

# High-Performance Measure Details

<b>Measure Name</b> Pool and Spa Air-to-Water Heating Technology	<b>Use Category</b> Swimming Pool Electrification
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<b>Measure Stage</b> Early Adoption & High Priority Data Collection	

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## Technology Summary

A heat pump pool heater (HPPH) is a high-efficiency electric pool and spa heating technology that uses the vapor-compression cycle to extract heat from ambient outdoor air and transfer it to pool or spa water. HPPHs are certified and rated in accordance with Title 20 and AHRI Standard 1160, with published performance commonly referenced at the 80°F air / 63% relative humidity / 80°F entering water (80/63/80) rating condition. For this measure, the regulatory minimum efficiency baseline for HPPHs is established by Title 20, which sets a minimum COP of 3.5.

With the 2025 Title 24, Part 6 code cycle, pool and spa heating design has shifted more clearly toward electric, solar, and other renewable or recovered-energy pathways. Under §110.4(c), compliant primary-heating pathways now include an HPPH sized per manufacturer guidance or JA16.3, qualifying solar thermal systems, qualifying renewable or recovered-energy systems, or a combination of solar and HPPH with no supplemental heater. This change moves HPPHs from an emerging option to a core component of code-aligned pool and spa heating design for current-cycle projects.

This High-Performance Measure is intended to support that transition by distinguishing minimum regulatory compliance from CEDA's above-code program objectives. In V3.2, the measure clarifies that Title 20 establishes the code efficiency baseline, while CEDA applies higher performance thresholds to recognize stronger design outcomes. The measure therefore emphasizes not only improved efficiency, but also verified sizing, sound staging and sequencing, clear documentation, and stronger operational performance in the field.

The measure also addresses several practical market gaps that have affected design consistency and reviewer interpretation, including confusion between code minimums and program tiers, inconsistent application of sizing methodology, and lack of clarity around controls expectations. In response, the HPM is structured to better support above-code implementation by aligning performance expectations with adopted code language, Title 20 appliance requirements, and JA16 sizing guidance.

Consistent with CEDA program goals and the Long-Term Tactical Plan, this measure supports near-term electrification while helping build the technical foundation for future market readiness and code advancement. By encouraging data-ready design, stronger documentation, and optional monitoring capability, the measure also supports future learning around HPPH performance, sizing practices, and control strategies in real project applications.

## Alignment with CEDA Program Goals

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

Projects must meet one of the CEDA Inducement Requirements identified in the next section to receive an inducement on the equipment and will be evaluated for level of interest in metering to support Code Readiness Objectives.

This measure meets the CEDA program goals as follows:

- **Building partnerships with market stakeholders** by consulting on innovative technologies and best practices in energy efficiency, which can lead to the development of more effective solutions and accelerate the adoption of new technologies. As teams adopt the measure, this increases the volume of engineers able to design the equipment, contractors capable of installing the equipment, and owners able to operate the equipment.
- **Increasing the supply of high-performance measures and all-electric buildings** by combining electrification with energy efficiency that can result in projects implementing measures to achieve greater energy savings, reduced emissions, and overall improved building performance. As more buildings specify and install heat pump pool and/or spa heaters, this helps to increase the overall supply of heat pump pool and/or spa heaters 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 intended to support high-performance pool and spa heating system designs that exceed minimum regulatory requirements, strengthen real-world operational performance, and advance CEDA's broader electrification, decarbonization, and market transformation objectives.

With the 2025 Title 24, Part 6 code cycle, compliant pool and spa heating design has shifted toward heat pump, solar, and other renewable or recovered-energy pathways. As a result, this High-Performance Measure is structured to focus inducement eligibility on above-code heat pump pool heater (HPPH) system designs that deliver stronger performance through improved efficiency, sound sizing methodology, appropriate staging and sequencing, clear documentation, and enhanced control capability where applicable.

For V3.2, this measure also clarifies the distinction between minimum regulatory baseline requirements and CEDA program performance tiers. The applicable minimum efficiency baseline for HPPHs is established by Title 20, while CEDA inducement tiers are intended to recognize projects that go beyond that baseline through stronger system design and higher-performance outcomes. This distinction is important to preserve a clear and defensible separation between code compliance and above-code program support.

This HPM offers two design tiers:

- **Advanced Level** – Above-Baseline Pool and Spa Heat Pump System
- **Premium Level** – High-Performance, Smart-Controlled Pool and Spa Heat Pump System

Projects seeking inducements at the Premium Level must first demonstrate compliance with all applicable Advanced Level requirements. Eligibility is based on the highest tier for which all required System Design Requirements and Supporting Documentation Requirements are satisfied. Tier-specific requirements are provided in the sections that follow.

