We will be starting soon!

Thanks for joining us

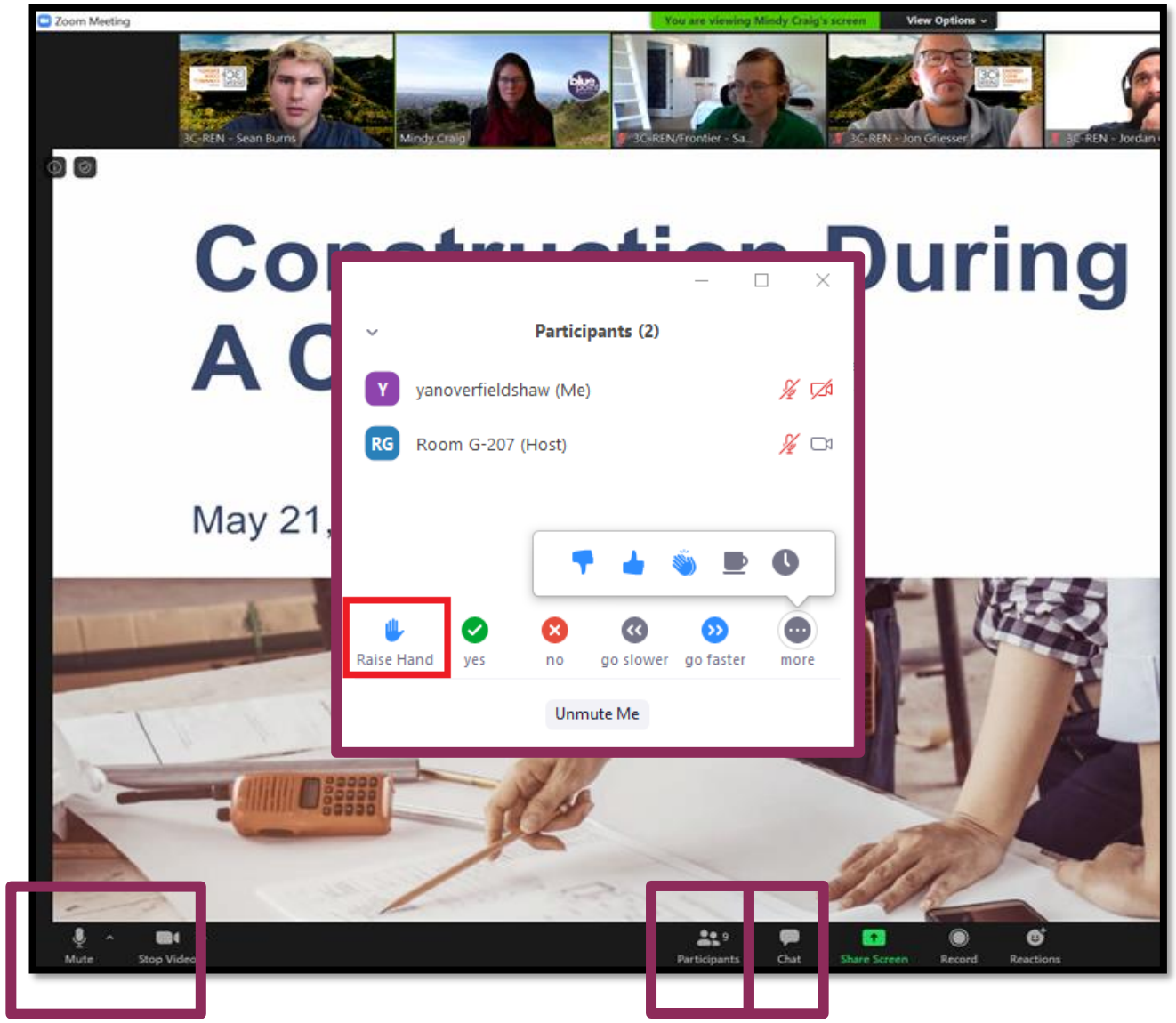
Understanding Heat Pump Water Heaters for Building Departments

