High-Performance Measure Details

Measure Name
Heat Recovery Chiller

Use Category
Space & Service Water Heating Electrification

Effective Date
June 16, 2025

End Date
December 31, 2025

Version
2

Measure Code
LM401

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Technology Summary

A heat recovery chiller captures the heat typically rejected during the hydronic space cooling process and repurposes it for building space heating or service water heating needs, particularly during the heating season. By recovering and transferring this heat, the system improves overall energy efficiency and reduces the need for separate heating energy sources. This dual functionality makes heat recovery chillers especially effective in buildings with simultaneous heating and cooling demands.

Historically, the technology has been called a heat recovery chiller, heat recovery water-chilling packages, condenser heat recovery, air-to-water heat pump with simultaneous heating and cooling capabilities, simultaneous mechanical heat recovery, or hydronic heat recovery to differentiate from exhaust air or air-side refrigeration energy recovery.

A common attribute of heat recovery chillers is the production of chilled water (CHW) for space cooling needs while the chiller's condenser water-side of the equipment produces at most 95°F to 120°F temperature water, which is then repurposed for simultaneous heating needs. This 95°F or 120°F recovered waste heat is a low-grade temperature heating hot water (HHW), which is reusable but with limited applications. This low-grade temperature hot water could be used as a preheating coil to precondition the ventilation air of an air handling unit (AHU). A drawback of this arrangement is that often the ventilation preheat load is much smaller than the available recovered heat rejection, thus resulting in a low utilization of the asset.

Alternatively, this low-grade hot water may require a secondary heating source to boost the water temperature to a higher design condition, for example, 140°F temperature heating or service hot water. Historically, this booster or supplemental heating is accomplished by a variety of heating systems, but ultimately reduces the overall effectiveness of simultaneous mechanical heat recovery.

In other energy codes such as ASHRAE Standard 90.1, heat recovery for service hot water has been a requirement since the 2007 vintage with certain capacity thresholds and 24-hour operations. An excerpt of this code requirement is provided in Appendix Section 1. In ASHRAE Standard 90.1-2022, heat recovery for space heating was introduced with certain capacity thresholds, and 24-hour operations, and limited to a certain building type, acute inpatient hospitals. An excerpt of this code requirement is provided in Appendix Section 2. In Title 24 Part 6, 2025, heat recovery in chillers and the central plant was also added in late 2024 code adoption and will take effect January 1, 2026.

Within the latest language of Title 24 Part 6, 2025, there is a requirement for non-residential and hotel/motel buildings to include simultaneous mechanical heat recovery when certain simultaneous thresholds are met, along with minimum capacity for recovery requirements. The basis of the requirement compares the capacities of heating and service water heating systems against the capacities of cooling systems and a calculation of coincident cooling and heating loads. If the comparison of the capacities and loads exceeds a certain threshold, a heat recovery chiller capable of simultaneous mechanical heat recovery is required. When required, the heat recovery chiller must meet certain minimum efficiencies for part- and full-load operation.

Title 24 Part 6, 2025 does not mandate a certain leaving heating hot water temperature design.

Alignment with CEDA Program Goals

The CEDA program supports the implementation of energy efficiency measures that support Code Readiness's Long Term Tactical Plan (LTTP) to drive the goals of electrification, decarbonization, and load reduction.

Projects must meet one of the CEDA Inducement Requirements identified in the next section to receive an inducement and will be evaluated for level of interest in metering to support Code Readiness Objectives. This measure meets the CEDA program goals as follows:

- **Building partnerships with market stakeholders** by consulting on innovative technologies and best practices in energy efficiency, which can lead to the development of more effective solutions and accelerate the adoption of new technologies. As teams adopt the measure, this increases the volume of engineers able to design the equipment, contractors capable of installing the equipment, and owners able to operate the equipment.
- **Increasing the supply of high-performance measures and all-electric buildings** by combining electrification with energy efficiency, which can result in projects implementing measures to achieve greater energy savings, reduced emissions, and overall improved building performance. As more buildings specify and install heat recovery chiller technologies, this helps to increase the overall supply of 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 inducement requirements listed below are intended to support the adoption of the above code technologies in the current market by increasing energy efficiency, decreasing costs, and decreasing carbon emissions. Projects receive inducements based on market impacts, savings, and influence.

