

High-Performance Measure Details

Measure Name Extended-Range Water-Source Heat Pump & VRF Systems with Decoupled Ventilation and Heat Recovery	Use Category HVAC
Effective Date May 18, 2026	End Date -
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Measure Stage Early Adoption & High Priority Data Collection	

Table of Contents

High-Performance Measure Details.....	1
Technology Summary.....	1
Alignment with CEDA Program Goals	3
CEDA Inducement Requirements	3
Incremental Measure Cost.....	6
Code Readiness Objectives	9
Code Reference.....	13
Eligible Climate Zones and Building Types	20
Measure Exclusions	21
Appendix A: Representative Source-Side Configurations	23
Appendix B: Complementary CEDA HPMs.....	24
Reviewer Checklist.....	25
Version History Log	28

Technology Summary

Extended-range closed-loop water-source heat pumps (WSHPs) and water-source variable refrigerant flow (VRF) multi-split heat pumps, when paired with a decoupled ventilation and heat-recovery system, use a two-part HVAC approach that separates outdoor-air treatment from zone space conditioning to improve system efficiency, control, and flexibility. For this HPM, the decoupled ventilation path is limited to a Dedicated Outdoor Air System (DOAS), Heat Recovery Ventilator (HRV), or Energy Recovery Ventilator (ERV) that meets applicable 2025 Title 24 DOAS and exhaust-air heat-recovery requirements. The ventilation system conditions outdoor air for ventilation, filtration, and moisture management, while the water-source space-conditioning system handles zone heating and cooling. The space-conditioning path is limited to an extended-range closed-loop WSHP or a water-source VRF system. In a

WSHP system, individual zone heat pumps connect directly to a shared closed water loop. In a water-source VRF system, water-source VRF modules connect to the same type of closed loop and serve multiple indoor units through refrigerant piping. By decoupling ventilation from zone space conditioning, this approach can improve humidity control, increase opportunities for heat recovery, reduce reheat and backup heating needs, and support more efficient all-electric operation.

This measure applies to closed-loop WSHP and water-source VRF systems that utilize extended-range capabilities. In this context, extended-range refers to equipment that can continue operating at loop temperatures beyond those typical of conventional closed-loop water-source systems, which are commonly maintained around 60°F to 90°F. For this HPM, eligibility is based on equipment capable of operating at entering water temperatures of 32°F or lower in heating mode and 105°F or higher in cooling mode. The value of that wider operating band is not that the equipment is most efficient at the extremes; it is that the system can remain in heat-pump operation across more hours of loop operation before supplemental heat addition, heat rejection, or backup heating is needed. Representative source-side and ventilation arrangements are described in Appendix A, Representative Source-Side Configurations.

This matters for California electrification, decarbonization, and operational performance because it can reduce reliance on fossil-fuel and electric backup heating, improve ventilation effectiveness, and capture more value from simultaneous heating and cooling loads within a building. For CEDA, this technology is most relevant to new multifamily and multi-zone commercial buildings—such as offices, schools, hospitals, hotels, and similar projects—seeking an electrification-ready HVAC approach with central ventilation, zone-level comfort control, and loop-based heat recovery. A DOAS, HRV, or ERV with required heat recovery preconditions outdoor air and keeps ventilation treatment separate from local space-conditioning equipment, which can limit overcooling and reheat and improve humidity control where applicable. At the system level, the closed water loop allows zones with simultaneous heating and cooling needs to exchange heat, so energy rejected from one part of the building can help meet loads elsewhere before central source or sink equipment must intervene. The wider operating range can further reduce how often supplemental heat addition and heat rejection equipment must operate. In appropriate applications, this supports decarbonization-friendly and all-electric design pathways, lower overall HVAC energy use, better controllability, and better alignment with California’s broader decarbonization and grid-responsive building goals.

Common real-world performance gaps this HPM is designed to address include: (1) decoupled ventilation systems that do not sufficiently condition outdoor air or recover exhaust energy, leaving unnecessary ventilation or latent load on local space-conditioning equipment; (2) supply-air or control strategies that overcool and reheat air when colder ventilation air, better recovery, or better sequencing could offset loads more efficiently; (3) loop-temperature control strategies that are too narrow, poorly reset, or staged too conservatively, so the system rarely uses the equipment’s extended operating range; (4) poor hydronic balancing, constant-flow pumping, or weak coordination between water-source equipment and loop controls that increase pumping energy and create unstable operation; (5) limited system-level visibility, allowing mis-set parameters, failed sensors, or improper staging of ventilation, loop, and zone controls to go undetected; and (6) weak integration between the decoupled ventilation system, pumps, heat-rejection or heat-addition equipment, and zone WSHP or water-source VRF operation.

Relevant rating standards/certifications: Water-source heat pumps (WSHP): ISO 13256-1; AHRI Certified® Geothermal – Water-Source Heat Pumps (WSHP); 2025 Title 24 Table 110.2-B. Water-source VRF multi-split heat pumps: AHRI 1230-2023; AHRI Certified® Variable Refrigerant Flow (VRF) Multi-Split Air Conditioning and Heat Pump Equipment; 2025 Title 24 Table 110.2-G. Decoupled ventilation and heat recovery: 2025 Title 24 DOAS and exhaust-air heat-recovery requirements; AHRI 920 for DX-DOAS, where applicable; AHRI 1060/1061 for air-to-air energy-recovery components used in HRV/ERV equipment; ANSI/ASHRAE Standard 62.1; ANSI/ASHRAE/IES Standard 90.1.

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 extended-range water-source heat pumps and water-source VRF systems with decoupled ventilation and heat recovery, this helps to increase the overall supply of these 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 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 **Extended-Range Water-Source Heat Pump and VRF Systems with Decoupled Ventilation and Heat Recovery** HPM are intended to address a persistent design, controls, and verification gap in closed-loop water-source systems. While the 2025 Title 24 Energy Code establishes baseline efficiency requirements for water-source heat pumps and water-source VRF equipment and includes prescriptive requirements for DOAS and exhaust-air heat recovery, those provisions alone do not ensure that projects actually specify extended-range equipment, implement control sequences that use the wider loop-temperature band, prevent local electric resistance fallback, or provide monitoring points sufficient to confirm real-world operation. As a result, projects may install nominally compliant equipment while operating the system in a conventional manner that limits heat-pump utilization, reduces heat-sharing benefits, and weakens the value of the installation as a code-readiness data point.

This HPM is structured to encourage intentional specification and implementation of closed-loop, extended-range WSHP and water-source VRF systems paired with qualifying DOAS, HRV, or ERV ventilation and heat recovery. By tying inducement eligibility to extended-range capability, coordinated control sequences, and minimum monitoring points, the measure supports more consistent heat-pump operation across a wider range of loop conditions,

reduces reliance on fossil-fuel and electric backup heating, and improves the quality of field data available to CEDA and Codes & Standards for future code development. This is especially relevant for multi-zone buildings where simultaneous heating and cooling, loop heat exchange, and decoupled ventilation can materially affect whole-system performance.