Russ King – Coded Energy

March 15, 2023

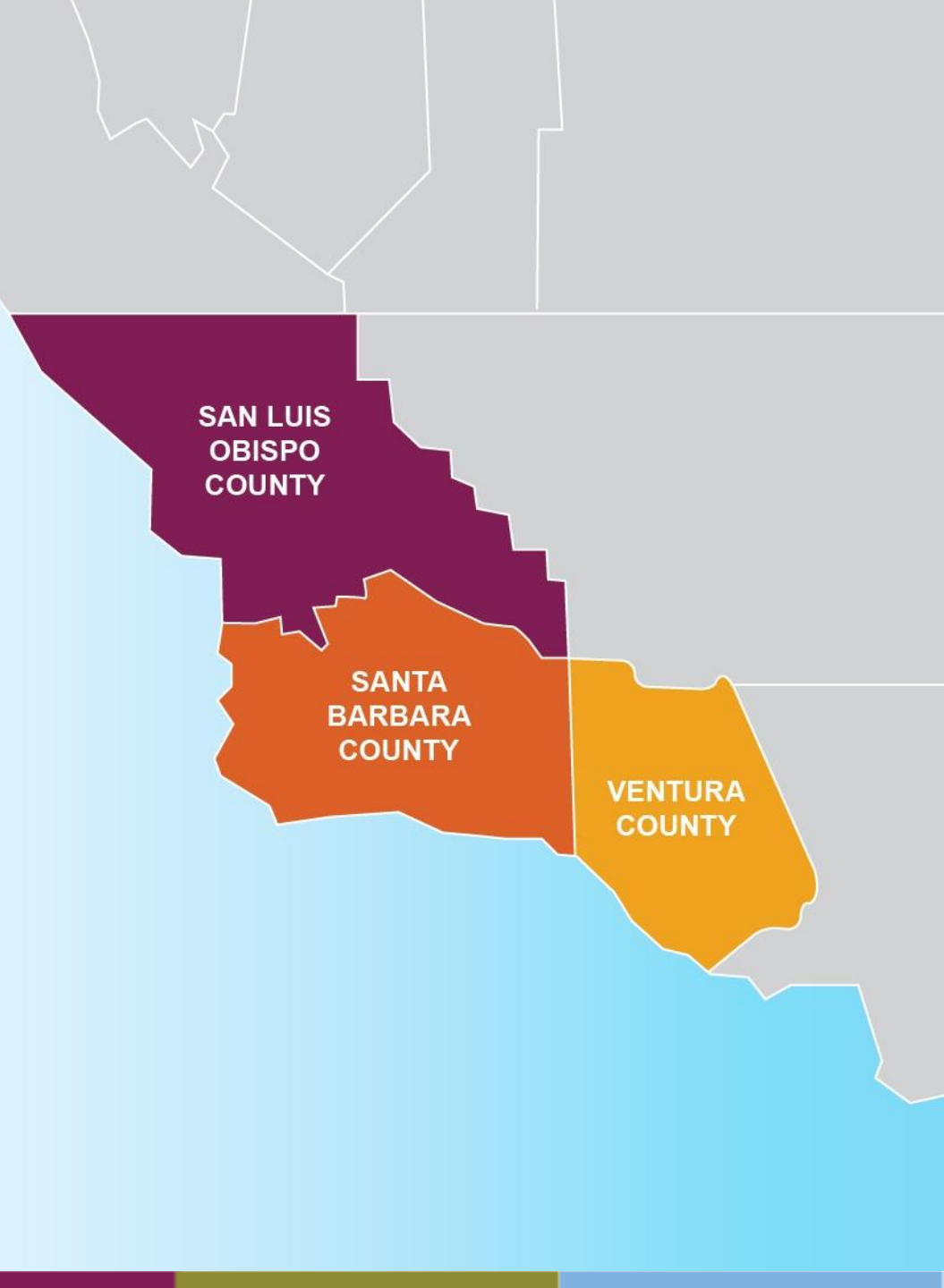
Zoom Orientation

- Please be sure your full name is displayed
- Please mute upon joining
- Use "Chat“ box to share questions or comments
- Under "Participant" select "Raise Hand" to share a question or comment verbally
- The session may be recorded and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
  - **Building Professionals:** industry events, training, and energy code compliance support
  - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region



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3C REN ENERGY CODE CONNECT

- Serves all building professionals
- Three services –
  - **Energy Code Coach**
  - **Training and Support**
  - **Regional Forums**
- Makes the Energy Code easy to follow

Energy Code Coach:
3c-ren.org/codes
805.220.9991

Event Registration:
3c-ren.org/events

BUILDING PERFORMANCE TRAINING

- Serves current and prospective building professionals
- Expert instruction:
  - **Technical skills**
  - **Soft skills**
- Helps workers to thrive in an evolving industry

Event Registration:
3c-ren.org/events

3C-REN HOME ENERGY SAVINGS

Multifamily (5+ units)

- No cost technical assistance
- Rebates up to $750/apartment plus additional rebates for specialty measures like heat pumps

Single Family (up to 4 units)

- Sign up to participate!
- Get paid for the metered energy savings of your customers

Enrollment:
3C-REN.org/contractor-participation

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Local Governments Empowering Our Communities

Heat Pump Water Heaters:

2022 Energy Code (Title 24 Part 6) Requirements

BayREN Codes & Standards

www.BayREN.org

Introduction

Today's Learning Objectives

- Understand the **fundamentals of unitary (individual) heat pump water heaters (HPWHs).**
- Be able to **identify HPWHs in the field.**
- Understand the **energy code requirements for unitary HPWHs.**
- Become familiar with the **related compliance forms and documentation.**
- Become familiar with **Best Practices for Code Compliance.**

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Agenda

- Identifying Heat Pump Water Heaters
- HPWHs in the 2022 Energy Code
- Documenting Compliance
- Resources for Permitting and Compliance
- Best Practices for Enforcement
- Q&A

Handouts

- You were emailed the following handouts before the training:
  - Individual Dwelling Units and Heat Pump Water 2022 Building Code Assistance Sheet
  - HPWH Permit Supplement Template
  - Compliance Process for Residential New Construction and Additions

Identifying Heat Pump Water Heaters

Photo credit: Modern Enviro

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Introduction to HPWHs

- Fuel type = electric
- Employ storage tanks
- Most have heat pump AND resistance elements
- Control and maximize heat pump operation to increase efficiency
- Use resistance elements when additional capacity required