### **System Design Requirements**

#### **1. Advanced Level: Above-Baseline Pool and Spa Heat Pump System**

Projects qualifying for the Advanced Level shall demonstrate a pool and/or spa heating system that exceeds the applicable minimum regulatory baseline through above-baseline HPPH efficiency, verified sizing, and documented HPPH-first control logic. For projects subject to 2025 Title 24, the HPPH shall serve as the primary heating source in accordance with the applicable §110.4(c) pathway. For eligible legacy projects still proceeding under 2022 Title 24, gas may remain part of the project context, but projects pursuing this measure shall still be expected to target one of the HPM's above-code tiers.

##### **1.1. Primary Heating Source Requirement**

- 1.1.1. The installed pool and/or spa heating system shall use a heat pump pool heater (HPPH) as the primary heating source for the measure-qualifying system.
- 1.1.2. For projects governed by 2025 Title 24, the system shall comply with an applicable §110.4(c) primary-heating pathway that includes:
  - 1.1.2.1. An HPPH sized per manufacturer specifications, or per JA16.3 when manufacturer sizing guidance is unavailable; or
  - 1.1.2.2. A combination of solar and HPPH with no supplemental heater.
- 1.1.3. Any supplemental heater, if provided, shall comply with §110.4(d), and the design shall demonstrate that the HPPH remains the primary heating source under normal operating conditions.

- 1.2. Minimum Program Efficiency
  - 1.2.1. The installed HPPH shall meet a minimum CEDA Advanced threshold of COP greater than or equal to 3.8.
  - 1.2.2. For purposes of this HPM, this threshold is a program-defined above-code requirement and shall not be represented as the code minimum.
  - 1.2.3. The applicable minimum regulatory baseline for HPPHs is Title 20, which establishes a minimum COP of 3.5.
- 1.3. Code-Mandatory Equipment and Installation Provisions
  - 1.3.1. The system shall include all applicable mandatory pool and spa equipment and installation provisions required by §110.4(b).
  - 1.3.2. Required provisions shall include, as applicable to the project scope:
    - 1.3.2.1. Dedicated on/off switches;
    - 1.3.2.2. Time switches;
    - 1.3.2.3. Directional inlets;
    - 1.3.2.4. Pool and/or spa covers, where required; and
    - 1.3.2.5. Proper piping layout, feature controls, and equipment configuration.
- 1.4. Verified HPPH Sizing
  - 1.4.1. HPPH sizing shall follow manufacturer sizing guidance where available.
  - 1.4.2. Where manufacturer sizing guidance is not available, sizing shall be documented using JA16.3.
  - 1.4.3. The sizing basis shall reflect expected operating conditions, seasonal use, recovery expectations, and local climate context.
  - 1.4.4. Where JA16.3 is used, the design shall reflect the JA16.3 methodology, including a temperature rise not exceeding 10°F and a heat-up duration not exceeding 17.5 hours.
  - 1.4.5. The design narrative shall acknowledge that HPPH systems are commonly sized differently from gas pool heaters, with lower individual unit output and longer operating duration often offset through staged or multiple-unit configurations.
- 1.5. System Configuration and Supplemental Heat
  - 1.5.1. Eligible configurations may include fully electric HPPH systems or hybrid systems incorporating supplemental heat, provided the HPPH remains the primary heating source.
  - 1.5.2. Where supplemental heating is provided, the design shall demonstrate proper staging, lockout, and integration such that:
    - 1.5.2.1. The HPPH operates first under normal conditions;
    - 1.5.2.2. Supplemental heating is disabled whenever the HPPH can meet the load; and
    - 1.5.2.3. Supplemental heating is limited to abnormal recovery demands, extreme weather conditions, or manufacturer-specified safety operation.
  - 1.5.3. Supplemental heating shall not be used to compensate for inadequate HPPH sizing or to serve as a routine heating source during normal operation.
- 1.6. Controls and Sequencing
  - 1.6.1. Control sequencing shall ensure HPPH-first operation.
  - 1.6.2. Controls shall prevent routine simultaneous operation of the HPPH and any supplemental heater, except where required for equipment protection or manufacturer-specified operation.
  - 1.6.3. The Advanced Level does **not** require BAS, BMS, EMS, or IoT-connected controls. The intent of this tier is to ensure sound sizing, proper staging, and clear sequence of operation above the regulatory baseline.