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

Inducement Requirements

- **System Design Requirements**
  - **Essential level**:
    - Provide a heat recovery chiller(s) serving a space and/or domestic/service water heating load exceeding the minimum efficiency requirements as stated in Title 24, Part 6, 2025 Section 110.2 - Table 110.2-N.
      - Table 1: Title 24, Part 6, 2025 Section 110.2 - Table 110.2-N:

Equipment Type	Size Category, (tons)	Heating Operation				
		Heating Source Conditions	Heat Recovery Chiller Full-Load Efficiency Simulateneous Cooling and Heating Full-Load Efficiency			
			Leaving Heating Water Temperature			
			Low	Med	High	Boost
			105°F	120°F	140°F	>140°F
Water source electrically operated positive displacement or centrifugal	<300 tons	54F/44F	8.33	6.41	4.42	NA
		75F/65F	NA	NA	NA	6.15
	>300 tons	54F/44F	8.9	6.98	5	NA
		75F/65F	NA	NA	NA	6.85

    - The heat transfer rate of the heat recovery chiller(s) must meet one of the 25% minimum thresholds as stated in Title 24, Part 6, 2025 Section 140.4(s) 1. B, which is shared below in Appendix - Section 3 for reference.

- **Advanced level:**
  - Provide a heat recovery chiller(s) serving a space and/or domestic/service water heating load that meets the minimum efficiency requirements of T24, Part 6, 2025 Section 110.2 Table 110.2-N, as seen in Table 1 above, and includes a design leaving heating hot water temperature of 105°F or lower.
    - Note: The hot water from the heat recovery chiller(s) may be combined with either an electric boiler or an air-to-water heat pump.
  - The heat transfer rate of the heat recovery chiller(s) must meet one of the 25% minimum thresholds as stated in Title 24, Part 6, 2025 Section 140.4(s) 1. B, which is shared below in Appendix - Section 3 for reference.
- **Premium level**:
  - For sites that are not required to have a heat recovery chiller(s) as defined by Title 24, Part 6, 2025, and have chosen to provide a heat recovery chiller(s), the project must:
    - Provide a heat recovery chiller(s) serving a space and/or domestic/service water heating load that meets the minimum efficiency requirements as stated in Title 24, Part 6, 2025 Section 110.2 Table 110.2-N.
      - Note: This premium level of inducement is targeted towards sites that are not required to have a heat recovery chiller(s) in accordance with Title 24, Part 6, 2025 Section 140.4.

- **Supporting Documentation Requirements**
  - Provide engineered, stamped, and permitted construction plans demonstrating compliance with all state and local jurisdiction requirements and regulations for installation and operation.
  - Provide system start-up documentation confirming that start-up service was performed by a manufacturer-authorized representative.
  - Provide a sequence of operations for the heat recovery chiller design.
  - Provide equipment submittals stamped and approved by the responsible engineer of record.
  - Provide equipment-cost information for the heat recovery chiller system design.
  - Provide load calculations to determine the outcome of either Section 140.4(s) 1. A.I or 140.4(s) 1. A. ii in accordance with Title 24, Part 6, 2025; Section 140.4 Mechanical Heat Recovery.

Code Readiness Objectives

While the energy code has some criteria as of Title 24, 2025 for chiller heat recovery, opportunities to improve the effectiveness or utilization of recovered heat still exist. The information would help to specifically inform energy codes to:

- Support Market Transformation: Provide installation examples to help update building energy codes and encourage wider adoption.
- Identify the high-performance hydronic-based all-electric heating systems.

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

- Identify available heat recovery chillers that exceed the minimum efficiency requirements and the margin that selected equipment exceeds the minimum efficiency requirements. The number of projects and the magnitude of the selected efficiency rating can inform more stringent efficiency requirements.
- Identify building types and topologies that utilize low-temperature leaving hot water heating plants. This information can be used to inform the requirements of low-temperature leaving hot water heating plants to increase the performance of electrified buildings.
- Identify projects that require and exceed the heat recovery chiller requirements.

