High-Performance Measure Details

Measure Name
Drain & Wastewater Heat Recovery

Use Category
HR – Heat Recovery

Effective Date
December 08, 2025

Version
2

Measure Code
LM646

Measure Stage
Early Adoption

Table of Contents

Technology Summary

Drain water heat recovery (DWHR) and wastewater heat recovery (WWHR) technologies capture and reuse thermal energy from water that would otherwise be wasted down the drain. This includes heat from showers, sinks, dishwashers, laundry, and industrial processes. By recovering this low-grade heat before it enters the sewer system, these systems significantly reduce the energy required to produce domestic hot water or to support space and process heating needs.

Drain Water Heat Recovery (DWHR): Targets greywater, which is relatively clean wastewater from showers, sinks, and dishwashers. These systems are typically compact, low-maintenance, and well-suited to residential and multifamily buildings. Because they avoid contact with blackwater, they face fewer regulatory barriers and are easier to install in both new construction and retrofit settings.

Wastewater Heat Recovery (WWHR): Captures heat from the combined wastewater stream (greywater + blackwater). These systems require more robust heat exchangers and filtration or cleaning mechanisms, making them ideal for large-scale or centralized applications such as commercial buildings, district energy systems, or municipal wastewater treatment facilities.

Drain and wastewater heat recovery represent a foundational energy efficiency measure in California's push toward carbon-neutral buildings and clean thermal energy systems. Water heating is one of the largest sources of energy consumption in both residential and commercial sectors, accounting for roughly 15–25% of building energy use statewide. By reducing water heating demand, DWHR and WWHR directly cut greenhouse gas (GHG) emissions, lower peak electricity demand, and enhance grid resilience.

As California transitions toward all-electric buildings, DWHR and WWHR technologies offer an underutilized yet cost-effective opportunity to recover waste energy already embedded in daily water use. Broad deployment in multifamily, commercial, and district-scale systems can yield substantial cumulative energy savings and emissions reductions, helping bridge the gap between current performance and the state's aggressive climate action milestones.

Alignment with CEDA Program Goals

The CEDA program supports the implementation of energy efficiency measures that advance 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 the 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 drain and wastewater heat recovery technologies, this helps to increase the overall supply of wastewater heat recovery 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 following inducement requirements are designed to accelerate the adoption of DWHR and WWHR in the current market by enhancing energy efficiency, lowering operational costs, and reducing carbon emissions. Project inducements will be determined by assessing each project's projected energy-savings impacts and its ability to support broader electrification adoption.

This HPM offers two independent design levels: **Essential — Drain Water Heat Recovery (DWHR)** and **Premium — Wastewater Heat Recovery (WWHR)**. Project teams must comply with one design level—Essential or Premium—to be eligible. The tiers are independent; a project does not need to meet both. Refer to the tier-specific sections that follow for the applicable Minimum Performance Requirements and Required System Configurations for the option you are claiming.