*Advanced Level Intent: Support above-baseline pool and spa HPPH designs through modestly improved efficiency, verified sizing, and proper control logic that materially improve implementation quality and real-world operation beyond minimum compliance.*

## 2. Premium Level: High-Performance, Smart-Controlled Pool and Spa Heat Pump System

Projects pursuing the Premium Level must meet **all Advanced Level requirements** and also demonstrate higher HPPH performance and enhanced smart-control capability. Premium is intended to distinguish projects that pair stronger equipment performance with more sophisticated control functionality, operating visibility, and future readiness for load management or grid-interactive operation. This tier is not intended to redefine code baseline; it is a CEDA stretch tier above both the Title 20 minimum and the Advanced Level threshold.

### 2.1. Tier Dependency

2.1.1. Projects seeking Premium Level inducements must demonstrate full compliance with all Advanced Level System Design Requirements.

### 2.2. Premium Program Efficiency

2.2.1. The installed HPPH shall meet a minimum CEDA Premium threshold of **COP greater than or equal to 5.5** at 80°F air / 63% relative humidity / 80°F entering water (80/63/80).

2.2.2. This Premium threshold is a **CEDA program stretch requirement** and shall not be represented as the adopted code minimum.

2.2.3. Any references to proposed CASE efficiency concepts or non-adopted efficiency tables are informational only and shall not be used in this HPM as the enforceable code baseline.

### 2.3. Enhanced Sizing and Load Matching

2.3.1. The project shall provide an enhanced sizing approach demonstrating that the selected HPPH capacity is well matched to the anticipated heating load and operating pattern.

2.3.2. Acceptable approaches may include documented manufacturer sizing, JA16.3 calculations with project-specific inputs, or a concise sizing summary showing:

2.3.2.1. Design heating load;

2.3.2.2. Selected HPPH capacity;

2.3.2.3. Recovery assumptions;

2.3.2.4. Representative climate conditions; and

2.3.2.5. Any staged or multiple-unit strategy used to satisfy total required capacity.

2.3.3. The Premium design shall demonstrate how the selected configuration supports stable operation, avoids excessive recovery times, avoids short cycling, and limits reliance on supplemental heating.

### 2.4. Smart Controls Requirement

2.4.1. The system shall include smart controls capable of scheduling, sequencing, and monitoring HPPH operation beyond the minimum Advanced tier control requirements.

2.4.2. Acceptable control platforms may include manufacturer-connected controls, Wi-Fi or IoT-enabled controls, BAS integration, EMS integration, or another equivalent control architecture.

2.4.3. At a minimum, Premium controls shall provide the capability for:

2.4.3.1. Remote or centralized scheduling;

2.4.3.2. Load shifting or time-of-use-oriented operation where appropriate;

2.4.3.3. Monitoring of key operating parameters or system status; and

2.4.3.4. Future participation in grid-aware or demand-response-oriented operation, either directly or through platform integration. Enrollment in a demand-response program is not required.

2.4.4. A BAS, BMS, or EMS is acceptable but not mandatory, provided equivalent smart-control functionality is demonstrated through another control platform.

### 2.5. Premium Controls and Operational Intent

2.5.1. Premium controls shall support improved staging, visibility, and operational optimization rather than serving only as a compliance accessory.

2.5.2. Where supplemental heating is present, the Premium sequence of operation shall maintain HPPH-first control logic and clearly document the conditions under which supplemental heat is permitted to operate.

- 2.5.3. Premium projects should be configured to support future monitoring, performance verification, and potential load-management participation where project conditions allow.

*Premium Level Intent: Promote high-performance pool and spa HPPH systems that combine stretch-level efficiency with smart controls, stronger load matching, improved operational visibility, and readiness for future grid-responsive operation.*

### **Supporting Documentation Requirements**

Projects shall submit the documentation listed below to demonstrate compliance with the selected design tier. Documentation requirements are tier-dependent. Projects pursuing the Premium Level shall submit all Advanced Level documentation in addition to the Premium-specific items. Documentation is intended to verify system design quality, performance assumptions, and control capability without requiring detailed energy modeling or excessive reporting burden.

#### **1. Advanced Level Supporting Documentation**

The following documentation is required to verify compliance with the Advanced Level System Design Requirements.

##### **1.1. Engineered Construction Drawings**

1.1.1. Engineered, stamped, and permitted construction drawings showing, as applicable:

- 1.1.1.1. Pool and/or spa heating system configuration and layout;
- 1.1.1.2. HPPH equipment schedules;
- 1.1.1.3. Electrical requirements;
- 1.1.1.4. Piping configuration;
- 1.1.1.5. Controls and sequence references; and
- 1.1.1.6. Compliance with applicable state and local code requirements.