Inducement eligibility is determined based on the project’s compliance with all applicable **System Design Requirements and Supporting Documentation Requirements** for the selected equipment pathway. Inducement amounts for this HPM are expected to be evaluated using a combination of served conditioned floor area and projected performance impacts, including modeled energy savings, reductions in supplemental or backup heating operation, and estimated carbon dioxide equivalent (CO_{2e}) emissions reductions relative to a conventional code-minimum system. Final eligibility and inducement levels are verified through the CEDA review process based on the qualifying heat pump pathway, required certifications, control sequences, monitoring capability, and supporting submittals.

System Design Requirements

1. **Eligible HVAC System Configuration:** The qualifying HVAC system shall provide space heating and space cooling using a closed-loop, extended-range water-source space-conditioning system paired with a decoupled ventilation and heat-recovery system.
2. **Qualifying Heat Pump Equipment Pathways:** Qualifying projects shall include either one of the following equipment pathways:
 - a. **Water-Source Heat Pump (WSHP) Pathway:** A closed-loop, extended-range water-source heat pump system serving zone space heating and cooling.
 - b. **Water-Source VRF Multi-Split Heat Pump Pathway:** A closed-loop, extended-range water-source variable refrigerant flow (VRF) multi-split heat pump system serving zone space heating and cooling.
3. **Required Decoupled Ventilation and Heat-Recovery System:** The project shall include a **DOAS, HRV, or ERV** that meets applicable 2025 Title 24 DOAS and exhaust-air heat-recovery requirements.
4. **Extended-Range Capability:** Qualifying WSHP or water-source VRF equipment shall be specifically designed for extended-range operation.
 - a. **Fluid Temperature Capability:** Qualifying equipment shall be capable of operating with entering water or water-glycol temperatures of 32°F or lower in heating mode and 105°F or higher in cooling mode.
 - b. **Local Electric Resistance Restriction:** Local electric resistance heat shall not be enabled at the zone heat pump unit as the means of maintaining qualifying heating operation at the required low entering-fluid condition.
5. **Minimum Efficiency and Certification Requirements:** All qualifying heat-pump and ventilation equipment shall meet the applicable full-load and part-load minimum efficiency requirements required by 2025 Title 24 or ANSI/ASHRAE/IES Standard 90.1-2022, as applicable to the project and equipment type. Units shall be certified based on the applicable equipment type, as shown below.

Equipment Type	Minimum Efficiency Reference	Required Certification / Rating Standard
Water Source Heat Pumps (WSHP)	2025 Title 24, Part 6, Table 110.2-B	AHRI certification under the applicable WSHP certification program, including ISO 13256-1 as applicable
Water Source Variable Refrigerant Flow (VRF) Multi-Split Heat Pump	2025 Title 24, Part 6, Table 110.2-G	AHRI 1230
DX-DOAS, where applicable	2025 Title 24, Part 6, Table 110.2-H	AHRI 920
HRV / ERV, where applicable	2025 Title 24 DOAS and exhaust-air heat-recovery requirements	Applicable rating / certification path demonstrating compliance with 2025 Title 24 heat-recovery requirements; AHRI 1060/1061 where applicable

6. **Required Controls and Sequence of Operation:** The project shall include control sequences designed to use the extended-range capability of the qualifying equipment. Control documentation shall identify, at a minimum:
 - a. Closed-loop water temperature setpoints and reset logic
 - b. Enable/disable logic and staging for supplemental heat-addition and heat-rejection equipment
 - c. Lockouts or other control logic preventing local electric resistance heat from serving as the qualifying low-temperature heating strategy
 - d. Coordination between the decoupled ventilation and heat-recovery system and the space-conditioning system, including ventilation-air treatment and heat-recovery operation where applicable.
7. **Minimum Required Monitoring Data Points:** The system shall be capable of providing, at a minimum, the following monitoring points:
 - a. Closed-loop supply water temperature
 - b. Closed-loop return water temperature
 - c. Operating status of the primary WSHP or water-source VRF system
 - d. Operating status of supplemental heat-addition equipment, where applicable
 - e. Operating status of heat-rejection equipment, where applicable
 - f. Operating status or lockout status of local electric resistance heat, where present
 - g. Operating status of the decoupled ventilation system
 - h. Heat-recovery enable/bypass status, where available

Where central closed-loop supply and return temperature points are not available, representative entering and leaving fluid temperatures at the qualifying equipment shall be acceptable.

Supporting Documentation Requirements

Documentation shall include, as applicable:

1. Product specifications, equipment schedules, and procurement submittals confirming the qualifying equipment pathway, extended-range capability, applicable efficiency compliance, and required product certification.
2. Design drawings identifying the closed-loop heat-pump system type, the decoupled ventilation and heat-recovery system type, and the ventilation airflow zones served.
3. Control drawings or written sequences of operation identifying extended-range operating logic, loop temperature control and reset logic, staging of supplemental heat-addition and heat-rejection equipment, local electric resistance restriction, and coordination between the space-conditioning system and the decoupled ventilation and heat-recovery system.
4. A point list, trend list, BAS/BMS/EMS point schedule, or equivalent documentation confirming availability of the required monitoring points.
5. Where applicable, acceptance-test documentation required by 2025 Title 24 for DOAS, HRV, ERV, or related ventilation and heat-recovery systems.

Incremental Measure Cost

The Incremental Measure Cost (IMC) presented below is intended for CEDA program planning and inducement calibration only. It represents a normalized incremental first cost for implementing a qualifying closed-loop extended-range WSHP or water-source VRF system paired with a code-compliant decoupled ventilation and heat-recovery system, relative to a 2025 Title 24–compliant baseline system of the same equipment pathway under typical California new construction conditions. The IMC is not intended to serve as a project-specific cost estimate, contractor bid comparison, or reconciliation tool for actual project pricing.

Actual project costs may vary based on system configuration, controls scope, ventilation approach, procurement timing, and other project-specific factors; accordingly, the IMC is based on representative planning anchors rather than project-specific installed-cost data.

Base Case

The Base Case represents a 2025 Title 24–compliant closed-loop water-source space-conditioning system of the same equipment pathway, paired with a code-compliant decoupled ventilation and heat-recovery system. The system is designed to meet space-conditioning loads using conventional equipment selection and control strategies consistent with standard practice. The Base Case includes:

- **Closed-loop WSHP or water-source VRF equipment** meeting applicable minimum efficiency requirements
- **Conventional loop temperature control**, commonly maintained around 60°F to 90°F
- **Standard manufacturer-provided controls and communications**, without extended-range sequencing or enhanced monitoring requirements
- **Standard backup or supplemental heating provisions**, where applicable, available to maintain comfort when loop conditions or loads exceed normal heat-pump operating conditions
- **Typical design, installation, and commissioning scope**
- **A code-compliant DOAS, HRV, or ERV** meeting applicable 2025 Title 24 ventilation and exhaust-air heat-recovery requirements.