System Design Requirements

1. **Essential Level**: Drain Water Heat Recovery (DWHR)
   - 1.1. Minimum Performance Requirements:
     - 1.1.1. Performance rating: The installed DWHR unit(s) shall have a minimum rated effectiveness of 50%.
     - 1.1.2. Product Compliance & Certification:
       - 1.1.2.1. Vertical DWHR Units: Compliant with CSA B55.2 and tested/labeled to CSA B55.1 or IAPMO IGC 346-2017.
       - 1.1.2.2. Sloped DWHR Units: Compliant with IAPMO PS 92 and tested/labeled to IAPMO IGC 346-2017.
       - 1.1.2.3. All units must be certified to the Energy Commission per RA3.6.9 and appear on the CEC DWHR certification list.
     - 1.1.3. Installation tolerances: Sloped units shall be installed within ±1° of rated slope; minimum lengthwise slope 1°; lateral level ±1°.
   - 1.2. Required System Configuration:
     - 1.2.1. Allowed installation configurations: (*Refer to Appendix A*)
       - 1.2.1.1. Equal-flow
       - 1.2.1.2. Unequal flow to the water heater
       - 1.2.1.3. Unequal flow to showers
     - 1.2.2. Minimum served fixtures (per RA3.6.9):
       - 1.2.2.1. Single-Dwelling Systems: Recover from at least the master bathroom shower and transfer heat to all showers or the water heater.
       - 1.2.2.2. Central Systems (multiple dwellings): Recover from ≥ 50% of showers above the first floor and transfer heat to all respective showers or the water heater.
     - 1.2.3. Orientation: Vertical and sloped units are both eligible when they meet the above product standards and installation tolerances.
2. **Premium Level:** Wastewater Heat Recovery (WWHR)
   - 2.1. Intent: Enable flexible, application-based paths for service water heating (SWH), space heating, and space cooling using wastewater as a heat source/sink. WWHR systems typically combine wastewater screening/pumping, a wastewater-side heat exchanger, and a water-to-water heat pump (reversible for cooling where applicable).
   - 2.2. Minimum Performance Requirements (by application)
     - 2.2.1. Cross-cutting requirements (apply to all WWHR projects):
       - 2.2.1.1. Heat pump rating standard: Heat pumps shall be rated to ISO 13256-2 (water-to-water) (or be listed under an equivalent AHRI/AHRI-ISO WSHP program).
       - 2.2.1.2. Whole-system efficiency disclosure: Submittals shall include modeled system COP/EER that accounts for heat pump(s) + heat exchanger (HX) + source/load pumps at the project's

declared design wastewater temperature and flow. (Industry case studies and literature support COPs ≥3 and often >4 where source temps are moderate.)

2.2.1.3. Wastewater-side HX performance: At design flow, specify an approach temperature ≤ 10°F (≈5–6°C) (wastewater outlet to secondary return) or provide manufacturer data showing equal/greater annual energy capture at a different target (e.g., spiral or fouling-tolerant HX).

2.2.1.4. Fouling control & maintainability: Provide screening/straining (typically 3–6 mm), clean-in-place (CIP)/back-flush provisions, accessible HX surfaces, and bypass piping to maintain sewer hydraulics during service.

2.2.1.5. Instrumentation for M&V (all paths): Calibrated source and load flow meters, supply/return temperatures on both sides of the HX, and energy metering of heat pump(s) and all associated pumps.

2.2.2. Application-specific minimums (select the path being claimed):

2.2.2.1. A) Service Water Heating (SWH) Path

2.2.2.1.1. Heat Pump Minimum: COP_heating ≥ 3.0 at declared design point with wastewater EWT ≥ 55–60°F and hot-water setpoint up to 130–140°F, per ISO 13256-2 rating data and project selection sheets.

2.2.2.1.2. Integration: Either preheat a dedicated storage tank upstream of existing heaters/HPWHs, or serve as the primary heat source with electric resistance or other low-carbon backup. (NREL and other studies document substantial DHW savings when wastewater is used as a source.)

2.2.2.2. B) Space Heating Path (hydronic)

2.2.2.2.1. Heat Pump Minimum: COP_heating ≥ 3.2 at design conditions with wastewater EWT ≥ 55–60°F and hydronic supply temperatures ≤ 120°F. (Low-temperature distribution maximizes COP and aligns with WSHP rating practice.)

2.2.2.2.2. Simultaneous heat/cool (optional): Projects that deliver concurrent heat/cool from one machine may claim performance using net heating COP at the declared operating point.

2.2.2.3. C) Space Cooling Path

2.2.2.3.1. Reversible HP or chiller using wastewater as sink: COP_cooling ≥ 4.5 (EER ≈ 15.3) at design with wastewater EWT ≤ 75°F and chilled-water LWT ≈ 44–46°F (or project-specific). (Documented WWHR systems commonly achieve COPs ~4–8 depending on temperature lift.)

2.3. Required System Configuration (SWH, Space Heating, and/or Space Cooling)

2.3.1. Allowed topologies (select any that meet the above performance and code):

2.3.1.1. In-building side stream (“sewer mining”): Screened wastewater is pumped through an external plate/spiral HX; secondary loop serves a water-to-water HP for SWH and/or hydronic loads.

2.3.1.2. In-sewer or effluent HX: Purpose-built HX modules embedded in a sewer or WWTP effluent channel with secondary loop to HPs (district or campus loads).