##### **1.2. HPPH Equipment Submittals**

1.2.1. Manufacturer equipment submittals, stamped or otherwise approved by the Engineer of Record, including:

- 1.2.1.1. AHRI 1160 certification or equivalent rating documentation, as applicable;
- 1.2.1.2. Published performance ratings at 80°F air / 63% RH / 80°F entering water (80/63/80);
- 1.2.1.3. Manufacturer installation requirements; and
- 1.2.1.4. Manufacturer control and operating requirements.

##### **1.3. Efficiency Verification**

- 1.3.1. Manufacturer documentation shall demonstrate that the installed HPPH meets the CEDA Advanced threshold of **COP greater than or equal to 3.8**.
- 1.3.2. Where available, the submittal shall clearly identify the published COP rating at the applicable rating condition used for review.
- 1.3.3. Documentation shall be sufficient to distinguish the proposed equipment performance from the Title 20 minimum baseline of COP 3.5 used for program reference.

##### **1.4. Sizing Documentation**

1.4.1. One of the following shall be provided:

- 1.4.1.1. Manufacturer-provided sizing documentation; or
- 1.4.1.2. A completed JA16.3 sizing worksheet or equivalent project calculation when manufacturer sizing guidance is unavailable.

1.4.2. The sizing documentation shall identify the basis for selected capacity, including pool and/or spa volume, recovery assumptions, and design operating conditions as applicable.

##### **1.5. Controls Narrative / Sequence of Operation**

1.5.1. A brief written controls narrative or sequence of operation shall be provided demonstrating:

- 1.5.1.1. HPPH-first operation;
- 1.5.1.2. Proper staging and lockout of any supplemental heating, if present; and
- 1.5.1.3. Alignment with §110.4(d), where supplemental heating is included.

#### 1.6. Equipment Cost Information

- 1.6.1. Equipment-level cost information sufficient for program verification shall be submitted.
- 1.6.2. Detailed contractor bid reconciliation or project-level cost breakdowns are not required unless specifically requested for program review.

## 2. Premium Level Supporting Documentation

Projects pursuing the Premium Level shall submit all Advanced Level documentation plus the following additional documentation.

#### 2.1. Premium Efficiency Verification

- 2.1.1. Manufacturer documentation shall demonstrate that the installed HPPH meets the CEDA Premium threshold of **COP greater than or equal to 5.5** at 80°F air / 63% relative humidity / 80°F entering water (80/63/80).
- 2.1.2. Where available, AHRI 1160 listings, manufacturer performance tables, or equivalent published ratings shall be included to verify Premium-tier efficiency.
- 2.1.3. Documentation based solely on proposed CASE tables or other non-adopted code references shall not be used as the sole basis for Premium qualification.

#### 2.2. Enhanced Sizing Summary

- 2.2.1. A concise enhanced sizing summary shall be provided in table or narrative form.
- 2.2.2. The summary shall document, as applicable:
  - 2.2.2.1. Design heating load;
  - 2.2.2.2. Selected HPPH capacity;
  - 2.2.2.3. Recovery assumptions;
  - 2.2.2.4. Representative climate or seasonal considerations; and
  - 2.2.2.5. Any staged or multiple-unit strategy used to satisfy total required capacity.
- 2.2.3. Detailed energy modeling is not required.

#### 2.3. Smart Controls Documentation

- 2.3.1. Documentation shall be provided describing the Premium control platform and key control capabilities.
- 2.3.2. Acceptable documentation may include manufacturer literature, controls submittals, controls diagrams, sequence excerpts, or a brief design narrative.
- 2.3.3. The documentation shall demonstrate, as applicable:
  - 2.3.3.1. Remote or centralized scheduling capability;
  - 2.3.3.2. Time-of-use or load-shifting capability, where provided;
  - 2.3.3.3. Monitoring of key system status or operating parameters; and
  - 2.3.3.4. Readiness for future grid-aware or demand-response-oriented operation, whether directly or through platform integration.

#### 2.4. BAS / EMS / IoT Platform Documentation

- 2.4.1. Where BAS, EMS, manufacturer-connected controls, or IoT-enabled controls are used to satisfy Premium requirements, the submittal shall include a brief description or diagram identifying:
  - 2.4.1.1. The control platform used;
  - 2.4.1.2. The key monitored points or accessible data points, if available; and
  - 2.4.1.3. The means by which the system supports monitoring, optimization, or future grid-interactive operation.