The Base Case reflects standard-practice water-source system design without the additional equipment selection, control logic, monitoring readiness, and verification needed to ensure extended-range heat-pump operation.

Measure Case

The Measure Case represents the same general system type and application as the Base Case but is modified to meet the HPM System Design Requirements for extended-range operation, controls integration, and monitoring readiness. The Measure Case includes:

- **Qualifying extended-range WSHP or water-source VRF equipment**
- **Extended loop temperature capability**, including operation at 32°F or lower entering water or water-glycol temperature in heating mode and 105°F or higher in cooling mode
- **Control sequences designed to actively utilize the extended operating range** before supplemental heat addition, heat rejection, or backup heating is required
- **Restrictions on local electric resistance or other zone-level supplemental heat** so that such heat is reserved for limited backup, protection, or non-routine conditions rather than normal first-stage heating
- **Monitoring-ready controls and communications** with the minimum point visibility required to support verification of loop conditions, operating status, and sequence performance
- **Additional startup, verification, commissioning, and supporting documentation**
- **A code-compliant DOAS, HRV, or ERV** meeting applicable 2025 Title 24 ventilation and exhaust-air heat-recovery requirements.

Incremental cost is driven primarily by qualifying extended-range equipment selection, controls programming and integration, monitoring-ready communications and point visibility, and enhanced startup, verification, commissioning, and documentation. Because some current commercial WSHP product families already offer extended-range capability as a standard or optional feature, the IMC primarily reflects qualifying controls, communications, and verification rather than a full HVAC architecture change.

The Measure Case therefore represents an above-code implementation premium to a standard water-source system, not a full replacement of the underlying HVAC architecture.

IMC Values and Normalization

IMCs for this measure are presented as representative normalized values by size class, selected to reflect typical project conditions and system scale. For this HPM, IMCs are normalized on a **\$/ton** basis to align with how WSHP and water-source VRF systems are typically sized and estimated in commercial and multifamily applications.

For purposes of this HPM, total system size means the total qualifying nominal installed space-conditioning cooling capacity of the WSHP or water-source VRF pathway serving the project. Typical project sizes for these systems range from approximately 20 tons (minimum) to 500+ tons. Per-ton IMCs are higher for smaller systems and lower for larger systems, reflecting fixed infrastructure costs and expected economies of scale as project size increases.

Total System Size Based on Nominal Cooling Capacity	WSHP IMC	WS-VRF IMC
20 - 49 tons	\$390/ton	\$650/ton
50 - 149 tons	\$200/ton	\$325/ton
150 - 500+ tons	\$110/ton	\$185/ton

These IMC values are representative planning values calibrated for program use and reflect typical new construction market conditions and are intended for program calibration and measure review only. Actual project costs may vary based on system configuration, building type, controls platform, and project-specific design and construction conditions.

Sources

IMC values are informed by a combination of publicly available market pricing, industry cost references, and program experience, and are intended to reflect typical market conditions rather than project-specific pricing, including:

- [2025 California Building Energy Efficiency Standards \(Title 24, Part 6\)](#)
- [Variable Refrigerant Flow \(VRF\) Multi-Split Air Conditioning and Heat Pump Equipment \(AHRI\)](#)
- [Geothermal – Water-Source Heat Pumps \(WSHP\) \(AHRI\)](#)
- [ISO 13256-1: Water-Source Heat Pumps Performance Rating Standard](#)
- [Energy-Saving Strategies for Water-Source Heat-Pump Systems](#)
- [Aquazone™ 50PCH, PCV, PCD007-070 - Compact Water Source Heat Pumps with Puron® Refrigerant](#)
- [Aquazone™ 50HQP Indoor Water-Cooled Large Capacity Water Source Heat Pump](#)
- [Aquazone™ 50VQP Large Capacity Water Source Heat Pump](#)
- [SmartSource® Small Capacity Single Compressor WSHP](#)
- [SmartSource® Large Capacity Vertical & Horizontal WSHP](#)
- [Trane® Axiom™ High Efficiency Water Source Heat Pumps](#)
- [Mitsubishi VRF Heat Recovery Water Source – PQRY](#)
- [Mitsubishi Electric Sales Canada Service Bulletin – PQRY-P96ZLMU-A1 \(575V\)](#)
- [Commercial Building Sensors and Controls Systems – Barriers, Drivers, and Costs \(NREL/TP-6A50-82117\)](#)
- [Commercial Building Sensors and Controls Systems: Barriers, Drivers, and Costs \(NREL/BR-6A50-82750\)](#)
- [Mitsubishi Electric PAC-UKPRC001-CN-1 BACnet and Modbus Interface MelcoBEMS MINI](#)
- [Trane BAYBCIR001A BACNET Communication Interface](#)
- [MT3042 BACNET MS/TP Communication Module](#)

Code Readiness Objectives

This measure supports CEDA's Code Readiness efforts by collecting performance and market data for future Title 24 improvements related to extended-range WSHP or WS-VRF with decoupled ventilation and heat recovery. The data will help determine the most cost-effective, low-energy configurations of these systems compared to standard-practice 2025 Title 24-compliant closed-loop water-source WSHP or water-source VRF systems with code-compliant decoupled ventilation and heat recovery that do not include extended-range sequencing, monitoring readiness, or enhanced verification requirements. The objectives include the following:

- **Quantify extended-range heating performance in the field.** For each participating project, document minimum observed entering-fluid temperature, maximum loop temperature, percent of occupied heating hours served primarily by compressor operation, percent of heating hours with local electric resistance heat locked out and not operating, and any unmet-load or comfort issues during low-temperature events. Use this to determine whether the extended-range thresholds are practical, repeatable, and materially reduce backup heat.
- **Verify that control sequences actually use the extended operating range before supplemental equipment is enabled.** Trend loop temperature setpoints and reset logic, primary WSHP or water-source VRF operating status, staging of heat-addition and heat-rejection equipment, local resistance lockout status, and simultaneous heating/cooling diversity. Quantify the number of hours the intended sequence is maintained without override, plus the frequency and causes of sequence failures or premature backup operation.
- **Evaluate coordination between the space-conditioning system and the decoupled ventilation/heat-recovery system.** Trend DOAS/HRV/ERV operating status, heat-recovery enable/bypass status, ventilation supply-air temperature, and ventilation airflow or fan status where available. Quantify the percent of occupied hours ventilation operates as intended without driving unnecessary supplemental heating, heat rejection, or comfort complaints.
- **Characterize climate-zone and building-type variation.** Compare normalized performance by California climate zone and building type, including heating energy use, heat pump runtime, supplemental heat runtime, loop temperature profile, and comfort outcomes. Use the results to determine whether future code language should be statewide or targeted by climate zone, occupancy, or system size.
- **Assess contractor, controls-integrator, and design-team readiness.** For each project, record whether complete sequences of operation, point lists, design drawings, startup forms, and TAB/acceptance documentation were produced and whether first-pass commissioning was successful. Quantify deficiency rates, reprogramming effort, recurring installation errors, and training gaps to identify what market support is still needed before a code proposal is practical.
- **Quantify incremental cost drivers and avoided costs.** Collect project cost data for qualifying equipment, controls/communications, sensors and metering, commissioning/startup, glycol or loop modifications, plant integration, electrical upgrades, and any avoided backup-heating or heat-rejection infrastructure. Normalize costs by project size and \$/ton to identify which costs are persistent hardware premiums versus one-time soft costs that may decline with market maturity.
- **Demonstrate monitorability, enforceability, and persistence.** Verify that required points are project-accessible, trendable at useful intervals, and sufficient to reconstruct actual sequence performance over at least one representative heating season. Quantify point-availability rate, trend quality, and ability to verify loop reset, resistance lockout, and supplemental-equipment staging from data alone, so CEDA can determine the minimum code-ready monitoring package.