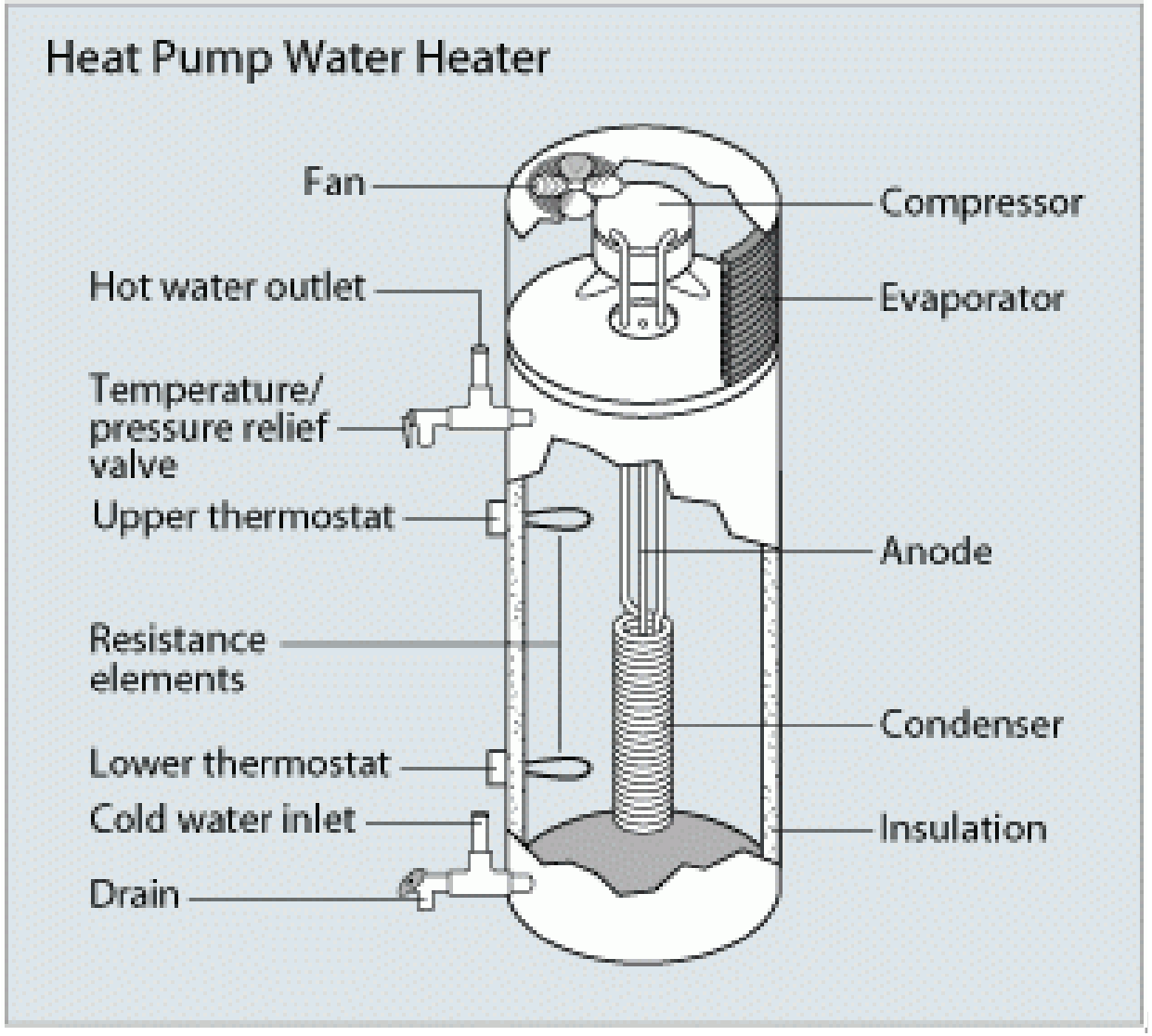

Image Credit: Department of Energy

The Current Market

- Common characteristics
  - Storage tanks: 40 – 80 gallons, larger sizes available for MF
  - Heat pump electric draw: Typically ~1.3 kW
  - Resistance element electric draw: Typically 4 – 5 kW

Brief History of HPWHs

- First entered U.S. market in 1970s
  - Driven by OPEC oil embargo
  - Products were rushed to market, did not succeed
- Today…gaining traction again with CA climate goals
  - High efficiency, low carbon
  - Evolving technology and controls
  - Possible to power with renewable energy (solar electric panels)
  - Third generation

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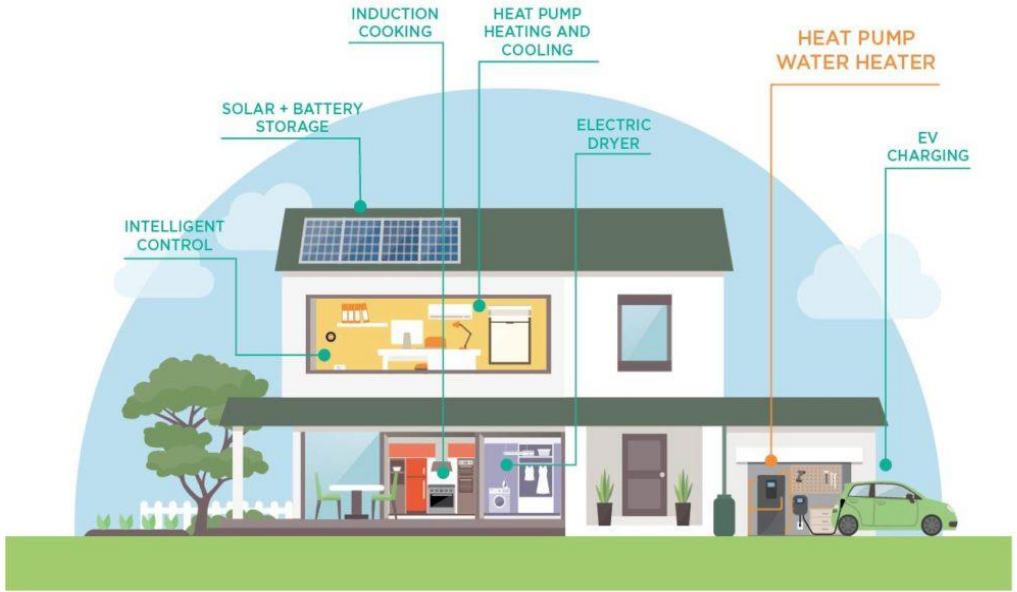
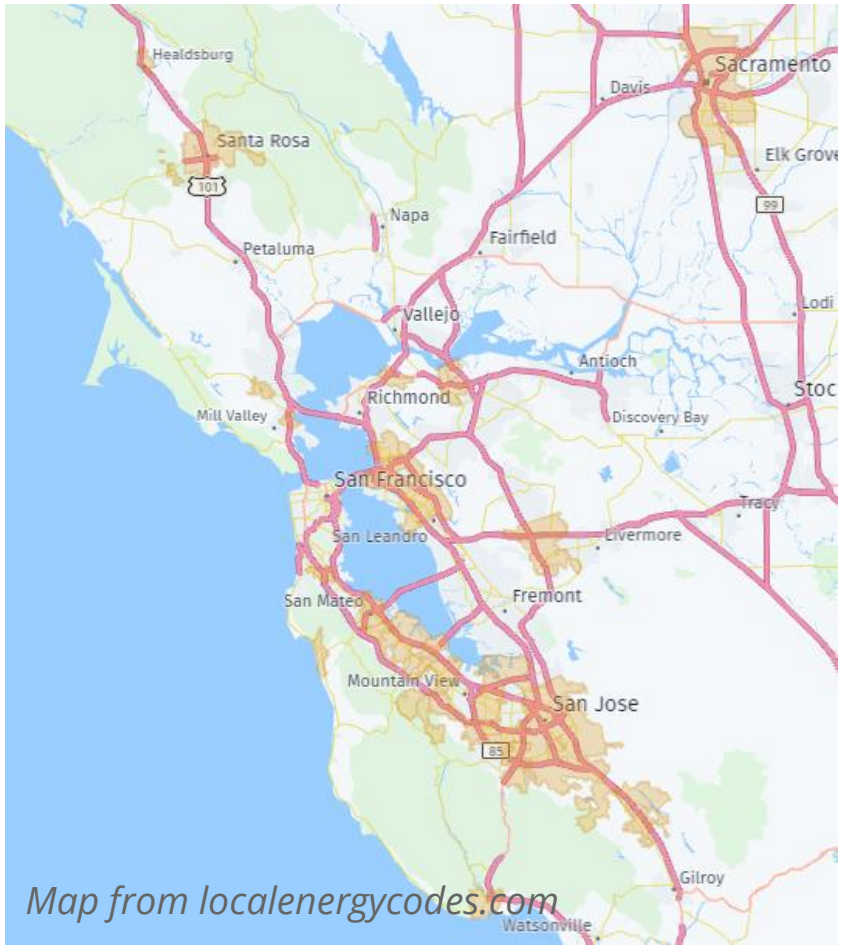
Why You May See More Electrification

