High-Performance Measure Details

Measure Name
Central Heat Pump Water Heater Systems

Use Category
WH - Service & Domestic Hot Water

Effective Date
March 31, 2025

End Date
December 31, 2025

Version
3

Measure Code
LM402

Table of Contents

Technology Summary

Heat pump water heaters (HPWHs) utilize a direct expansion (DX) heat pump to transfer heat to the water. Within the insulated water storage tank, the heat pump condenser coils facilitate the transfer of heat from the hot refrigerant, effectively warming the water.

In a centralized heat pump water heater (CHPWH) system, the primary energy savings come from using a heat pump vs. an electric boiler or natural gas boiler to heat water, pulling heat out of the air at an efficiency of up to 500%, depending on the system and climate. The CHPWH system typically utilizes a series of storage tanks for major hot water use demands and will use HPWHs to charge the storage tanks.

Most systems will include a secondary system of tanks called swing tanks or recirculation tanks for the distribution piping which will include an additional heating element to account for recirculation pipe losses.

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 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 buildings specify and install CHPWHs, this helps to increase the overall supply of CHPWHs 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 electrification in the current market by increasing energy efficiency, decreasing costs, and decreasing carbon emissions. Projects receive inducements based on market impacts, savings, and influence. Lower-level inducement requirements must be satisfied to be eligible for higher-level inducements. This measure can be combined with the "Water Heating with High-Performance Distribution Systems" high-performance measure.

Inducement Requirements:

- **Essential level**:
  - Provide a central heat pump water heating system serving the domestic/service hot water needs of a commercial, industrial, public, agricultural, or high-rise multi-family building.
  - Provide engineered, stamped, and permitted construction plans demonstrating that the CHPWH system design fully complies with all state and local jurisdiction requirements and regulations.
  - Provide equipment submittals stamped and approved by the responsible engineer of record.
  - Provide equipment-cost information.

- **Advanced level**:
    - Provide construction documents identifying which of the piping configurations the project aligns with from one or more of the following qualified configurations in accordance with NEEA's Advanced Water Heater Specification (AWHS):
        - Single-pass HPWH
            - No hot water circulation; primary heat pump water heating only.
            - Hot water circulation returned to primary storage.
            - Hot water circulation returned to a temperature maintenance tank in series with an electric resistance element, also referred to as a "swing tank."
            - Hot water circulation returned to a temperature maintenance storage tank in parallel with multi-pass HPWH for reheat.
        - Multi-pass HPWH
            - Integrated HPWH, no hot water circulation.
            - Integrated HPWH, hot water circulation returned to primary storage.
            - Split-system, hot water circulation returned to the primary storage.
    - Provide manufacturer heat pump water heater Product Assessment Datasheet (PADS) that outlines compliance with the requirements of the NEEA AWHS.
    - Provide system start-up documentation showing that start-up service was performed by a manufacturer-authorized representative.
- **Premium level:**
    - Provide a CHPWH system listed on the NEEA's AWHS Qualified Products List.
    - Provide a CHPWH system achieving Tier 3 or better System COP (SysCOP) as defined by Table 3: CHPWH System Efficiency Tiers.
        - NEEA's AWHS CHPWH Systems Efficiency Tiers:

Advanced Water Heating Specification Version 8.1

Table 3. CHPWH System Efficiency Tiers

	Minimum SysCOP			
	Hot Climate (IECC Zones 1–2)	**Mild Climate (IECC Zones 3–4)**	**Cold Climates (IECC Zones 5–6)**	**Extremely Cold Climates (IECC Zones 7–8)**
Tier 1	1.75	1.50	1.25	1.15
Tier 2	2.25	2.00	1.60	1.50
Tier 3	2.75	2.50	2.25	2.15
Tier 4	3.50	3.00	2.75	2.50

Code Readiness Objectives

Used to determine what the most cost-effective, low-energy configurations of HPWH systems are compared to unitary systems. While the energy code has some criteria as of T24 2022, the market is not mature and designs still lack consistent delivery of products. The information would help to specifically inform energy codes to:

- Define acceptable configurations for installations prescriptively.
- Define enhancements to any performance software capabilities.
- Improve acceptance testing and ways to certify proper installations.
- Define applications where CHPWHs may not be a good fit or may need supplemental systems to meet loads.

To support future code cycles, Code Readiness seeks to capture the following information:

- Information on how heat pump water heaters can be used to cost-effectively provide hot water in commercial, public, multi-family, agricultural and industrial buildings.
- Identify operational efficiencies of specific configurations or controls.
- Identify what distribution system type and configuration are installed and what additional information or requirements for efficiency by the system would be needed in an energy code.
- Determine efficiency criteria which can be established in building codes in addition to equipment ratings.
- Identify product availability and market readiness of contractors and equipment vendors and first cost information.
- Identify any enhancements to criteria used in equipment test procedure for HPWH, beyond what is currently required and or is useful for the specific building heating application.

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 central HPWH in commercial applications.
- Efficiency and energy use of water heating and distribution systems including secondary temperature maintenance heating (depending on the configuration).
- Engineering configurations, temperature maintenance system details, and customization requirements.
- Product cost and availability of larger HPWH products in CA.
- Costs of installation versus equipment in commercial and MF applications.

Sample Data Points:

A sample set of data points that would ideally be collected is provided below for reference. This list will be re-developed for each project based on the infrastructure and need of 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 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 heat pump or site
Outdoor Air Moisture Level	°F	Measured at heat pump or site
Indoor Temperature	°F	Average
Building Mode (Occupied Unoccupied)	-	Flag indicating status

Code Reference

2022 CA Title 24, Part 6, Section 110.3 Mandatory Requirements for Service Water-Heating Systems and Equipment.

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 high-rise multifamily buildings of four or more habitable stories above grade, as well as commercial, public, agricultural, and industrial buildings.

Measure Exclusions

This high-performance measure excludes the following:

- HPWHs with a storage capacity of less than 119 gallons do not qualify
- HPWH systems in more than one central location serving the SHW/DHW needs of the building
- Pool and spa heat pump water heaters
- Heat pumps used solely for space heating

Reviewer Checklist

High-Performance Measure Review Checklist: Central Heat Pump Water Heater Systems

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 project have a CHPWH system serving the SHW/ DHW needs of a commercial, industrial, public, agricultural, or high-rise multi-family building?	
☐ Were engineered, stamped, and permitted construction drawings provided?	
☐ Were CHPWH equipment submittals, stamped and approved by the responsible engineer of record, provided?	
☐ Was equipment-cost information provided?	

Advanced Level Inducement Requirements	Comments
☐ Does the CHPWH system conform to one of the qualified piping configurations in accordance with NEEA's Advanced Water Heater Specification (AWHS)?	
☐ Was a Product Assessment Datasheet (PADS) provided for the CHPWH that demonstrates compliance with the requirements of the NEEA AWHS?	
☐ Was documentation provided showing proof that a system start-up service was completed by a manufacturer-authorized service representative?	

Premium Level Inducement Requirements	Comments
☐ Is the CHPWH system listed on the NEEA's AWHS Qualified Products List?	
☐ Does the CHPWH system achieve a SysCOP equal to or greater than Tier 3 as shown in NEEA's AWHS Table 3: CHPWH Systems Efficiency Tiers?	

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	June 14, 2023	May 16, 2024	N/A
2	May 17, 2024	March 30, 2025	Updated format, sample data points list
3	March 31, 2025	December 31, 2025	Updated format, requirements, checklist