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:

- Quantify real-world extended-range WSHP and WS-VRF performance across varying loop conditions.
- Determine how often systems remain in heat-pump operation before supplemental heat addition or heat rejection is required.
- Evaluate whether extended-range operation reduces reliance on local electric resistance and other backup heating.
- Verify that loop reset, staging, and lockout sequences operate as intended in the field.
- Document coordination between water-source equipment and decoupled ventilation / heat-recovery systems.
- Characterize simultaneous heating and cooling diversity and loop heat-sharing behavior.
- Quantify primary heat pump, loop pump, and ventilation energy impacts where metering is available.
- Compare performance across climate zones, building types, and project sizes.
- Identify commissioning, controls-integration, and monitoring factors that affect realized performance.
- Support future Title 24 code pathways for extended-range water-source systems with decoupled ventilation and heat recovery.
- Document representative entering and leaving fluid temperatures at qualifying equipment under actual operation.
- Quantify whole-system performance indicators such as heat-transfer rate and system COP where optional metering is available.
- Identify recurring sensor, sequencing, or controls issues that limit use of the extended operating range.
- Demonstrate whether the required monitoring points are sufficient for future code verification, enforceability, and persistence.

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
Minimum Required Data Points		
Closed-Loop Supply Water Temperature	°F	Average or trended value. If a central loop point is unavailable, use representative entering fluid temperature at qualifying equipment.
Closed-Loop Return Water Temperature	°F	Average or trended value. If a central loop point is unavailable, use representative leaving fluid temperature at qualifying equipment.
Primary WSHP / WS-VRF Operating Status	Status	Minimum on/off or enable/run indication; heating/cooling/standby mode where available.
Supplemental Heat-Addition Equipment Status	Status	Boiler, AWHP, electric supplemental heater, or other heat-addition device; on/off and stage where applicable.
Heat-Rejection Equipment Status	Status	Cooling tower, fluid cooler, dry cooler, or equivalent heat-rejection device; on/off and stage where applicable.
Local Electric Resistance Heat Status / Lockout	Status	Where present, capture actual operating status and/or lockout proof.
Decoupled Ventilation System Status	Status	DOAS / HRV / ERV unit run status; supply and exhaust fan status are acceptable where a single unit status point is unavailable.
Heat-Recovery Enable / Bypass Status	Status	Where available, capture heat-recovery enabled/disabled, bypass open/closed, or equivalent wheel/core/bypass status.
Optional – Space-Conditioning / Loop		
Representative Entering Fluid Temperature at Qualifying WSHP / WS-VRF Module	°F	Optional; one or more representative units or modules.
Representative Leaving Fluid Temperature at Qualifying WSHP / WS-VRF Module	°F	Optional; one or more representative units or modules.
Primary Heat Pump System Power	kW	Optional; interval average or trended value; separate from loop pump and ventilation power where possible.
Loop Pump Status or Speed	Status / % / Hz	Optional; on/off, VFD speed, or commanded speed.
Closed-Loop Water Flow	gpm	Optional; recommended if heat transfer rate or COP will be calculated from measured flow and delta-T.
Loop Pump Power	kW	Optional; recommended if whole-system COP will be reported.
Closed-Loop Water Temperature Setpoint / Reset Command	°F	Optional; BAS loop temperature setpoint and reset target used to verify control sequence performance.
Supplemental Heat-Addition / Heat-Rejection Stage or Enable Command	Status	Optional; BAS enable/disable or stage command for supplemental plant equipment.
Zone Heating/Cooling Mode or Diversity Indicator	Status / %	Optional; prefer an aggregate count or percent of zones/modules in heating versus cooling.
Optional – Ventilation / Heat Recovery		
Ventilation Airflow	cfm	Optional; measured or controller-calculated value where available.

Data Points to Meter	Unit	Additional Specifications
Ventilation Fan Status	Status	Optional; recommended when measured airflow is unavailable or when separate supply/exhaust proof is needed.
Ventilation Supply-Air Temperature	°F	Optional; average or trended value.
Outdoor Air Dry-Bulb Temperature	°F	Optional; measured at heat pump, DOAS, or site.
Outdoor Air Dew Point	°F	Optional; measured directly or calculated from outdoor-air temperature and relative humidity.
Optional – Supplemental Heat / Context / Diagnostics		
Supplemental Heat-Addition Power	kW	Optional; electric supplemental heat only, where separately metered.
Supplemental Heat-Addition Fuel Use	therm/h or kBtu/h	Optional; use when supplemental heat is fuel-fired.
Indoor Zone / Space Temperature	°F	Optional; one or more representative zones.
Occupied / Unoccupied Mode	Status	Optional; BAS schedule or occupied-mode flag.
Alarm / Fault Code	Status / Text	Optional; high-value troubleshooting point at system level or for representative modules.
Loop Differential Pressure	psid	Optional; useful for loop pump-control diagnostics.
Optional – Calculated KPIs		
Heat Pump / Closed-Loop Heat Transfer Rate	kBtu/h	Optional; derived thermal-transfer KPI. Calculate from measured loop flow and supply/return temperature differential, or use OEM/controller-derived heat pump thermal output where available. Define calculation method consistently across the project.
System COP	Unitless	Optional; calculated KPI; define whether this is heat-pump-only COP or whole-system COP including loop pumps and ventilation.

Code Reference

2025 Title 24, Part 6 – Building Energy Efficiency Standards: GENERAL

- **Section 110.2 – Mandatory Requirements for Space-Conditioning Equipment**

Table 110.2-B – HEAT PUMPS, MINIMUM EFFICIENCY REQUIREMENTS

This table establishes the applicable minimum efficiency requirements for the **WSHP pathway**.

