High-Performance Measure Details

Measure Name
Semi-Central Heat Pump Water Heater Systems

Use Category
SHW - Water Heating Electrification

Effective Date
February 13, 2026

End Date
Pending New Version Release in June, 2026

Version
1.2

Measure Code
LM402

Measure Stage
Early Adoption & High Priority Data Collection

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Technology Summary

Semi-central heat pump water heater (HPWH) systems use one or more centrally located heat pump water-heating plants to serve the domestic or service hot water needs of a defined cluster of dwelling units or building uses, rather than an entire building or a single unit. In the context of the California Energy Design Assistance (CEDA) program—which supports electrification, decarbonization, and grid resilience in new construction—semi-central HPWH systems represent a scalable electrified alternative to conventional gas-fired central service water-heating plants. These systems are commonly applied in multifamily buildings, hotels, and nonresidential facilities where in-unit HPWHs are impractical, and fully centralized systems would result in long distribution runs and higher standing losses. A typical semi-central configuration includes primary heat pump capacity, central thermal storage, and a distribution network that may incorporate temperature maintenance (or “swing”) tanks to maintain delivery temperatures.

Semi-central HPWH systems matter for California decarbonization goals because they combine electrification with improved distribution efficiency. By limiting the distance between the heat pump plant and the fixtures it serves, semi-central designs can reduce recirculation heat losses compared to fully centralized systems. This approach can

lower reliance on electric resistance temperature maintenance and improve overall system efficiency when properly designed. From an operational perspective, performance depends on coordinated system design—including plant sizing, piping layout, recirculation strategy, and control sequencing—rather than equipment efficiency alone.

In practice, semi-central HPWH performance is highly sensitive to implementation details. Common performance gaps include: inadequate separation between primary heating and temperature maintenance functions; continuous or poorly controlled recirculation that erodes system COP; oversizing or under sizing due to improper load diversity assumptions; control strategies that allow unnecessary electric resistance operation; and piping configurations that do not align with manufacturer-recommended system architectures. Without careful design, systems described as "semi-central" may not deliver measurable improvements over traditional centralized layouts.

Relevant industry standards and references include the NEEA Advanced Water Heater Specification (AWHS), AHRI performance certifications, Title 20 Appliance Efficiency Regulations, and 2025 Title 24 Part 6 service water-heating 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 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 semi-central HPWH, this helps to increase the overall supply of semi-central HPWH 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 enables 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 for this measure are intended to address a market and implementation gap in the application of semi-central HPWH systems. While heat pump water heating is increasingly adopted as an electrification strategy, semi-central system architectures are not explicitly defined under the 2025 Title 24 Energy Code and can vary significantly in design quality. System performance is highly sensitive to distribution layout, recirculation strategy, load diversity assumptions, and control sequencing. Without targeted guidance and incentives, projects may install systems described as “semi-central” that do not materially improve performance or reduce distribution-related losses relative to conventional centralized designs.

This high-performance measure is structured to encourage intentional, well-documented semi-central HPWH system design that supports measurable electrification and decarbonization outcomes in multifamily and nonresidential buildings. By clarifying system configuration expectations and promoting coordinated design practices, the measure helps reduce implementation risk and improve real-world performance consistency while advancing service water-heating electrification.

Inducement eligibility is determined based on the project’s compliance with the applicable System Design Requirements and Supporting Documentation Requirements. Inducement amounts for this measure are calculated based on the avoided therms relative to a conventional gas service water-heating system installed in the building, reflecting the electrification impact of displacing fossil-fuel-based water heating. Final eligibility and inducement levels are verified through the CEDA review process.