- State Goals
- Building Code
- Local Ordinances: Over 60 jurisdictions have adopted electrification reach codes
- Increase in incentives, tax credits, and financing targeting electrification and heat pumps





Map from localenergycodes.com

Image credit: Silicon Valley Clean Energy

Identifying HPWHs – 2 Basic Types

- Integrated
  - Heat pump equipment on top of the storage tank
  - The entire system is contained in a single component

Image credit:
A. O. Smith

- Split
  - The condenser for the heat pump is split from the rest of the unit
  - Allows installation of condenser outside

Image credit:
Sanden

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Identifying Integrated HPWHs

- Features:
  - Heat pump on top of storage tank
  - Control panel
  - Air vents for heat pump
  - Large storage tank
  - Electrical connection
  - No gas connection

Photo credit: A. O. Smith

Identifying Split HPWHs

- Features:
  - No Heat pump on top of tank
  - Large storage tank
  - Control panel
  - Electrical connection
  - No gas connection
  - Condenser is a separate component
  - Water/ Refrigerant lines running between condenser and tank (like a mini-split space heating system)

Photo credit: Sanden

Differentiating from Electric Resistance

- Features
  - No heat pump on top
  - Large storage tank
  - Electrical connection (240v)
  - No gas connection
  - **Only** electric resistance elements