## Incremental Measure Cost

The Incremental Measure Cost (IMC) represents the typical incremental first cost to implement this HPM relative to a 2025 Title 24 code-minimum pool and/or spa heating system. Consistent with the scale of commercial and multifamily pool heating systems, IMCs are presented as capacity-normalized costs in **\$/kBtuh of installed HPPH heating capacity**. IMC values are intended to support CEDA inducement calibration and market transformation and are not intended for project-level cost reconciliation.

### **Base Case** (*Code-Minimum: 2025 Title 24*)

The base case for this HPM is a 2025 Title 24-compliant pool and/or spa heating system using a heat pump pool heater (HPPH) as the primary heating source, sized in accordance with manufacturer guidance or JA16.3 as required, and including all applicable mandatory code provisions under §110.4. The base case reflects a standard code-compliant HPPH installation with minimum required controls and accessories, but without the additional above-code efficiency, enhanced control functionality, or upgraded control integration associated with the Advanced or Premium tiers.

Representative baseline cost anchor for normalization purposes:

- **Standard 140 kBtuh class HPPH system:** approximately **\$6,500** equipment cost basis.

### **Measure Case** (*HPM-Compliant*)

#### **Advanced Level: Above-Baseline Pool and Spa Heat Pump System**

The Advanced Level builds on the 2025 code-minimum HPPH base case by requiring modestly improved equipment performance above the Title 20 minimum baseline, together with more deliberate implementation quality around sizing, staging, lockout, and HPPH-first operation. Because the Advanced tier does not require BAS, BMS, EMS, or a full smart-controls platform, the incremental cost remains relatively modest and is driven primarily by a small above-baseline equipment premium plus limited controls integration and field coordination.

Representative Advanced cost drivers over the base case include:

- modest HPPH equipment premium associated with meeting the Advanced threshold of  $COP \geq 3.8$ , and
- basic controls enablement and lockout integration allowance to support documented HPPH-first sequencing.

#### **Premium Level: High-Performance, Smart-Controlled Pool and Spa Heat Pump System**

The Premium Level builds on the Advanced tier by requiring a higher-performance HPPH meeting the CEDA Premium threshold of  **$COP \geq 5.5$  at 80/63/80**, together with a smarter control platform capable of remote scheduling, enhanced sequencing, monitoring visibility, and future grid-aware operation. Compared to the base case, the Premium tier is therefore driven by both a larger equipment premium and a more capable controls package.

Representative Premium cost drivers over the base case include:

- higher-efficiency HPPH equipment premium associated with Premium-tier performance, and
- smart controls / BAS-, EMS-, or IoT-equivalent platform allowance to support enhanced scheduling, monitoring, and future load-management capability.

### **IMC Values and Normalization**

**Normalized unit for this HPM:** \$/kBtuh of installed HPPH heating capacity

(Representative capacity basis: 140 kBtuh class HPPH, consistent with common commercial-scale equipment.)

#### Advanced Level IMC (Incremental over Base Case)

Representative Advanced incremental cost basis:

- modest above-baseline HPPH equipment premium: **\$300**
- controls enablement / lockout integration allowance: **\$400**

Total representative incremental cost: **\$700**

Calculation: **\$700 / 140 kBtuh = \$5.0/kBtuh**

- **Advanced Level IMC: \$5/kBtuh**

#### Premium Level IMC (Incremental over Base Case)

Representative Premium incremental cost basis:

- higher-efficiency HPPH equipment premium: **\$1,200**
- smart controls / BAS-EMS-IoT platform allowance: **\$600**

Total representative incremental cost: **\$1,800**

Calculation: **\$1,800 / 140 kBtuh = \$12.9/kBtuh**

- **Premium Level IMC: \$13/kBtuh**

#### IMC Notes

These IMC values are intended to reflect the typical incremental scope associated with the revised V3.2 tier definitions relative to a 2025 code-minimum HPPH system. They are meant to capture the principal cost differences that distinguish the Advanced and Premium measure tiers from the base case and should not be interpreted as full project cost estimates.

Code-required equipment, standard installation scope, and normal design documentation associated with 2025 Title 24 compliance are assumed to be included in the base case and are therefore not separately counted as incremental cost drivers in this section. Likewise, project-specific cost variation related to unusual site conditions, specialty controls integration, or atypical equipment selections may cause actual project costs to vary from these representative normalized values.

#### 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:

- Title 24 (2025) Pool & Spa Heating Fact Sheet summary of §110.4 requirements and primary-heating options.
- Representative HPPH market pricing (standard and premium equipment listings).
- Representative Wi-Fi controller / IoT control module pricing for pool heating control.
- Representative pool automation controller pricing (IoT/BAS-grade control platform).