2.3.1.3. Hybrid/dual-source: Wastewater primary with air-source or cooling tower backup/trim for shoulder periods or maintenance.

Measure Notes:

1. *If a project installs only DWHR, consider Essential.*
2. *If a project installs WWHR (for service water heating, space heating, and/or space cooling), consider Premium using the appropriate application path.*
3. *If a project installs both DWHR and WWHR serving different end uses or distinct systems, each may be considered separately under its respective tier, with inducements assigned to the end-use served.*
4. *Do not stack or double-count impacts for the same load with both tiers.*

Supporting Documentation Requirements

1. **Required for Both Design Levels**
   - 1.1. Cover Sheet
     - 1.1.1. Project info, climate zone, HPM level(s) claimed, point of contact.
     - 1.1.2. Simple yes/no attestation that applicable code requirements are met (e.g., CPC cross-connection protections; any local approvals if tapping public sewers/effluent for WWHR).
   - 1.2. One-Line Schematic
     - 1.2.1. A single diagram (or marked-up as-built) showing the heat-recovery device, connections, and any pumps/valves/sensors.
   - 1.3. Key Product Cutsheets
     - 1.3.1. DWHR: page showing model number and rated effectiveness ≥ 50% and the relevant listing/standard.
     - 1.3.2. WWHR: page showing ISO 13256-2 (water-to-water) or equivalent rating for the selected heat pump model.
   - 1.4. Acceptance Snapshot
     - 1.4.1. A short test at steady operation (30–60 minutes): note source & load flow, supply/return temperatures, and kW or amps for the heat pump(s)/pumps.
2. **Essential Level — Drain Water Heat Recovery**
   - 2.1. Photo Set
     - 2.1.1. Unit label (model/serial), installed orientation, cold/hot tie-ins, shower tie-in(s), and a photo showing level/slope.
   - 2.2. Configuration Declaration
     - 2.2.1. Check a box: Equal-flow / Unequal-to-heater / Unequal-to-showers.
     - 2.2.2. List of the showers served (for central systems: a quick count of showers served vs. total).
   - 2.3. Compliance Proof
     - 2.3.1. ECC-rater form/bundle or installer affidavit confirming model matches submittal, configuration as declared and install within code tolerances.
     - 2.3.2. CEC DWHR certification page PDF for each DWHR model installed (model number highlighted).
3. **Premium Level — Wastewater Heat Recovery**
   - 3.1. Design-Point Performance Sheet
     - 3.1.1. From manufacturer selection or a simple table: wastewater EWT, secondary supply/return, design flows, HX approach, and COP_heating / COP_cooling used to claim the measure.
   - 3.2. Source & Pretreatment Note
     - 3.2.1. One paragraph stating the wastewater source (in-building side stream / in-sewer / effluent) and the pretreatment method (e.g., screen/backflush).
   - 3.3. Controls Summary
     - 3.3.1. Bullet the implemented setpoints (key temps, pump control, safeties). A controller screenshot is acceptable in place of text.

Code Readiness Objectives

Advance code readiness for DWHR and WWHR systems by improving their integration with existing building infrastructure and new construction practices. Encourage adoption of real-time performance monitoring and verification methods to ensure reliable energy savings data. Assess the cost-effectiveness of system implementation across different building types to establish a strong business case for future code inclusion.

There are also additional opportunities for future research:

- Developing more efficient and compact heat exchanger designs to enhance system performance and broaden application potential
- Exploring improved strategies for integrating heat recovery with other building systems—such as geothermal loops or centralized heat pump water heaters—in high-rise multifamily apartments.
- Collecting and analyzing long-term metered data to validate modeled energy savings and inform future updates to energy standards
- Evaluating the broader environmental impacts and benefits of widespread adoption of DWHR and WWHR, supported by case studies from diverse building types and climates

Site Metering Prerequisites

To support system performance monitoring and data collection, each project shall provide access for metering and communication equipment installation according to the following:

- Projects equipped with a Building Automation System (BAS), Energy Management System (EMS), or equivalent platform should enable integration of advanced metering devices through that system to facilitate data collection and remote access.
- Projects without a BAS/EMS shall allow the Code Readiness team to install temporary stand-alone data loggers, sensors, and communication equipment as needed to monitor system performance. Metering equipment may be deployed on-site for a monitoring period of up to 12 months.
- Instrumentation and sensors will be installed or supplemented as needed to measure key system parameters—such as fluid flow, temperature differentials, and energy transfer—sufficient to evaluate the performance of the drain or wastewater heat recovery system (and any associated equipment or systems, where applicable).