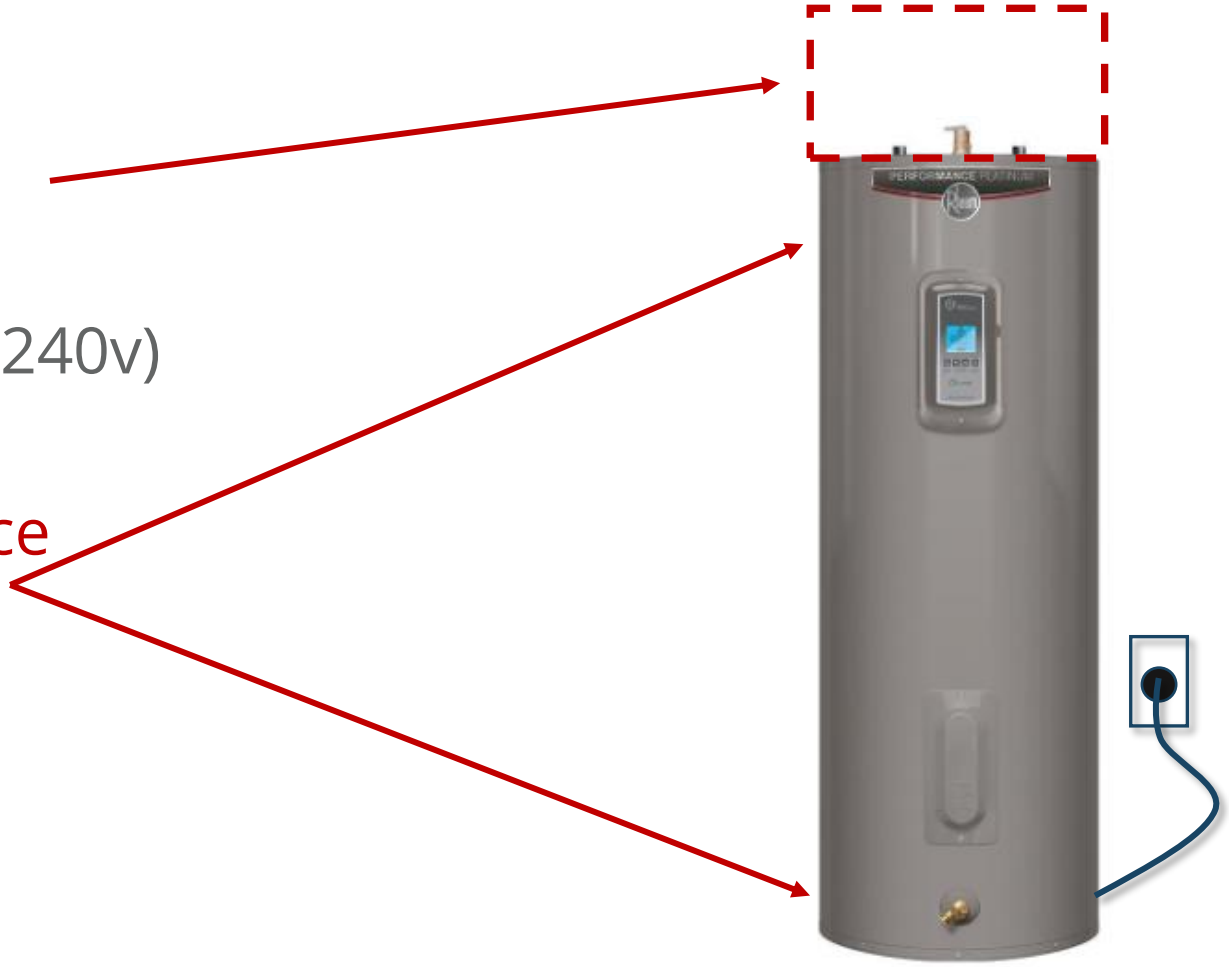

Photo credit: Rheem

Differentiating from Gas Storage

- Features:
  - Flue gas piping
  - Average storage tank
  - Temperature adjustment knob instead of control panel
  - Gas connection
  - Electrical connection (115v) for starter/ power vent

Photo credit: Bradford White

Differentiating from Gas Tankless

- Features:
  - Flue gas vent
  - No storage tank
  - Much smaller
  - Wall mounted
  - Control panel (External or Internal)
  - Electrical connection (115v)
  - Gas connection

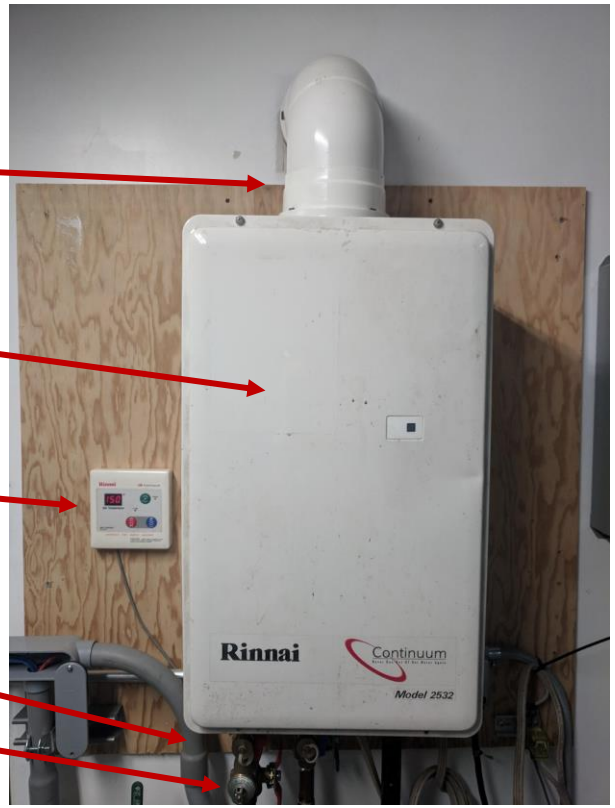

Photo credit: Frontier Energy

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Installation Requirements and Considerations

- Most require 240 V, 30A electrical supply
  - Some products require 240 V, **15A**
  - Some new products are also **115 V**, 15A-20A
- HPWH requires adequate **volume or ventilation**
  - 750 – 1000 cubic feet in room OR
  - Vents allowing air flow from a neighboring space
- Preferred location - hot spaces such as a garage
- Condensate drain needed
- Typically larger storage than gas storage WH
- Other considerations: Sound and venting of cool/dry air

Image source: Silicon Valley Clean Energy

HPWHs in the 2022 Energy Code

Photo credit: Berkeley Energy and Resources Collaborative

Energy Code Compliance Options

Mandatory Measures: Minimum requirements that must **always** be met

Prescriptive Path

- Usually a "prescribed" list of measures by CZ
- No design flexibility
- Common for alterations, changeouts, and smaller additions.

Pick One

Performance Path

- The energy performance of the "prescriptive package" is the target, but tradeoffs are allowed.
- Based on an energy simulation using State-approved software (CBECC, Energy Pro, etc.)
- Very common for new construction and larger additions.
- Rare for alterations, changeouts, etc.

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In short….under 2022 Energy Code

- Yes, you can install HPWHs
- Yes, you can replace a gas storage water heater with a HPWH

In fact, the Energy Code encourages HPWHs!

HPWH Mandatory Measures [110.3]

HPWH also must follow min efficiency per Title 24 Energy Standards Sec. 110.3 and Title 20 Appliance Standards

- Eligible Appliances on CEC MAEDBs List – https://cacertappliances.energy.ca.gov/ Recommend for Installing contractors, HERS rater, and some code enforcement personnel
- Easier to reference the NEEA list of Qualified Products https://neea.org/ (updated 5/1/2020)

Note: All HPWHs available meet Title 20 min. standards

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Mandatory Pipe Insulation

- All domestic hot water piping shall be insulated as specified in Section 609.12 of the *California Plumbing Code*.
  - First 5 feet of cold water pipes from storage tank
  - Pipe ≤ 2 inches: Minimum wall thickness of not less than the diameter of the pipe
  - Pipes > 2 inches: Insulation wall thickness shall be not less than 2 inches (51 mm)

Mandatory Requirements for new homes and additions installing a **gas or propane** storage water heater

Both the 2019 and 2022 Energy Codes have requirements for future HPWHs when installing gas or propane storage water heaters:

- 2019 Code required adequate electric capacity
- 2022 Code requires adequate electric capacity **PLUS** location and plumbing requirements

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2022 **Mandatory** Requirements [150.0(n)1]

- All new homes and additions installing a new gas or propane water heater must provide:
  - **An adequate reserved location for a heat pump water heater: 2.5’ x 2.5’ x 7’ tall**
  - Adequate electrical capacity for future HPWHs.
  - **Some additional plumbing requirements**
- The electrical and plumbing requirements vary depending on whether the location is more or less than 3 feet from the installed water heater. (next slides)
- Note that the requirements for future upgrading to tankless in the 2019 code have been removed.