Equipment Type	Size Category	Rating Condition	Efficiency *	Test Procedure *
Water source (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	86°F entering water	Federal Minimum EER	ISO-13256-1
Groundwater source (cooling mode)	≥ 135,000 Btu/h	59°F entering water	18.0 EER	ISO-13256-1
Ground source (cooling mode)	≥ 135,000 Btu/h	77°F entering water	14.1 EER	ISO-13256-1
Water source	≥ 135,000 Btu/h	86°F entering water	10.6 EER	ISO-13256-2
Water-to-water (cooling mode)				
Groundwater source water-to-water (cooling mode)	≥ 135,000 Btu/h	59°F entering water	16.3 EER	ISO-13256-2
Ground source brine-to-water (cooling mode)	≥ 135,000 Btu/h	77°F entering water	12.1 EER	ISO-13256-2

Equipment Type	Size Category	Rating Condition	Efficiency ^a	Test Procedure ^b
Water source (heating mode)	< 135,000 Btu/h (cooling capacity)	68°F entering water	Federal Minimum COP	ISO-13256-1
Water source (heating mode)	≥ 135,000 Btu/h and < 240,000 Btu/h	68°F entering water	Federal Minimum COP	ISO-13256-1
Groundwater source (heating mode)	< 135,000 Btu/h (cooling capacity)	50°F entering water	3.7 COP	ISO-13256-1
Ground source (heating mode)	< 135,000 Btu/h (cooling capacity)	32°F entering water	3.2 COP	ISO-13256-1
Water source water-to-water (heating mode)	< 135,000 Btu/h (cooling capacity)	68°F entering water	3.7 COP	ISO-13256-2
Groundwater source water-to-water (heating mode)	< 135,000 Btu/h (cooling capacity)	50°F entering water	3.1 COP	ISO-13256-2
Ground source brine-to-water (heating mode)	< 135,000 Btu/h (cooling capacity)	32°F entering water	2.5 COP	ISO-13256-2

a Deduct 0.2 from the required EERs and IEEs for units with a heating section other than electric resistance heat.

b Applicable test procedure and reference year are provided under the definitions.

Table 110.2-G – Electrically Operated Variable Refrigerant Flow Air to Air and Applied Heat Pumps Minimum Efficiency Requirements

This table establishes the applicable minimum efficiency requirements for the **water-source VRF multi-split pathway**.

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure ^b
VRF Water source (cooling mode)	<65,000 Btu/h	All	VRF Multi-split System ^a 86°F entering water	12.0 EER Federal Minimum IEER	AHRI 1230
VRF Water source (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	All	VRF Multi-split System ^a 86°F entering water	12.0 EER Federal Minimum IEER	AHRI 1230
VRF Water source (cooling mode)	≥135,000 Btu/h and < 240,000	All	VRF Multi-split System ^a 86°F entering water	10.0 EER Federal Minimum IEER	AHRI 1230
VRF Water source (cooling mode)	≥ 240,000 Btu/h	All	VRF Multi-split System ^a 86°F entering water	10.0 EER Federal Minimum IEER	AHRI 1230
VRF Groundwater source (cooling mode)	<135,000 Btu/h	All	VRF Multi-split System ^a 59°F entering water	16.2 EER	AHRI 1230
VRF Groundwater source (cooling mode)	≥135,000 Btu/h	All	VRF Multi-split System ^a 59°F entering water	13.8 EER	AHRI 1230
VRF Ground source (cooling mode)	<135,000 Btu/h	All	VRF Multi-split System ^a 77°F entering water	13.4 EER	AHRI 1230
VRF Ground source (cooling mode)	≥135,000 Btu/h	All	VRF Multi-split System ^a 77°F entering water	11.0 EER	AHRI 1230
VRF Water source (heating mode)	< 65,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68°F entering water	Federal Minimum COP	AHRI 1230
VRF Water source (heating mode)	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68°F entering water	Federal Minimum COP	AHRI 1230
VRF Water source (heating mode)	≥135,000 Btu/h and < 240,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68°F entering water	Federal Minimum COP	AHRI 1230
VRF Water source (heating mode)	≥ 240,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68°F entering water	Federal Minimum COP	AHRI 1230
VRF Groundwater source (heating mode)	<135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 50°F entering water	3.6 COP	AHRI 1230
VRF Groundwater source (heating mode)	≥135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 50°F entering water	3.3 COP	AHRI 1230
VRF Ground source (heating mode)	<135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 32°F entering water	3.1 COP	AHRI 1230
VRF Ground source (heating mode)	≥135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 32°F entering water	2.8 COP	AHRI 1230

a Deduct 0.2 from the required EERs and IEERs for Variable Refrigerant Flow (VRF) Multi-split system units with a heating recovery section.

b Applicable test procedure and reference year are provided under the definitions.

c IEERs are only applicable to equipment with capacity control as specified by AHRI 1230 test procedures.

Table 110.2-H – DX-DOAS Units, Single-Package and Remote Condenser – Minimum Efficiency Requirements

This table establishes the applicable minimum efficiency requirements for **DX-DOAS** equipment and is relevant where the qualifying decoupled ventilation pathway uses a DX-DOAS rather than an HRV or ERV.

Equipment Type	Energy Recovery	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure ^a
Air cooled (dehumidification mode)	Without energy recovery	NA	3.8 ISMRE2	AHRI 920
Air source heat pumps (dehumidification mode)	Without energy recovery	NA	3.8 ISMRE2	AHRI 920
Water cooled (dehumidification mode)	Without energy recovery	Cooling Tower Condenser Water	4.7 ISMRE2	AHRI 920
Water source heat pump (dehumidification mode)	Without energy recovery	Ground source, closed and open loop	4.6 ISMRE2	AHRI 920
Water source heat pump (dehumidification mode)	Without energy recovery	Water source	3.8 ISMRE2	AHRI 920
Air source heat pumps (heating mode)	Without energy recovery	NA	2.05 ISCOP2	AHRI 920
Water source heat pump (heating mode)	Without energy recovery	Ground source, closed and open loop	2.13 ISCOP2	AHRI 920
Water source heat pump (heating mode)	Without energy recovery	Water source	2.13 ISCOP2	AHRI 920
Air cooled (dehumidification mode)	With energy recovery	NA	5.0 ISMRE2	AHRI 920
Air source heat pumps (dehumidification mode)	With energy recovery	NA	5.0 ISMRE2	AHRI 920
Water cooled (dehumidification mode)	With energy recovery	Cooling tower condenser water	5.1 ISMRE2	AHRI 920
Water source heat pump (dehumidification mode)	With energy recovery	Ground source, closed and open loop	5.0 ISMRE2	AHRI 920
Water source heat pump (dehumidification mode)	With energy recovery	Water source	4.6 ISMRE2	AHRI 920
Air source heat pumps (heating mode)	With energy recovery		3.2 ISCOP2	AHRI 920
Water source heat pump (heating mode)	With energy recovery	Ground source, closed and open loop	3.5 ISCOP2	AHRI 920
Water source heat pump (heating mode)	With energy recovery	Water source	4.04 ISCOP2	AHRI 920

^a Applicable test procedure and reference year are provided under the definitions.