Data Benefits

- Energy Savings: Significant reduction in energy consumption for water heating.
- Cost Savings: Lower utility bills due to reduced energy use.
- System Efficiency: Enhanced efficiency of heating systems through pre-heating.

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
Wastewater (HX primary) flow rate	gpm	**WWHR**; ultrasonic or magmeter, ±1–2% accuracy; locate on HX primary loop
Wastewater inlet temp to HX (T_p,in)	°F	**WWHR**; immersion/thermowell upstream of HX; sensor accuracy ±0.5 °F
Wastewater outlet temp from HX (T_p,out)	°F	**WWHR**; downstream of HX; used to calculate HX approach

Data Points to Meter	Unit	Additional Specifications
Secondary/load loop flow rate	gpm	**WWHR**; to HP or distribution; required for kBtuh transfer calc
Secondary supply temp (to HP/load)	°F	**WWHR**; thermowell; for ΔT and COP/EER; for SWH path, DHW tank top temp may substitute
Secondary return temp (from HP/load)	°F	**WWHR**; thermowell; pairs with supply temp for ΔT
Heat pump electrical power	kW	**WWHR**; true-power meter (±1%); log or snapshot; note if auxiliaries included
DWHR potable-side flow (through coil)	gpm	**DWHR**; inline turbine or clamp-on ultrasonic; snapshot during steady shower draw
DWHR cold-water inlet temp (pre-DWHR)	°F	**DWHR**; upstream thermowell; pairs with outlet temp
DWHR cold-water outlet temp (post-DWHR)	°F	**DWHR**; downstream thermowell; demonstrates preheat effectiveness

Code Reference

California Plumbing Code (CPC): 603.5.4 Heat Exchangers

> *Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat-transfer medium. Single-wall heat exchangers used in indirect-fired water heaters shall meet the requirements of Section 505.4.1. Double-wall heat exchangers shall separate the potable water from the heat-transfer medium by providing a space between the two walls that are vented to the atmosphere.*

California Building Green Building Code (2025): A4.203.1.2.4 Drain Water Heat Recovery

> *Meet the requirements for installation of Drain Water Heat Recovery specified in Title 24, Part 6, Reference Appendix RA4.4.21.*

RA4.4.21 – Verified Drain Water Heat Recovery System

> *An ECC-rater inspection is required to obtain this credit. All DWHR unit(s) shall be certified to the Energy Commission according to the following requirements:*
>
> *a. Vertical DWHR unit(s) shall be compliant with CSA B55.2 and tested and labeled in accordance with CSA B55.1 or IAPMO IGC 346-2017. Sloped DWHR unit(s) shall be compliant with IAPMO PS 92 and tested and labeled with IAPMO IGC 346-2017.*
> *b. The DWHR unit(s) shall have a minimum rated effectiveness of 42 percent.*
>
> *The ECC-rater shall verify that:*
>
> *a. The make, model, and CSA B55.1 or IAPMO IGC 346-2017 rated effectiveness of the DWHR unit(s) shall match the compliance documents. The DWHR unit(s) shall also be verified as a model certified to the Energy Commission as qualified for credit as a DWHR unit(s).*
> *b. The installation configuration (e.g. equal flow, unequal flow to the water heater, or unequal flow to the showers) and the percent of served shower fixtures shall match the compliance documents.*
> *c. For water heating system serving a single dwelling, the DWHR system shall, at the minimum, recover heat from the master bathroom shower and must at least transfer that heat either back to all the respective showers or the water heater.*

d. *For central water heating system serving multiple dwellings, the DWHR system shall, at the minimum, recover heat from half the showers located above the first floor and must at least transfer that heat either back to all the respective showers or the water heater.*
e. *The DWHR unit(s) shall be installed within 1 degree of the rated slope. Sloped DWHR shall have a minimum lengthwise slope of 1 degree. The lateral level tolerance shall be within plus or minus 1 degree.*
f. *The installation shall comply with any applicable California Plumbing Code requirements.*

Eligible Climate Zones, Building Types, & Project Scopes

Eligible Climate Zones

This 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 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 measure applies to:

- **New construction**, **additions**, and **major alterations/retrofits** to service water heating and/or hydronic HVAC systems served by the measure.