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2022 **Mandatory** Requirements [150.0(n)1]

Space for future HPWH **within 3'** of installed gas water heater. Provide:

- A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, within 3 feet from the water heater and accessible to the water heater with no obstructions; and. In addition, all of the following:
- Both ends of the unused conductor shall be labeled with the word "spare" and be electrically isolated; and
- A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words "Future 240V Use"; and
- A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance.
- Note: aligns with 2019 code pre wire

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2022 **Mandatory** Requirements [150.0(n)1]

Space for future HPWH **outside of 3'** of installed gas water heater. Provide:

- A dedicated 240 volt branch circuit shall be installed within 3 feet from the designated space. The branch circuit shall be rated at 30 amps minimum. The blank cover shall be identified as "240V ready"; and
- The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future HPWH installation. The reserved space shall be permanently marked as "For Future 240V use"; and
- Either a dedicated cold water supply, or the cold water supply shall pass through the designated HPWH location just before reaching the gas or propane water heater; and
- **The hot water supply pipe coming out of the gas or propane water heater shall be routed first through the designated HPWH location before serving any fixtures; and**
- **The hot and cold water piping at the designated HPWH location shall be exposed and readily accessible for future installation of a HPWH; and**
- A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance.

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2022 **Performance** Path – New Construction & Additions

- HPWHs can be modeled by **performance** approach software.
  - Individual
  - Limited central design
- In some cases, they can result in an energy *credit* (better than prescriptive) that offsets other features.

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2022 **Prescriptive**- New Construction and Additions [150.1(c)8A]

The 2022 Energy Code **no longer allows tanked gas or propane water heaters for new construction** under the prescriptive path

2022 **Prescriptive-**
New Construction and Additions [150.1(c)8A]

Domestic Water Heater Options:

1. **A 240v HPWH**, located in garage or conditioned space, plus:
   - If in climate zone 1 or 16, a "compact hot water distribution system"
   - If in climate zone 16, a "drain water heat recovery system"
2. **A single 240v HPWH** meeting the NEEA Tier 3 requirement, or higher, plus
   - If in climate zone 16, a "drain water heat recovery system" and tank located in garage or conditioned space.
3. A solar water-heating system with electric backup meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum annual solar savings fraction of 0.7.
4. In climate zones **3, 4, 13 and 14**, gas or propane tankless instantaneous water heaters with an input of 200,000 BTU per hour or less (*will trigger mandatory electrical, space, and plumbing requirements for a future HPWH*)
5. For dwelling units with conditioned floor area of 500 sf or less, an instantaneous electric water heater
6. For dwelling units with 1 bedroom or less, **a 120V HPWH** may be installed

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2022 **Prescriptive** – Alterations (replacements) [150.2(b)1H]

For prescriptive alterations, the 2022 Energy Code **allows gas and propane water-heating systems as well as HPWH**

2022 **Prescriptive** – Alterations (replacements) [150.2(b)1H]

For prescriptive alterations, the 2022 Energy Code allows:

1. A natural gas or propane water-heating system; or
2. A single (base efficiency) **heat pump water heater.**
   - The storage tank shall not be located outdoors and be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10.
   - The water heater shall be installed with a communication interface that meets either the requirements of 110.12(a) or has a ANSI/CTA-2045-A B communication port; or
3. A **single heat pump water heater** that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or
4. If the existing water heater is an electric resistance water heater, a consumer electric water heater; or
5. A water-heating system determined by the Executive Director to use no more energy than specified

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Uniform Energy Factor - Efficiency Rating

- UEF: US Department of Energy's newly developed metric for communicating the energy efficiency of water heaters
- Allows comparison of WHs to each other in same Bin
- Replaces the Energy Factor (EF) metric.
- Water heaters designed and manufactured
  - After June 2017 must be rated with UEF
  - Before June 2017 will have EF.
- Variations between EF and UEF. Some lower and some may be higher

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NEEA Advanced Water Heater Specification

- NEEA – Northwest Energy Efficiency Alliance
  - Collaboration of Pacific Northwest Organizations
  - Fund energy efficiency research in their territory
- Advanced Water Heater Specification
  - Expectations driving high performance HPWH
  - Now on Version 8

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NEEA Rated/Tier 3 HPWHs

- NEEA Rated HPWHs can be identified in the NEEA Qualified Products List
  - https://neea.org/resources/qualified-products-list (updated 1/18/2023)

Tier (Integrated HPWHs)	Minimum UEF Northern Climate	Minimum Features	Demand Response Enabled
Tier 1	2.0	ENERGY STAR compliance Freeze protection	Optional
Tier 2	2.3	Tier 1 plus: Minimal use of resistance elements Compressor shut-down/notification 10 yr warranty Condensate management	Optional
Tier 3	2.6	Tier 2 plus: Simultaneous intake and exhaust capacities Air filter management Override and default mode behavior	Required
Tier 4	3.0	Tier 3 plus: Controls or design to limit resistance heating to less than upper 50% of tank	Required
Tier 5	3.5	Tier 4 plus: No resistance element usage in default	Required

Note: There is a different table for Split HPWHs

NEEA Qualified Products List

- NEEA Tier 3
  - Tier category
  - Manufacturer and Model Number

Advanced Water Heater Specification Qualified Products List for Heat Pump Water Heaters

Last Updated: 04/15/2019

Product Tier	Product Brand	Model	Volume (gallons)	Maximum Recommended Household Size	Uniform Energy Factor NC†	Energy Factor NC†	Qualified Date
Tier 3							
	A. O. Smith	HPTU 50 120	50	2-3	2.9	--	6/24/2016
	A. O. Smith	HPTU 50N ***	50	2-3	2.9	--	6/24/2016
	A. O. Smith	HPTU 66 120	66	3	3.1	--	6/24/2016
	A. O. Smith	HPTU 66N ***	66	3	3.1	--	6/24/2016
	A. O. Smith	HPTU 80 120	80	4+	2.9	--	6/24/2016
	A. O. Smith	HPTU 80N ***	80	4+	2.9	--	6/24/2016
	A. O. Smith	HP10-50H45DV	50	2-3	2.9	--	3/14/2017

Documenting Compliance

Photo credit: Eco-$mart

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2022 Energy Code – HPWHs and Documenting Compliance

- Regardless of the scope of the project or the compliance pathway (prescriptive or performance), compliance is documented using at least two types of certificates:
  - CF1R – Certificate of Compliance – Documents what is required
  - CF2R – Certificate of Installation – Documents what is installed

- The CF3R is only required when 3rd-party HERS verification is required. There are some special hot water distribution systems that require HERS verifications, but they are **not unique** to HPWHs.