Site Metering Prerequisites

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

Data Benefits

- The availability of higher-than-minimum efficiency heat recovery chiller equipment could demonstrate the opportunity to increase code-required efficiency levels.
- Demonstrate where all-electric designs and building topologies that utilize a low design leaving heating water temperature produce higher levels of efficiency compared to their medium and high design leaving hot water temperature counterparts.
- Demonstrate designs and building topologies that incorporate heat recovery chillers when not required by code. The data can be used to justify lower minimum capacity thresholds, thus requiring the heat recovery chiller technology for a broader scale of the new building stock.

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 needs of the monitoring effort:

Data Points to Meter	Unit	Additional Specifications
Heat Recovery Chiller Power	kW	Maximum and minimum values
Thermal Load Provided	BTU	Average and Peak values
Operational Efficiency	COP	Efficiency is measured at each instance
Operational Efficiency	TMCOP	Efficiency of temperature maintenance
Supply Water Flow	GPM	Average
Supply Water Supply Temp	°F	Average
Supply Water Return Temp	°F	Average
Supply Water Load	Btu/h	Average
Heat Recovery Water Flow	GPM	Average
Heat Recovery Water Supply Temp	°F	Average
Heat Recovery Water Return Temp	°F	Average
Heat Recovery Water Load	Btu/h	Average
Pump(s) Power	kW	Average
Outdoor Temperature	°F	Measured at the unit or site
Outdoor Air Moisture Level	% RH	Measured at the unit or site
Indoor Temperature	°F	Average
Building Mode (Occupied Unoccupied)	-	Flag indicating status

Eligible Climate Zones and Building Types

Eligible Climate Zones

This measure is applicable in all California climate zones.

Eligible Building Types

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

Measure Exclusions

This high-performance measure excludes the following:

- Sites that are required as defined by the 2025 CA energy code to use a heat recovery chiller(s) and are only meeting code minimum requirements.

Appendices

Appendix Section 1: ASHRAE Standard 90.1-2007

6.5.6.2 Heat Recovery for Service Water Heating

6.5.6.2.1 Condenser heat recovery systems shall be installed for heating or preheating of service hot water provided all of the following are true:

a. The facility operates 24 hours a day.
b. The total installed heat rejection capacity of the water-cooled systems exceeds 6,000,000 Btu/h of heat rejection.
c. The design service water heating load exceeds 1,000,000 Btu/h.

6.5.6.2.2 The required heat recovery system shall have the capacity to provide the smaller of

a. 60% of the peak heat rejection load at design conditions or
b. preheat of the peak service hot water draw to 85°F.

Exceptions:

a. Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30% of the peak water-cooled condenser load at design conditions.
b. Facilities that provide 60% of their service water heating from *site-solar* or *site-recovered energy* or from other sources.

Appendix Section 2: ASHRAE Standard 90.1-2022

6.5.6.3 Heat Recovery for Space Conditioning. Where heating water is used for *space* heating, a heat-pump chiller meeting the requirements of Table 6.8.1-16 for heat recovery that uses the cooling *system* return water as the heat source shall be installed, provided all of the following are true:

a. The *building* is an acute inpatient hospital, where the *building* or portion of a *building* is used on a 24-hour basis for the inpatient medical, obstetric, or surgical care for patients.
b. The total design chilled-water capacity for the acute inpatient hospital, either air cooled or water cooled, required at cooling *design conditions* exceeds 3,600,000 Btu/h of cooling.
c. Simultaneous heating, including *reheat*, and cooling occurs above 60°F *outdoor air temperature.*

The required heat recovery *system* shall have a cooling capacity that is at least 7% of the total design chilled-water capacity of the acute inpatient hospital at peak *design conditions*.

Exception to 6.5.6.3: Buildings in Climate Zones 5C, 6B, 7, and 8.

Appendix Section 3: Title 24, Part 6 2025; Section 140.4(s) Mechanical Heat Recovery

(s) **Mechanical heat recovery**

1. **Simultaneous mechanical heat recovery.**

A. Simultaneous mechanical heat recovery is required for newly constructed buildings that meet either i or ii:

i. CHL + 0.1 x CLL ≥ 200 tons and SWHCAP + HCAP ≥ 2200 kBtuh; or

ii. CCAP ≥ 300 tons and SWHCAP + 0.1 x HCAP ≥ 700 kBtuh

where:

CCAP = design capacity of all mechanical cooling systems.