Measure Exclusions

This measure excludes the following:

- **Low-rise residential** (single-family and multifamily ≤3 habitable stories above grade).
- **Program-Wide**
  - Not permanent or code-safe: Temporary/portable installs or any plumbing, electrical, or safety non-compliance (incl. cross-connection/backflow).
  - Unapproved source tie-ins: Sewer or WWTP effluent connections without required local utility/POTW approvals.
  - Administrative risk: Designs that present health/safety risks or cannot reasonably be inspected/validated.
- **Essential — DWHR**
  - Sub-minimum / unlisted equipment: Rated effectiveness < 50% or not certified/listed to required standards.
  - Non-qualifying configuration/coverage: Not piped to an allowed configuration or (for central systems) insufficient shower coverage.
  - Improper installation: Orientation/level/slope outside allowed tolerances.
- **Premium — WWHR**
  - Missing rated HP: No water-to-water heat pump with an appropriate rating (e.g., ISO 13256-2/AHRI equivalent).
  - Potable separation not ensured: Any potable HX interface lacking required protection (e.g., double wall/vented where applicable).
  - Unsuitable/unauthorized source or unverifiable performance: Source conditions or approvals that preclude meeting—or proving—minimum COP/EER.

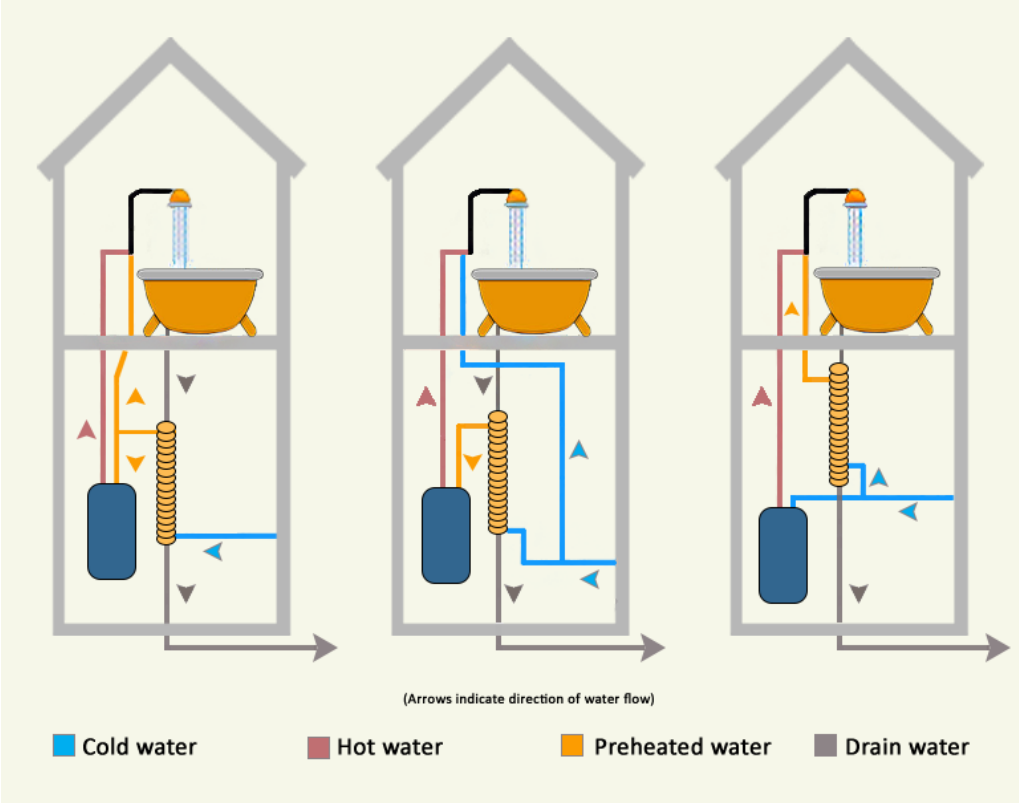
Appendix A: DWHR Example Installation Configurations

Figure 1 illustrates the three **program-recognized DWHR configurations**. Colors match the legend in the graphic (cold water = blue, hot water = red, preheated water = orange, drain water = gray). Arrows indicate flow direction.