2025 Title 24, Part 6 – Building Energy Efficiency Standards: NONRESIDENTIAL

- **Section 120.1 – Nonresidential Mandatory Requirements for Ventilation and Indoor Air Quality**
 - This section establishes the minimum nonresidential ventilation and indoor air quality requirements applicable to DOAS, HRV, and ERV systems.
- **Section 120.2 – Nonresidential Mandatory Required Controls for Space-Conditioning Systems**
 - This section establishes mandatory controls requirements for nonresidential space-conditioning systems. It is relevant to loop temperature reset, staged heat-addition and heat-rejection logic, local electric resistance lockout, and coordination between the decoupled ventilation system and the space-conditioning system.
- **Section 120.5 – Nonresidential Mandatory Required Nonresidential Mechanical System Acceptance**
 - This section establishes the mechanical acceptance-testing requirements for applicable nonresidential systems, including DOAS, HRV, and ERV systems where required.
- **Section 140.4(p) – Nonresidential Prescriptive HVAC Requirements. Dedicated Outdoor Air Systems (DOAS)**
 - This section establishes prescriptive requirements for dedicated outdoor air systems in nonresidential buildings, including ventilation-air delivery, fan-speed control for balancing, fan power, and limits on supply-air warming under cooling-dominant conditions.
- **Section 140.4(q) – Nonresidential Prescriptive HVAC Requirements. Exhaust Air Heat Recovery**
 - This section establishes prescriptive exhaust-air heat-recovery requirements for nonresidential systems, including recovery thresholds, applicability criteria, and energy-recovery bypass or control provisions. The following tables identify when exhaust-air heat recovery is required based on system operating hours, climate zone, and percent outdoor air, and provide the economizer high-limit conditions used for energy-recovery bypass or control.
 - **Table 140.4-G – Air Economizer High Limit Shut Off Control Requirements**
 - **Table 140.4-J – Energy Recovery Requirements by Climate Zone and Percent Outdoor Air at Full Design Airflow (<8,000 hrs/year)**
 - **Table 140.4-K – Energy Recovery Requirements by Climate Zone and Percent Outdoor Air at Full Design Airflow (≥8,000 hrs/year)**

2025 Title 24, Part 6 – Building Energy Efficiency Standards: RESIDENTIAL

- **Section 170.2(c)4N – Multifamily Prescriptive. Dedicated Outdoor Air Systems (DOAS)**
 - This section establishes prescriptive DOAS requirements for high-rise multifamily residential projects, including fan power limits, direct delivery of ventilation air, minimum three-speed supply and exhaust fans for balancing, and limits on warming DOAS supply air above 60°F when the majority of zones require cooling.

- **Section 170.2(c)4O – Multifamily Prescriptive. Exhaust Air Heat Recovery**
 - This section establishes prescriptive exhaust-air heat-recovery requirements for high-rise multifamily residential fan systems, including minimum sensible or enthalpy recovery ratios and energy-recovery bypass or control provisions. The following tables establish the design supply fan airflow thresholds at which exhaust-air heat recovery is required based on system operating hours, climate zone, and percent outdoor air.

2025 Reference Appendices for Title 24, Part 6

- **Joint Appendix JA1 – Definitions**
 - This appendix provides definitions for incorporated standards and technical terms used in the Energy Code and Reference Appendices, including AHRI 1230 and ASHRAE Guideline 36.
- **Appendix NA7.5.4 – Air Economizer Controls and Exhaust Air Heat Recovery**
 - This appendix establishes acceptance-testing requirements for nonresidential air economizer controls and exhaust-air heat-recovery systems, including heat-recovery bypass control. It is relevant to the decoupled ventilation and heat-recovery pathway where the project includes a DOAS, HRV, or ERV subject to 2025 Title 24 exhaust-air heat-recovery and bypass/control requirements.
- **Appendix NA7.18.4 – Rated Central Ventilation System Heat Recovery or Energy Recovery Acceptance**
 - This appendix establishes construction-inspection and functional-testing requirements for a central HRV / ERV serving multiple dwelling units under the multifamily prescriptive pathway. It is relevant where the qualifying decoupled ventilation pathway uses a central multifamily HRV or ERV, including verification of required airflow, minimum sensible recovery efficiency, fan power, and recovery bypass / free-cooling capability.

California Appliance Efficiency Regulations (Title 20)

- This regulation establishes California appliance efficiency standards, test methods, and certification requirements for regulated equipment. This is a secondary reference for the WSHP and water-source VRF pathways where equipment is subject to state efficiency standards and MAEDbS listing requirements under **Section 1605.1(c)(1)**.
 - **Table C-5:** Applicable efficiency standards for the WSHP pathway.
 - **Table C-8:** Applicable efficiency standards for the water-source VRF pathway

Federal Standards

- **10 CFR Part 431, Subpart F – Commercial Air Conditioners and Heat Pumps**
 - This subpart establishes the federal framework for product definitions, test methods, and efficiency standards for covered commercial air conditioners and heat pumps. It is relevant to the WSHP pathway, the water-source VRF pathway, and applicable DX-DOAS equipment classes.
- **10 CFR 431.92 – Definitions concerning commercial air conditioners and heat pumps**
 - This section establishes federal definitions for covered equipment, including water-source heat pumps, VRF multi-split systems, and DOAS-related efficiency metrics such as ISMRE2 and IS COP2. It is relevant to the WSHP pathway, the water-source VRF pathway, and the DX-DOAS ventilation pathway.
- **10 CFR 431.96 – Uniform test method for the measurement of energy efficiency of commercial air conditioners and heat pumps**
 - This section establishes the applicable federal test procedures for covered commercial air conditioners and heat pumps. It is relevant to the WSHP pathway, the water-source VRF pathway, and the DX-DOAS ventilation pathway.

- **10 CFR 431.97 – Energy efficiency standards and their compliance dates**
 - This section establishes federal efficiency standards and compliance dates for covered commercial HVAC equipment. It is relevant where the underlying federal efficiency baseline must be acknowledged in addition to Title 24.

AHRI Standards and Certification References

- **AHRI Certified® Geothermal – Water-Source Heat Pumps (WSHP) / ISO 13256-1**
 - This certification program establishes the applicable rating and certification framework for the WSHP pathway, including ISO 13256-1 / 13256-2 as applicable.
- **AHRI 1230 – Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment**
 - This standard establishes the applicable rating framework for VRF multi-split systems and applies to the water-source VRF pathway.
- **AHRI 920 – Performance Rating of Direct Expansion-Dedicated Outdoor Air System Units**
 - This standard establishes the applicable rating framework for DX-DOAS equipment and is relevant where the qualifying decoupled ventilation pathway uses a DX-DOAS rather than an HRV or ERV.
- **AHRI 1060 / 1061 – Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment**
 - These standards establish rating methods for air-to-air energy-recovery components and are relevant where the qualifying decoupled ventilation pathway uses an HRV or ERV rather than a DX-DOAS.