CHL = coincident peak cooling load of all spaces with a design equipment power density > 5 watts/ft^2 and a minimum outdoor airflow requirement < 0.5 cfm/ft^2 (i.e., high load spaces).

CLL = CCAP - CHL. If the design includes capacity for future cooling systems, then assume 20 percent of future systems serve high load spaces.

SWHCAP = design capacity of all service water heating (SWH) systems, excluding systems expected to operate less than 5 hours per week, such as instant-hot water systems for emergency eyewash stations.

HCAP = design capacity of all space-heating systems.

B. The heat recovery system shall include a heat recovery chiller, or other means, capable of transferring the lesser of the following from spaces in cooling to spaces in heating and/or to the SWH system:

i. 25 percent of the peak heat rejection of the cooling system.

ii. 25 percent of (SWHCAP + HCAP).

EXCEPTION 1 to Section 140.4(s)1: Laboratory buildings with exhaust air heat recovery systems meeting Section 140.9(c)6.

EXCEPTION 2 to Section 140.4(s)1: Buildings in Climate Zone 15 with SWHCAP < 600 kBtuh.

2. **Heat recovery for service water heating.**

If the building is required to have simultaneous mechanical heat recovery by Section 140.4(s)1, and SWHCAP ≥ 500 kBtuh, then the heat recovery system shall also heat or preheat the service hot water. The heat recovery system shall have the capacity to transfer the smaller of:

A. 30 percent of the peak heat rejection of the cooling system; or

B. 30 percent of SWHCAP.

EXCEPTION to Section 140.4(s): Buildings with a computer room heat recovery system or wastewater heat recovery system capable of providing not less than 25 percent of SWHCAP + HCAP.

Reviewer Checklist

High-Performance Measure Review Checklist: Heat Recovery Chiller

Checklist Description: This checklist captures the elements that must be present in the project design to be eligible for the high-performance measure inducement or consideration for additional site metering.

Project Name: _____ **Review Date:** _____

Assessment:

- ☐ Approved
- ☐ Not approved

Notes:

Reviewer: _____ **Signature:** _____

Essential Level Inducement Requirements	Comments
☐ Was a heat recovery chiller(s) provided that serves a space and/or domestic/service water heating load and exceeds the minimum efficiency requirements as stated in Title 24, Part 6, 2025 Section 110.2 - Table 110.2-N?	
☐ Does the heat transfer rate of the heat recovery chiller(s) meet one of the 25% minimum thresholds as stated in Title 24, Part 6, 2025 Section 140.4(s) 1. B?	

Advanced Level Inducement Requirements	Comments
☐ Was a heat recovery chiller(s) provided that serves a space and/or domestic/service water heating load and meets the minimum efficiency requirements of T24, Part 6, 2025 Section 110.2 Table 110.2-N?	
☐ Does the heat recovery chiller system design have a leaving heating hot water temperature of 105°F or lower?	
☐ Does the heat transfer rate of the heat recovery chiller(s) meet one of the 25% minimum thresholds as stated in Title 24, Part 6, 2025 Section 140.4(s) 1. B?	

Premium Level Inducement Requirements	Comments
☐ Is the site not required to have a heat recovery chiller(s) as defined by Title 24, Part 6, 2025 Section 140.4, but has chosen to provide a heat recovery chiller(s) anyway?	
☐ Was a heat recovery chiller(s) provided that serves a space and/or domestic/service water heating load and meets the minimum efficiency requirements of T24, Part 6, 2025 Section 110.2 Table 110.2-N?	

Supporting Documentation Requirements for Inducement	Comments
☐ Were engineered, stamped, and permitted construction drawings provided?	
☐ Were equipment submittals, stamped and approved by the responsible engineer of record, provided?	
☐ Was equipment-cost information provided?	
☐ Was system start-up documentation provided, performed by a manufacturer-authorized representative?	
☐ Was a sequence of operations documentation provided for the design?	
☐ Were load calculations provided to determine whether the site is required to have mechanical heat recovery per Title 24, Part 6, 2025; Section 140.4 Mechanical Heat Recovery?	

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

Version History Log

Version	Effective Date	End Date	Change Description
1	July 14, 2023	June 15, 2025	N/A
2	June 16, 2025	December 31, 2025	New format, requirements, and checklist