System Design Requirements

1. Products selected must be listed on the AWHS Qualified Products List (NEEA).
    a. Northwest Energy Efficiency Alliance (NEEA) | View NEEA's Advanced…
2. Must meet the requirements of the Advanced Water Heater Specification 8.0 (NEEA 2022) or later.
    a. HPWH Products Used and Manufacturer Requirements
        i. Heat pump water heater product manufacturers must complete and submit a Product Assessment Datasheet (PADS) that outlines compliance with the requirements of the AWH specification.
        ii. HPWH manufacturer shall provide a five-year parts warranty on the HPWH that commences on the HPWH system startup date or six months after the HPWH ship date, whichever is earlier.
        iii. HPWH manufacturer shall provide a one-year labor warranty for HPWH system troubleshooting, technical support, and parts replacement that commences on the HPWH system startup date.
        iv. HPWH system startup shall be performed by a manufacturer-authorized service provider.
        v. HPWH system shall be capable of sending alarms or notifications to an off-site location if the following events occur:
            1. HPWH fails to start or is forced to shut off before the heating cycle is completed per the HPWH system sequence of operation.
            2. Auxiliary electric-resistance heating is activated (excluding swing tank heater or defrost operation).
    b. Product Standard Testing Requirements
        i. The HPWH shall meet UL 1995 and or UL 60335-2-40 through testing by a Nationally Recognized Testing Laboratory (NRTL), Electrical Testing Laboratories (ETL), CSA International (CSA), or an equivalent third-party agency to all standards required by local and national code.
    c. Piping and System Design Configuration
    d. HPWH system piping schematics shall align with one or more of the following qualified piping configurations (See the AWH Specification document):

i. **Single-pass HPWH**
    1. No hot water circulation, primary heat pump water heating only.
    2. Hot water circulation returned to the primary storage.
    3. Hot water circulation returned to a temperature maintenance tank in series w/electric resistance element, also referred to as a “swing tank.”
    4. Hot water circulation returned to a temperature maintenance storage tank in parallel with multi-pass HPWH for reheat.

ii. **Multi-pass HPWH**
    1. Integrated HPWH, no hot water circulation.
    2. Integrated HPWH, hot water circulation returned to primary storage.
    3. Split-system, hot water circulation returned to the primary storage.

3. System must be sized using an Ecosizer or the manufacturer’s alternative sizing tool with documentation of the method.
4. Systems using Tier 3 and 4 configurations are encouraged though not a requirement.

Incremental Measure Cost

A semi-central HPWH system uses 2–3 smaller plants instead of a single centralized plant. This creates:

- Added costs:
  - Multiple plant rooms (plumbing, pumps, controls).
  - Redundant circulation / valving.
  - More design/engineering time.
- Offsetting savings:
  - Shorter recirculation loops reduce swing-tank resistance losses.
  - May avoid oversizing that often happens in central plants.
  - Potentially easier phasing or modular construction.
- Key point: The first costs of semi-central HPWH system design will generally be slightly higher than central, because you're duplicating equipment and distribution headers. That means the IMC for semi-central HPWH should be a modest increment above central HPWH.

Multifamily – Recommended IMC ($/Dwelling Unit):

Definition of size class based on # of dwelling units (DU), consistent with CA prototypes & NEEA segmentation.

MFm Size	Advanced	Premium	Notes
Small (<19 DU)	$4,500/DU	$5,500/DU	Small sites have least scale benefit; costs align with reported CA retrofits
Medium (20–79 DU)	$3,500/DU	$4,500/DU	Typical podium MFm, roughly 3–5 stories
Large (>80 DU)	$2,000/DU	$2,500/DU	High-rise or dense podiums; strong economies of scale

Non-Residential / Commercial / Public – Recommended IMC ($/ft²):

Normalized by building gross floor area (GFA)

Size Class	Advanced	Premium	Notes
Small (<20k ft²)	$7.50/ft²	$8.50/ft²	Small office/retail/public; limited load diversity
Medium (20–50k ft²)	$5.50/ft²	$6.50/ft²	Mid-size commercial/public buildings
Large (>50k ft²)	$3.50/ft²	$4.50/ft²	Large campuses/buildings; CHPWH plant costs spread over bigger load

Sources:

- 2025_T24_CASE-Report-_MF-DHW-Final-1.pdf
- Central-Heat-Pump-Water-Heaters-for-Multifamily-Supply-Side-Assessment-Study.pdf
- Advanced-Water-Heating-Specification.pdf
- ET22SWE0017 Commercial and Multifamily CO2 Heat Pump Water Heater Final Report

Code Readiness Objectives

This measure supports Code Readiness objectives by determining what the most cost-effective, low-energy configurations of HPWH systems are compared to unitary systems. While the energy code has some criteria in Title 24, 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.