ASHRAE Standards & Guidelines

- **ANSI/ASHRAE Standard 62.1 – Ventilation and Acceptable Indoor Air Quality**
 - This standard establishes ventilation and indoor air quality requirements for commercial and institutional buildings. It is relevant to the DOAS, HRV, and ERV pathways.
- **ANSI/ASHRAE/IES Standard 90.1 – Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings**
 - This standard establishes national model energy-efficiency requirements for commercial buildings and serves as an alternate benchmark for applicable equipment efficiency requirements. It is relevant to the WSHP pathway, the water-source VRF pathway, and applicable ventilation equipment pathways where alternate efficiency benchmarking is needed.
- **ASHRAE Guideline 36 – High-Performance Sequences of Operation for HVAC Systems**
 - This guideline establishes best-practice high-performance HVAC control sequences and is relevant to loop temperature reset, staged heat-addition and heat-rejection logic, local electric resistance lockout, and coordination between the decoupled ventilation system and the space-conditioning system.

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 (HPM) applies only to qualifying closed-loop, extended-range water-source heat pump (WSHP) or water-source VRF multi-split heat pump systems paired with a qualifying DOAS, HRV, or ERV decoupled ventilation and heat-recovery system for space heating and cooling. This HPM excludes the following system types, applications, equipment cases, and inducement overlaps:

Out-of-Scope System Types and Applications

- **Open-loop or once-through water-source systems**, including systems using direct groundwater, surface water, or other non-closed-loop source arrangements as the qualifying space-conditioning pathway, are not eligible under this HPM.
- **Non-water-source HVAC systems**, including air-to-air heat pumps, air-source VRF systems, packaged or split DX systems, and other non-water-source space-conditioning systems, are not eligible under this HPM.
- **Air-to-water or water-to-water hydronic heat pump systems** serving occupied spaces through hydronic distribution, fan coils, chilled beams, radiant systems, or similar terminal systems are not eligible under this HPM.
- **Heat recovery chillers and other cooling-driven heat-recovery systems** are not eligible where space heating is provided primarily through recovered chiller or refrigeration waste heat rather than through qualifying extended-range WSHP or water-source VRF equipment.
- **Systems not providing both space heating and space cooling** through the qualifying closed-loop WSHP or water-source VRF system are not eligible under this HPM.
- **Systems serving non-space-conditioning end uses**, including domestic/service hot water, process heating, process cooling, pool/spa heating, refrigeration heat reclaim, or similar non-space-conditioning applications, are not eligible under this HPM.

Non-Qualifying Extended-Range, Efficiency, and Certification Cases

- **Standard-range WSHP or water-source VRF equipment, or equipment not specifically designed and documented for extended-range operation**, does not qualify. Qualifying equipment must be capable of operating at entering water temperatures of 32°F or lower in heating mode and 105°F or higher in cooling mode.
- **Equipment that fails to meet applicable minimum efficiency requirements** required by **2025 Title 24** or **ANSI/ASHRAE/IES Standard 90.1**, as applicable to the project and equipment type, does not qualify.
- **Equipment lacking the applicable certification or rating path** does not qualify, including:
 - **WSHP**: AHRI certification under the applicable WSHP certification program, including ISO 13256-1 as applicable
 - **Water-source VRF multi-split heat pump**: AHRI 1230
 - **DX-DOAS, where applicable**: AHRI 920
 - **HRV / ERV, where applicable**: Applicable rating/certification path used to demonstrate compliance with 2025 Title 24 exhaust-air heat-recovery requirements
- **Projects with local electric resistance heat enabled** at the zone heat pump unit as the normal low-temperature heating strategy do not qualify under this HPM.

- **Projects unable to provide the required controls, monitoring-ready point visibility, and supporting documentation** needed to verify qualifying extended-range operation do not qualify under this HPM.

Anti-Double-Dip Provision

To prevent overlapping incentives, the following restrictions apply:

- **The same HVAC system, common loop, ventilation equipment, controls package, monitoring package, or source-side infrastructure** may not receive overlapping inducements under this HPM and another HPM for the same claimed function or performance attribute.
- **An extended-range WSHP or water-source VRF system receiving inducements under this HPM** may not claim inducements under the following HPMs for the same equipment, feature set, controls scope, monitoring scope, or source-side infrastructure:
 - **Ground Source Heat Pump HPM**, when the same ground loop, borefield, or geothermal source-side system is claimed for the same HVAC system
 - **Hydronic Heat Pump HPM**, when source-side air-to-water or water-to-water heat pumps are used only to maintain a qualifying WSHP / WS-VRF loop serving the same HVAC system
 - **Heat Recovery Chiller HPM**, when the same heat-recovery chiller plant, recovered-heat function, or associated source-side heating scope is claimed for the same HVAC service
- **Projects may implement multiple HPMs within the same building** only where each inducement applies to a physically distinct system or to clearly separable, non-overlapping equipment, controls, and costs. If overlap exists for a given HVAC system or associated infrastructure, the project must select one HPM inducement path for that scope.

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

Appendix A: Representative Source-Side Configurations

This appendix provides a simple reference to common source-side configurations that may be used to support shared water-loop operation, including heat addition and/or heat rejection, in qualifying extended-range closed-loop water-source heat pump (WSHP) and water-source VRF systems paired with decoupled ventilation and heat recovery.

The configurations summarized below are representative and are intended to illustrate common source-side design pathways-only; they are not intended to prescribe a single required architecture.

Source-Side Configuration	Primary Source-Side Elements	Description
Conventional Boiler / Tower	Boiler for loop heat addition and cooling tower or fluid cooler for loop heat rejection	A shared closed water loop serves WSHPs or water-source VRF modules; the boiler adds heat when needed, and the cooling tower or fluid cooler rejects excess loop heat.
Closed-Loop Geothermal	Vertical borefield, horizontal ground loop, or other closed-loop geo-exchange field	The ground loop acts as the primary heat source and heat sink for the shared water loop.
Hybrid Geothermal + Boiler/Tower Trim	Ground heat exchanger plus boiler trim, cooling tower trim, or fluid cooler trim	The ground loop carries part of the annual load; supplemental source-side equipment trims the remainder. This arrangement is commonly used where site area, borefield cost, or annual load imbalance makes a fully geothermal design impractical.
AWHP + Cooling Tower / Fluid Cooler	Air-to-water heat pumps plus cooling tower, dry cooler, or fluid cooler	AWHPs support the shared loop by adding heat during heating operation; the cooling tower, dry cooler, or fluid cooler rejects excess loop heat during cooling operation.
AWHP + Backup Boiler	Air-to-water heat pumps as primary heat-addition equipment plus boiler for trim, peak, or emergency conditions	AWHPs provide normal loop heat-addition operation; the boiler is reserved for peak, emergency, or low-ambient conditions as defined by the project sequence of operation.
Mixed-Source System	Any combination of geothermal, AWHP, boiler trim, cooling tower trim, fluid cooler trim, or similar source-side elements	Two or more source-side strategies are combined to widen the practical loop operating band, improve annual heat balance, reduce reliance on backup heat, or respond to project-specific constraints such as site area, first cost, phasing, or redundancy.