Performance – New Construction and Additions

Plan Review

- CF1R-PRF-01 describes type of water heater.
  - The same type water heater must be installed with equal or better efficiency.
  - If a specific NEEA-rated HPWH make/model is shown, it must be installed.

Field Documentation

- Installed unit will be documented on a CF2R-PLB-02E or CF2R-PLB-22H (HERS) for single family before final inspection.
- Building Inspector should verify installed HPWH

Form for **Performance** - New Construction & Additions

- Refer to the Water Heater table of the CF1R-PRF -01E form:

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

CF1R-PRF-01-E
(Page 10 of 13)

Project Name: CZ 9 2 Story Example 2
Calculation Date/Time: 2023-01-20T11:48:55-08:00
Calculation Description: 2 Story Example
Input File Name: 2StoryExample.ribd22

WATER HEATERS - NEEA HEAT PUMP							
01	02	03	04	05	06	07	08
Name	# of Units	Tank Vol. (gal)	NEEA Heat Pump Brand	NEEA Heat Pump Model	Tank Location	Duct Inlet Air Source	Duct Outlet Air Source
Heat Pump	1	50	Generic	WhirlpoolHPSE2K50	Garage	Outside	Outside

Prescriptive – Additions <1,000sf

Plan Review

- CF1R-**ADD**-02 or CF1R-**ADD**-01 (HERS) prepared by an energy consultant describes type of water heater.
  - The same type water heater must be installed with equal or better efficiency

Field Documentation

- Installed unit will be documented on a CF2R-PLB-02E or CF2R-PLB-22H (HERS) for single family before final inspection.
- Building Inspector should verify installed HPWH

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Form for **Prescriptive** – Additions <1,000sf

CF1R-ADD-02- E Prescriptive - Non-HERS

PRESCRIPTIVE ADDITIONS 1000 FT² OR LESS

CALIFORNIA ENERGY COMMISSION

CEC-CF1R-ADD-01-E

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

L. Water Heating Systems (Section 150.2(a)1D)

List water heaters and boilers for both domestic hot water (DHW) heaters and hydronic space heating.

Options:

1. A single heat pump water heater. The storage tank shall not be located outdoors and shall be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that meets either the requirements of Section 110.12(a) or has an ANSI/CTA-2045-B communication port; or
2. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or
3. A gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank; or
4. For addition that are 500 square feet or less, an instantaneous electric water heater with point of use distribution as specified in the Reference Appendices, Residential Appendix, RA4.4.5

01	02	03	04	05	06	07	08	09
Water Heating System ID or Name	Water Heating System Type	System Option (from §150.2(a)1D)	# of Water Heaters/ Compressors in System	Water Heater Type	Fuel Type	Rated Input	Tank Location	Distribution Type

Prescriptive- Alterations

Plan Review

- CF1R-**ALT**- 05 - prepared by an energy consultant describes type of water heater.
  - The same type water heater must be installed with equal or better efficiency

Field Documentation

- The installed unit will be documented on either a
  - CF2R-ALT-05 (Non-HERS) or
  - CF2R-PLB-02 (Non-HERS) or CF2R-PLB-22 (HERS)
- Building Inspector should verify installed HPWH

Form for Prescriptive- Alterations

Forms- CF1R & CF2R-ALT-05 (Non-HERS)

CALIFORNIA ENERGY COMMISSION

PRESCRIPTIVE RESIDENTIAL ALTERATIONS

CEC-CF1R-ALT-01-E

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

J. Water Heating Systems (Section 150.2(b)1H)

List water heaters and boilers for both domestic hot water (DHW) heaters and hydronic space heating.

Options:

a. Gas or propane water heating system; or

b. A single heat pump water heater. The storage tank shall not be located outdoors and shall be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that meets either the requirements of Section 110.12(a) or has a ANSI/CTA-2045-B communication port; or

c. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or

d. If no natural gas is connected to the existing water heater location, a consumer electric water heater

01	Is natural gas connected to the existing water heater?					
02	03	04	05	06	07	08
Water Heating System ID or Name	Water Heating System Type	System Option (from §150.2(b)1Hiii)	Water Heater Type	Volume	Fuel Type	# of Water Heaters in System

CALIFORNIA ENERGY COMMISSION

PRESCRIPTIVE RESIDENTIAL ALTERATIONS THAT DO NOT REQUIRE HERS FIELD VERIFICATION

CEC-CF2R-ALT-05-E

O. Water Heating Systems (Section 150.2(b)1H)

List water heaters and boilers for both domestic hot water (DHW) heaters and hydronic space heating.

Options:

1. *Gas or propane water heating system; or*
2. *A single heat pump water heater. The storage tank shall not be located outdoors and shall be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that meets either the requirements of Section 110.12(a) or has a ANSI/CTA-2045-B communication port; or*
3. *A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or*
4. *If no natural gas is connected to the existing water heater location, a consumer electric water heater*

Table O-1

Field	Field Name	Data Entry
01	Is natural gas connected to the existing water heater?	◯ Yes ◯ No

Table O-2

Field	Field Name	Data Entry 1	Data Entry 2	Data Entry 3
02	Water Heating System ID or Name			
03	Water Heating System Type			
04	System Option (from §150.2(b)1Hiii)			
05	Water Heater Type			
06	Volume			
07	Fuel Type			
08	# of Water Heaters in System			

Field Verification form – Non-HERS required

- **Field Inspection - CF2R-PLB-02 - E – Certificate of Installation**

A. Design Dwelling Unit Water Heating Systems Information (other than HPWH)

This table reports features of the water heating system(s) other than **HPWH** systems specified on the registered CF1R compliance document for this project.