## Code Readiness Objectives

This High-Performance Measure supports Code Readiness by encouraging pool and spa heat pump projects to be designed, documented, and, where appropriate, monitored in a manner that improves understanding of real-world heat pump pool heater (HPPH) performance under California operating conditions. With 2025 Title 24 establishing HPPHs as a primary compliance pathway under §110.4(c), and JA16.3 providing a defined sizing pathway when manufacturer sizing guidance is unavailable, this HPM helps create a stronger foundation for future code and program development by promoting projects that are better suited for performance evaluation and data collection.

Code Readiness objectives focus on generating practical field insight that can help distinguish minimum-compliance installations from stronger above-code implementations. In particular, the measure is intended to support learning around efficiency performance above the Title 20 baseline, effectiveness of JA16.3-based sizing and load matching, real-world control sequencing and supplemental heat management, and the value of smart controls for future monitoring and grid-aware operation.

The data collection effort should focus on achieving the following objectives:

- Measure actual electric energy performance of above-code HPPH systems relative to 2025 code-minimum HPPH pathways.
- Evaluate how equipment efficiency, sizing approach, and operating conditions affect delivered system performance in the field.
- Assess performance variation across climate zones and seasonal conditions, including the influence of outdoor dry-bulb temperature, wet-bulb conditions, and water temperature on realized COP.
- Evaluate whether JA16.3 sizing assumptions and recovery expectations are producing appropriate capacity selection and acceptable operational outcomes in actual projects.
- Assess how HPPH-first sequencing, supplemental heat lockout, and smart control functionality affect system operation, runtime, recovery behavior, and overall efficiency.
- Inform future program and code development related to HPPH efficiency thresholds, sizing methodology, controls requirements, monitoring capability, and grid-responsive operation.

### **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 12 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

- Operational efficiencies of central HPWH in commercial applications.
- Efficiency and energy use of water heating and distribution systems, including secondary temperature maintenance heating (depending on the configuration).
- Engineering configurations, temperature maintenance system details, and customization requirements.
- Product cost and availability of larger HPWH products in CA.
- Costs of installation versus equipment in commercial and MF applications.
- Avoided gas infrastructure costs.
- The data collected from this monitoring effort will provide a foundation for future research and analysis:
  - Optimizing HPPH Sizing and Control Strategies: Research can investigate strategies to optimize HPPH sizing and controls to further enhance energy efficiency and performance in different climate conditions.
  - Evaluating Cold-Climate Performance: Investigate HPPH performance and the feasibility of extending their operational range in colder climates, potentially reducing reliance on backup heating systems.
  - Integration with Smart Grid and Demand Response Programs: Explore the potential for integrating HPPHs with smart grids and demand response programs to optimize energy use and manage peak demand.

### 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 for the monitoring effort.

<b>Data Points to Meter</b>	<b>Unit</b>	<b>Additional Specifications</b>
Heat Pump Power	kW	Maximum and minimum values
Thermal Load Provided	BTU	Average and Peak values
Operational Efficiency	COP	Efficiency measured at each instance
Temperature Set-point	°F	Average
Water Flow	GPM	Average
Water Supply Temperature	°F	Average
Water Return Temperature	°F	Average
Water Load	BTU	Average
Pump(s) Power	kW	Average
Outdoor Dry-bulb Temperature	°F	Measured at heat pump or site
Outdoor Wet-bulb Temperature	°F	Measured at heat pump or site
Pool Water Temperature	°F	Average

## Code Reference

### 2025 Title 24, Part 6 §110.4(c)

Compliant pool and spa heating must use one of the adopted primary-heating pathways identified in §110.4(c), including an HPPH sized per manufacturer specifications or JA16.3 when manufacturer sizing is unavailable, a qualifying solar thermal pathway, a qualifying renewable or recovered-energy pathway, or a combination of solar and HPPH with no supplemental heater. Supplemental heating, if used, must comply with §110.4(d) so that the HPPH remains the primary heating source. All applicable mandatory pool and spa equipment provisions must also comply with §110.4(b).