Code Readiness Site Monitoring

If selected for Code Readiness monitoring, equipment energy consumption and mechanical 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

Collected data will help support the following:

- Operational efficiencies of semi-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
- Avoided gas infrastructure costs

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 Dewpoint	°F	Measured at heat pump or site
Indoor Air Temperature	°F	Average
Building Mode (Occupied Unoccupied)	-	Flag indicating status

Code Reference

2025 California Energy Code (Title 24, Part 6)

Section 170.1 – Performance Compliance

> *Alternative compliance pathway allowing service water-heating systems that demonstrate equal or lower energy use relative to prescriptive requirements.*

Section 110.3 – Mandatory Requirements for Service Water-Heating Systems and Equipment

> *Mandatory efficiency, control, and installation requirements applicable to all service water-heating systems, regardless of compliance pathway.*

Residential Reference Appendix RA3 – Field Verification and Diagnostic Testing

> *Field verification requirements for service water-heating system insulation, controls, and related components.*

Eligible Climate Zones and Building Types

Eligible Climate Zones

This high-performance measure applies statewide in **California Climate Zones 1-16** (Title 24). Applicants must identify the project's climate zone in the submittal.

Eligible Building Types

This high-performance measure applies to:

- **High-Rise Multifamily**: Buildings with **four (4) or more habitable stories above grade**.
- **Nonresidential**: **Commercial, public, agricultural, and industrial** facilities (e.g., offices, retail, lodging, education, healthcare, food service, warehouses, manufacturing, civic buildings).

Eligible Project Scopes

This high-performance measure applies to:

- **New construction**, **additions**, and **major alterations/retrofits** to systems served by the measure.

This high-performance measure does not apply to (not in scope):

- **Low-rise residential** (single-family and multifamily ≤3 habitable stories above grade).

Measure Exclusions

This high-performance measure excludes the following:

- Central heat pump water heating systems
- Pool and spa heat pump water heaters
- Heat pumps used solely for space heating

Reviewer Checklist

High-Performance Measure Reviewer Checklist

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:** _____

High-Performance Measure Requirements	Comments

Product Eligibility

☐ Products selected are listed on the **NEEA Advanced Water Heater Specification (AWHS) Qualified Products List**.

☐ The HPWH system meets the requirements of the **Advanced Water Heater Specification (AWHS) 8.0 (NEEA 2022) or later**.

HPWH Products Used & Manufacturer Requirements

☐ Manufacturer has completed and submitted a **Product Assessment Datasheet (PADS)** outlining compliance with the AWHS requirements.

☐ Manufacturer provides a **minimum five-year parts warranty**, commencing on the HPWH system startup date or six months after the HPWH ship date, whichever is earlier.

☐ Manufacturer provides a **minimum one-year labor warranty** for HPWH system troubleshooting, technical support, and parts replacement, commencing on the HPWH system startup date.

☐ HPWH system startup was performed by a **manufacturer-authorized service provider**.

☐ HPWH system is capable of sending alarms or notifications to an off-site location if:

☐ The HPWH fails to start or is forced to shut off before the heating cycle is completed per the system sequence of operation.

☐ Auxiliary electric-resistance heating is activated (excluding swing tank heater or defrost operation).

Product Standard Testing Requirements

☐ The HPWH meets **UL 1995 and/or UL 60335-2-40** through testing by a Nationally Recognized Testing Laboratory (NRTL), ETL, CSA, or equivalent third-party agency, consistent with local and national code requirements.

Piping & System Design Configuration

☐ HPWH system piping schematics align with one or more of the qualified piping configurations identified in the AWHS specification.

Single-Pass HPWH (if applicable)

☐ No hot water circulation, primary heat pump water heating only.
☐ Hot water circulation returned to the primary storage.
☐ Hot water circulation returned to a temperature maintenance tank in series with electric resistance element (“swing tank”).
☐ Hot water circulation returned to a temperature maintenance storage tank in parallel with multi-pass HPWH for reheat.

Multi-Pass HPWH (if applicable)

☐ Integrated HPWH, no hot water circulation.
☐ Integrated HPWH, hot water circulation returned to primary storage.
☐ Split-system, hot water circulation returned to primary storage.

System Sizing

☐ System was sized using **Ecosizer** or the manufacturer’s alternative sizing tool
☐ Documentation of the sizing methodology is provided.

Version History Log

Version	Effective Date	End Date	Change Description
1	February 23, 2023	February 12, 2026	N/A
1.2	February 13, 2026	*Pending New Version Release in June, 2026*	Updated measure to the current CEDA HPM format, IMC, and added reviewer checklist