- **Equal-Flow (EF)** — *Left diagram*
  Preheated cold water is split to **both the water heater cold inlet and the fixture cold inlet**. This maximizes recovery at the point of use while also reducing water-heater lift.
- **Unequal-Flow — To Water Heater** — *Middle diagram*
  Preheated cold water is routed **only to the water heater cold inlet**. Fixture cold remains un-preheated.
- **Unequal-Flow — To Fixture** — *Right diagram*
  Preheated cold water is routed **only to the fixture cold inlet** (e.g., shower). The water heater's cold inlet is not preheated.

Configuration	Preheat Path(s)	Typical Use / Rationale
Equal-Flow (EF)	To the **water heater** and **cold fixture**	Most common for single vertical stacks serving showers; balances WH savings and shower comfort.
Unequal Flow → Water Heater	To the **water heater** only	Where piping access to fixture cold is limited, leverages WH preheat for whole-building DHW.
Unequal Flow → Fixture	To **cold fixture** only	Retrofit situations prioritizing shower comfort or where a WH tie-in is impractical.

Figure 1: Example Installation Configurations for Drain Water Heat Recovery (DWHR)



Reviewer Checklist

HPM Review Checklist: LM646 – Drain & Wastewater Heat Recovery – V2

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:** _____

Inducement Requirements – Essential Level	Comments
☐ Does the installed DWHR unit(s) have a minimum rated effectiveness of 50%?	
☐ Are product compliance and certifications met according to System Design Requirements 1.1.2?	
☐ Are sloped units be installed within ±1° of rated slope; minimum lengthwise slope 1°; lateral level ±1°?	
☐ Are allowed installation configuration requirements met according to System Design Requirements 1.2.1?	
☐ Are minimum served fixtures requirements met according to System Design Requirements 1.2.2?	
☐ Do vertical and sloped units meet the orientation requirements and installation tolerances according to all Essential level requirements?	

Inducement Requirements – Premium Level	Comments
☐ Is the installation enabled for flexible, application-based paths for service water heating (SWH), space heating, and space cooling using wastewater as a heat source/sink?	
☐ Are all applicable minimum performance requirements met according to System Design Requirements 2.2?	
☐ Do the installed systems meet the required configurations according to System Design Requirements 2.3?	

Supporting Documentation Requirements – Essential Level	Comments
☐ Were required cover sheets, one-line schematics, key product cutsheets, and acceptance snapshots provided according to Supporting Documentation Requirements 1.1-1.4?	
☐ Were photos provided that show the unit label (model/serial), installed orientation, cold/hot tie-ins, shower tie-in(s), and a photo showing level/slope?	
☐ Was documentation provided showing declared configuration according to Supporting Documentation Requirements 2.2?	
☐ Were all proof of compliance documents provided according to Supporting Documentation Requirements 2.3?	

Supporting Documentation Requirements – Premium Level	Comments
☐ Were required cover sheets, one-line schematics, key product cutsheets, and acceptance snapshots provided according to Supporting Documentation Requirements 1.1-1.4?	

HPM Review Checklist: LM646 – Drain & Wastewater Heat Recovery – V2

- ☐ Were design-point performance sheets provided that meet the requirements according to Supporting Documentation Requirements 3.1?
- ☐ Was a paragraph statement provided that states the wastewater source (in-building side stream / in-sewer / effluent) and the pretreatment method (e.g., screen/backflush)?
- ☐ Was a summary of controls provided that meet the requirements according to Supporting Documentation Requirements 3.3?

Version History Log

Version	Effective Date	End Date	Change Description
1	June 28, 2024	December 07, 2025	N/A
2	December 08, 2025	Active	Updated format, measure requirements, code references, eligibility, exclusions, checklist

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.