Ventilation Arrangement Note

For any of the configurations above, the ventilation path remains decoupled: a DOAS, HRV, or ERV conditions outdoor air separately from the water-source space-conditioning system. Conditioned outdoor air may be delivered directly to zones or through a separate ventilation distribution path, as appropriate to the project design.

Application Note

These example configurations are not intended to limit qualifying projects to a single source-side plant type.

Rather, they are intended to illustrate common ways a project may combine a closed-loop WSHP or water-source VRF space-conditioning system, a decoupled DOAS, HRV, or ERV ventilation path, and source-side heat-addition and/or heat-rejection equipment that supports extended-range loop operation.

Appendix B: Complementary CEDA HPMs

The following CEDA-approved High-Performance Measure is considered the most complementary add-on measure for the **Extended-Range Water-Source Heat Pump and VRF Systems with Decoupled Ventilation and Heat Recovery** HPM. This measure is listed because it can support controls integration, monitoring readiness, data collection, and remote access for qualifying projects.

This appendix identifies the most relevant complementary add-on measure and does not authorize overlapping inducements for the same controls package, monitoring package, integration scope, or commissioning scope.

- **Very High Efficiency DOAS HPM**, where the claimed ventilation and heat-recovery scope is beyond code and distinct from the base decoupled ventilation pathway required by this HPM
- **Building Management System / Energy Management System HPM**, for eligible buildings that are between 5,000 and 50,000 gross-square feet, and that classified under the California Building Code (CBC) as Group A – Assembly, B – Business, or M – Mercantile.

Reviewer Checklist

HPM Reviewer Checklist: LM401 – Extended-Range WSHP & VRF w/ Decoupled Ventilation & HR – 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

System Design Requirements:

- Eligible HVAC System Configuration (1):** The qualifying HVAC system provides space heating and space cooling using a closed-loop, extended-range water-source space-conditioning system paired with a decoupled ventilation and heat-recovery system.
- Qualifying Heat Pump Equipment Pathway (2):** The project includes either:
 - Water-Source Heat Pump (WSHP) Pathway (2a):** A closed-loop, extended-range water-source heat pump system serving zone space heating and cooling.
 - Water-Source VRF Multi-Split Heat Pump Pathway (2b):** A closed-loop, extended-range water-source variable refrigerant flow (VRF) multi-split heat pump system serving zone space heating and cooling.
- Required Decoupled Ventilation and Heat-Recovery System (3):** The project includes a DOAS, HRV, or ERV meeting applicable 2025 Title 24 DOAS and exhaust-air heat-recovery requirements.
- Extended-Range Capability (4, 4a):** Qualifying WSHP or water-source VRF equipment is specifically designed for extended-range operation and is capable of operating with entering water or water-glycol temperatures of **32°F or lower in heating mode** and **105°F or higher in cooling mode**.
- Local Electric Resistance Restriction (4b):** Local electric resistance heat is not enabled at the zone heat pump unit as the means of maintaining qualifying heating operation at the required low entering-fluid condition.
- Minimum Efficiency Requirements (5):** All qualifying heat-pump and ventilation equipment meets the applicable full-

load and part-load minimum efficiency requirements required by **2025 Title 24** or **ANSI/ASHRAE/IES Standard 90.1-2022**, as applicable to the project and equipment type.

High-Performance Measure Requirements

Comments

System Design Requirements: (continued)

- Required Certification / Rating Standard (5):** Submitted equipment shows the applicable certification / rating path:
 - WSHP:** AHRI certification under the applicable WSHP certification program, including ISO 13256-1 as applicable
 - Water Source VRF Multi-Split Heat Pump:** AHRI 1230
 - DX-DOAS, where applicable:** AHRI 920
 - HRV / ERV, where applicable:** Applicable rating / certification path demonstrating compliance with 2025 Title 24 heat-recovery requirements; AHRI 1060/1061 where applicable

- Required Controls and Sequence of Operation (6):** Control documentation identifies, at a minimum:
 - Closed-loop water temperature setpoints and reset logic (6a)
 - Enable/disable logic and staging for supplemental heat-addition and heat-rejection equipment (6b)
 - Lockouts or other control logic preventing local electric resistance heat from serving as the qualifying low-temperature heating strategy (6c)
 - Coordination between the decoupled ventilation and heat-recovery system and the space-conditioning system, including ventilation-air treatment and heat-recovery operation where applicable (6d)

- Minimum Required Monitoring Data Points (7):** Documentation confirms availability of the following monitoring points:
 - Closed-loop supply water temperature (7a)
 - Closed-loop return water temperature (7b)
 - Operating status of the primary WSHP or water-source VRF system (7c)
 - Operating status of supplemental heat-addition equipment, where applicable (7d)
 - Operating status of heat-rejection equipment, where applicable (7e)
 - Operating status or lockout status of local electric resistance heat, where present (7f)
 - Operating status of decoupled ventilation system (7g)
 - Heat-recovery enable/bypass status, where available (7h)

- Representative Temperature Point Allowance (7):** Where central closed-loop supply and return temperature points are not available, representative entering and leaving fluid temperatures at the qualifying equipment are used.

High-Performance Measure Requirements

Comments

Supporting Documentation Requirements:

- Product specifications, equipment schedules, and procurement submittals** confirm the qualifying equipment pathway, extended-range capability, applicable efficiency compliance, and required product certification.
- Design drawings** identify the closed-loop heat-pump system type, the decoupled ventilation and heat-recovery system type, and the ventilation airflow zones served.
- Control drawings or written sequences of operation** identify extended-range operating logic, loop temperature control and reset logic, staging of supplemental heat-addition and heat-rejection equipment, local electric resistance restriction, and coordination between the space-conditioning system and the decoupled ventilation and heat-recovery system.
- A point list, trend list, BAS/BMS/EMS point schedule, or equivalent documentation** confirms availability of the required monitoring points.
- Acceptance-test documentation**, where applicable, is provided for DOAS, HRV, ERV, or related ventilation and heat-recovery systems as required by 2025 Title 24.

Version History Log

Version	Effective Date	End Date	Change Description
1	February 23, 2023	May 17, 2026	N/A
1.2	May 18, 2026	-	Updated measure to the current CEDA HPM format, technology summary, IMC, sample data points, code readiness objectives, code reference, measure exclusions, and added appendices & reviewer checklist