code Reference

**2022 California Health and Safety Code** – Division 104 – Part 7 California Retail Food Code – Chapter 7 Water, Plumbing, and Waste – Article 1:

- *114192. (a) Except as provided in subdivision (d), an adequate, protected, pressurized, potable supply of hot water and cold water shall be provided. Hot water shall be supplied at a minimum temperature of at least 120ºF measured from the faucet, unless otherwise specified in this part…*
- *114195. (b) Hot water generation and distribution systems shall be sufficient to meet the peak hot water demands throughout the food facility.*

# Eligible Climate Zones and Building Types

**Eligible Climate Zones**

This measure is applicable in all California climate zones.

**Eligible Building Types**

This measure is applicable to commercial restaurants only.

# Measure Exclusions

None.

# Reviewer Checklist

## High-Performance Measure Review Checklist: HPWH with Adequate Storage for Restaurants

**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:**

- ☐ Approved
- ☐ Not approved

**Notes:**

**Reviewer:** _____ **Signature:** _____

| Essential Level Inducement Requirements | Comments |
|---|---|
| ☐ Does the dual fuel gas and HPWH system supply 100% of the restaurant's hot water demand across all operational hours? | |
| ☐ Does the dual-fuel gas and HPWH system meet or exceed the energy efficiency standards of California's Title 24 through the performance compliance path? | |
| ☐ Does the heat pump and storage tank deliver DHW at a minimum of 120°F consistently to meet sanitation and operational needs, per California Plumbing Code requirements? | |
| ☐ Is the DHW thermal storage tank sized to handle peak hot water demand, with insulation rated at R-12 or higher to limit standby heat losses? | |

| Premium Level Inducement Requirements | Comments |
|---|---|
| ☐ Did the restaurant install an HPWH system with thermal storage, supplemented by electric heating (if needed), to meet 100% of its DHW needs? | |
| ☐ If a backup system is needed, was a backup electric resistance heating system provided to ensure capacity during peak demand is satisfied, limited to <20% of the total annual DHW heating energy to maintain efficiency? | |
| ☐ Was the HPWH sized to meet peak hot water flow rates as specified in the California Plumbing Code and manufacturer guidelines, ensuring no shortfall during maximum usage? | |
| ☐ Does the HPWH system meet Title 24 prescriptive requirements or demonstrate compliance via the performance path? | |
| ☐ Is the DHW thermal storage tank sized to handle peak hot water demand, with insulation rated at R-12 or higher to limit standby heat losses? | |
| ☐ Are electric hot water boosters installed (if needed) for equipment requiring water above 120°F to comply with health codes and equipment specifications? | |

| Supporting Documentation Requirements for Inducement | Comments |
|---|---|
| ☐ Were engineered, stamped, and permitted construction drawings provided? | |
| ☐ Were equipment submittals, stamped and approved by the responsible engineer of record, provided? | |
| ☐ Was equipment-cost information provided? | |

☐ Was a sequence of operations documentation provided for the design?

| Site Metering Prerequisite | Comments |
| --- | --- |
| ☐ Did the project install a Building Automation System (BAS), Energy Management System (EMS), or similar building management system so that advanced metering devices can be installed? | |

# Version History Log

| Version | Effective Date | End Date | Change Description |
|---|---|---|---|
| 1 | October 11, 2024 | June 14, 2025 | N/A |
| 2 | June 15, 2025 | December 31, 2025 | Updated format, dual-fuel requirements, and checklist |