*Per §110.4(c), compliant pool and spa heating must use one of the following primary heating options:*

- 1. Solar thermal system meeting minimum collector sizing;*
- 2. A heat pump pool heater (HPPH) sized per manufacturer specifications or JA16.3 when manufacturer sizing is unavailable;*
- 3. A system providing ≥60% of annual pool/spa heating from on-site renewable or recovered energy;  
or*
- 4. A combination of solar and HPPH with no supplemental heater.*

*Supplemental heating, if used, must comply with §110.4(d) so that the HPPH is always the primary heating source, with supplemental heat disabled whenever the HPPH can meet load. All required pool equipment (e.g., pump, filter, time switches, on/off switches, covers, piping configuration) must meet applicable §110.4(b) requirements.*

*Section 110.4(b).3 requires the installation of any pool or spa equipment in a heated pool shall be installed with an outdoor pool cover.*

### California Appliance Efficiency Regulations (Title 20)

For purposes of this HPM, the regulatory minimum efficiency baseline for heat pump pool heaters is established by applicable Title 20 appliance efficiency requirements. As cited in this memo, Title 20 establishes a minimum COP baseline of 3.5 for HPPHs.

*Section 1605.1(g)(1) is for federally regulated appliances and 1605.3(g)(3) is for non-federally regulated appliances.*

- 1. Section 1605.1(g)(1) follows federal standards minimum thermal efficiency for natural gas pool water heaters and requires a minimum coefficient of performance (COP) of 3.5 for heat pump pool heaters.*
- 2. Section 1605.3(g)(3) requires that for heat pump pool heaters manufactured on or after March 1, 2003, the average of the COP at standard temperature rating and the COP at low temperature rating shall not be less than 3.5.*

### Informational CASE Reference Only – 2025 Final CASE Report

References in this HPM to the 2025 Final CASE Report, including proposed Table 110.4-B for heat pump pool heater minimum efficiency, **are provided for background and market context only**. Proposed CASE language is not, by itself, adopted code. For purposes of this HPM, enforceable code requirements shall be based on the published 2025 Title 24, Part 6 standards and applicable Title 20 appliance efficiency regulations. Accordingly, **proposed CASE Table 110.4-B shall not be interpreted as the adopted 2025 Title 24 code minimum baseline** for HPPH eligibility, efficiency, or tier qualification

*Requirements and min efficiency Table 110.4-B: Heat Pump Pool Heater Minimum COP Efficiency Requirements*

1. *A heat pump pool heater as the primary heating system shall meet the efficiency requirements in Table 110.4-B, shown below, taken from the 2025 Final CASE Report for NR Pool and Spa Heating.*

<b>(PROPOSED) Table 110.4-B: Heat Pump Pool Heater Minimum COP Efficiency Requirements</b>			
<b>Equipment Type</b>	<b>Efficiency</b>	<b>Compliance Date</b>	<b>Test Procedure</b>
Heat Pump Pool Heater	Coefficient of Performance (COP) of not less than 5.5 at the High Air Temperature - Mid Humidity rating condition.	Manufactured prior to May 31, 2028	10 C.F.R. section 430.23(p) (Appendix P to subpart B of part 430)
Heat Pump Pool Heater	Integrated Thermal Efficiency (TE <sub>i</sub> ) not less than: TE <sub>i</sub> = (600(PE)) / (PE+1,619) Where PE is the active electrical power, in Btu/h.	Manufactured on or after May 31, 2028	10 C.F.R. section 430.23(p) (Appendix P to subpart B of part 430)

**Reference Appendices JA16.3: 2025 Building Energy Efficiency Standards**

Where manufacturer sizing guidance is unavailable, HPPHs shall be sized in accordance with JA16.3, including the applicable pool volume, temperature rise, and recovery-time provisions.

*Sizing Methodology - JA16.3 Heat Pump Pool Heater Sizing*

- (a) *A heat pump pool heater (HPPH) shall be sized using the HPPH manufacturer’s specifications. The following sizing provisions shall be applicable if the HPPH manufacturer’s specifications do not include information on HPPH sizing:*
    1. *Determine the desired pool temperature in °F.*
    2. *Determine the average temperature for the coldest month of pool use in °F.*
    3. *Determine temperature rise in °F by subtracting the average temperature for the coldest month from the desired pool temperature.*
    4. *Calculate the pool volume in gallons.*
    5. *Calculate the time needed for the HPPH to achieve the 10°F degree rise in hours. This shall not exceed 17.5 hours.*
    6. *Use equation JA16-1 to determine the Btu/h output requirement of the HPPH.*
      - i. *Equation JA16-1:*

$$1) Q_{out} = (V_p \times 8.33 \times \Delta T) \div t$$
- a. *Where:*
- i. *Q<sub>out</sub> is the output heating capacity of the HPPH.*
  - ii. *V<sub>p</sub> is the pool volume in gallons.*
  - iii. *8.33 is the weight of a gallon of water at 62°F in pounds per gallon.*
  - iv. *ΔT is the pool temperature rise in °F, and shall not exceed 10°F.*
  - v. *t is the time needed for the HPPH to achieve the 10°F degree rise in hours and shall not exceed 17.5 hours.*

## Eligible Climate Zones and Building Types

### 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 and public facilities (e.g., offices, retail, lodging, education, civic buildings).

### Eligible Project Scopes

This measure applies to:

- **New pool and spa installations** in commercial, public, and high-rise multifamily buildings.
- **Additions or major alterations** where a pool or spa is newly constructed or newly equipped with a qualifying primary heating system.
- **Electrification retrofits** that replace an existing primary pool or spa heater with a qualifying heat pump pool heater (HPPH).
- **Qualifying HPPH-based system** configurations, including fully electric HPPH systems and solar-integrated or hybrid configurations, provided the HPPH serves as the primary heating source for the measure-qualifying system in accordance with applicable Title 24 requirements.

## Measure Exclusions

This high-performance measure excludes:

- **Pool or spa heating equipment not certified or rated as a heat pump pool heater (HPPH)** under applicable Title 20 and AHRI 1160 requirements.
- **Systems using gas or electric resistance as the primary pool or spa heating source** for the measure-qualifying system.
- **Projects in which the HPPH does not serve as the primary heating source** or where supplemental heating is configured to operate as a routine heating source under normal conditions.
- **Systems that do not meet applicable mandatory installation, equipment, sizing, control, or supplemental-heating requirements** under §110.4(b), §110.4(c), and §110.4(d), as applicable.
- **Projects that do not meet the minimum CEDA performance threshold for the claimed tier**, including Advanced or Premium efficiency and controls requirements, as applicable.
- **Alterations to existing heated pools or spas where no upgrade to the primary heating equipment is included.**

# Reviewer Checklist

## High-Performance Measure Review Checklist: Pool and Spa Air-to-Water Heating Technology

**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:** \_\_\_\_\_

CEDA High-Performance Measure Inducement Requirements	Comments
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### Advanced Level – System Design Requirements

- §1.1** HPPH is the primary heating source for the measure-qualifying system; any supplemental heat complies with §110.4(d).
- §1.2** Installed HPPH meets the Advanced threshold of **COP ≥ 3.8**.
- §1.3** System includes applicable mandatory pool/spa equipment and installation provisions under §110.4(b).
- §1.4** HPPH sizing is documented using manufacturer guidance or JA16.3, as applicable, and reflects project operating conditions.
- §1.5** Any supplemental heat is properly staged/locked out and is not used as a routine heating source.
- §1.6** Controls sequence demonstrates HPPH-first operation.

### Advanced Level – Supporting Documentation

- Adv. Doc. §1.1** Engineered, stamped, and permitted drawings provided.
- Adv. Doc. §1.2–§1.3** Equipment submittals and efficiency documentation provided, including AHRI 1160 or equivalent and proof of **COP ≥ 3.8**.
- Adv. Doc. §1.4** Sizing documentation provided.
- Adv. Doc. §1.5** Controls narrative / sequence of operation provided.
- Adv. Doc. §1.6** Equipment-level cost information provided.

### Premium Level – System Design Requirements

- §2.1** Project meets all Advanced Level requirements.
- §2.2** Installed HPPH meets the Premium threshold of **COP ≥ 5.5 at 80/63/80**.
- §2.3** Enhanced sizing/load-matching documentation demonstrates stable operation and appropriate capacity selection.
- §2.4** Premium controls provide smart scheduling, monitoring, and future grid-aware capability.
- §2.5** Premium controls support improved staging, visibility, and HPPH-first operation where supplemental heat is present.

**Premium Level – Supporting Documentation**

- Prem. Doc. §2.1** Premium efficiency documentation provided, including proof of **COP ≥ 5.5 at 80/63/80**.
- Prem. Doc. §2.2** Enhanced sizing summary provided.
- Prem. Doc. §2.3** Smart controls documentation provided.
- Prem. Doc. §2.4** BAS / EMS / IoT / equivalent platform documentation provided, if applicable.

## Version History Log

Version	Effective Date	End Date	Change Description
1	October 11, 2024	March 30, 2025	N/A
2	March 31, 2025	December 31, 2025	Updated format, requirements, checklist
3	January 1, 2026	March 22, 2026	Updated design level and supporting documentation requirements, scope, exclusions, and checklist
3.2	March 23, 2026	December 31, 2028	Clarified adopted code baseline, reset Advanced/Premium COP tiers, aligned 2025 eligibility and savings framing, added HPPH sizing/controls distinctions, and updated documentation, IMC, exclusions, and reviewer checklist