A2. Design Dwelling Unit HPWH System Information

This table reports the water heating system(s) that were specified on the registered CF1R compliance document for this project.

01	02	03	06	07	08	09

Should match CF1R

B. Installed Dwelling Unit Water Heating Systems Information

This table reports features of the water heating system other than **HPWH** systems installed in this project.

01	02	03	04	05	06	07	08	09	10

B2. Installed Dwelling Unit HPWH System Information

This table reports the water heating system(s) installed in this project.

01	02	03	04	05	06

Should match Section A.

HERS Verification Form

- **Field Inspection - CF2R-PLB-22 –H Certificate of Installation**

B. Installed HERS Verified Dwelling Unit Water Heating Systems Information

This table reports the water heating system features installed in this project.

01	01	02	03	04	05	06	07	08	09	10	11

D. Installed HERS Verified Dwelling Unit Water Heating Efficiency Information

This table reports the water heater(s) efficiency features installed in this project. (Not needed for central systems

01	02	...	06	07

Should match CF1R/ 2R

Should match Section B HERS field verification

E. Installed Water Heater Manufacturer Information

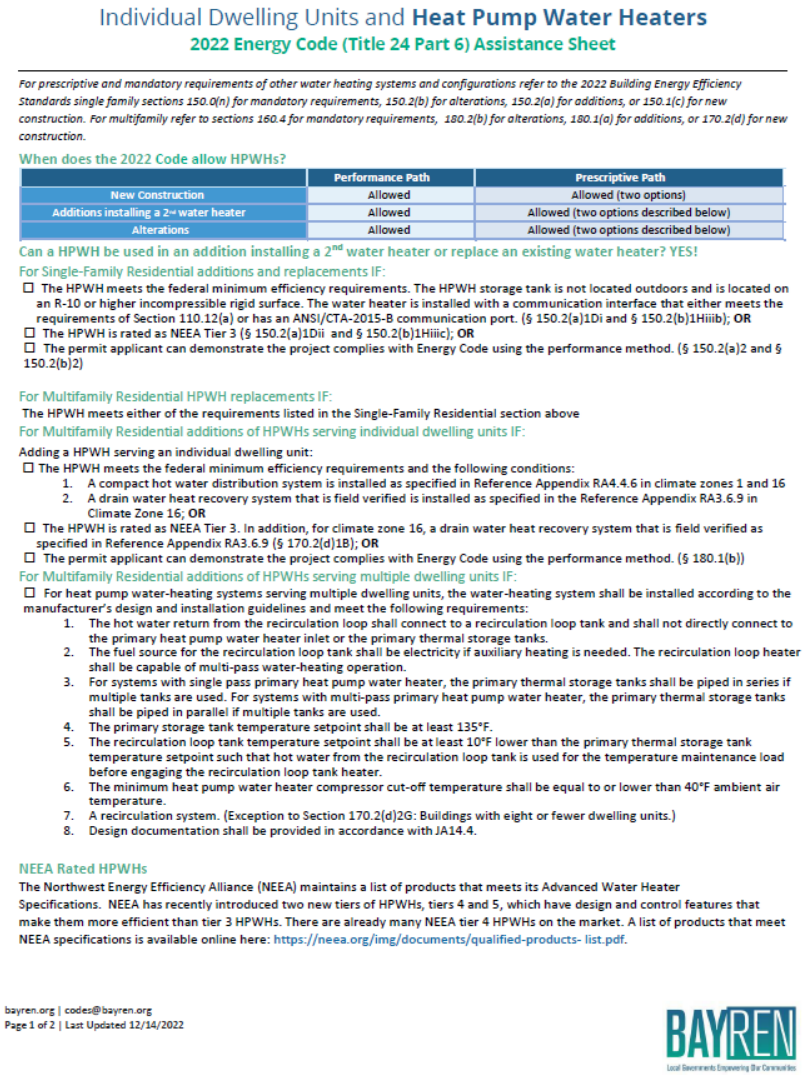
01	02	03
Water Heating System ID or Name	Manufacturer	Model Number

Resources for Permitting and Compliance

HPWH Guide Form for Staff and Applicants

Outlines prescriptive requirements for HPWHs in accessible format.

https://www.bayren.org/sites/default/files/2022-12/HPWH_Assistance_Sheet_2022_Final.pdf



Individual Dwelling Units and **Heat Pump Water Heaters**

2022 Energy Code (Title 24 Part 6) Assistance Sheet

For prescriptive and mandatory requirements of other water heating systems and configurations refer to the 2022 Building Energy Efficiency Standards single family sections 150.0(n) for mandatory requirements, 150.2(b) for alterations, 150.2(a) for additions, or 150.1(c) for new construction. For multifamily refer to sections 160.4 for mandatory requirements, 180.2(b) for alterations, 180.1(a) for additions, or 170.2(d) for new construction.

When does the 2022 Code allow HPWHs?

	Performance Path	Prescriptive Path
New Construction	Allowed	Allowed (two options)
Additions installing a 2nd water heater	Allowed	Allowed (two options described below)
Alterations	Allowed	Allowed (two options described below)

Can a HPWH be used in an addition installing a 2nd water heater or replace an existing water heater? YES!

For Single-Family Residential additions and replacements IF:

- ☐ The HPWH meets the federal minimum efficiency requirements. The HPWH storage tank is not located outdoors and is located on an R-10 or higher incompressible rigid surface. The water heater is installed with a communication interface that either meets the requirements of Section 110.12(a) or has an ANSI/CTA-2015-B communication port. (§ 150.2(a)1Di and § 150.2(b)1Hiiib); **OR**
- ☐ The HPWH is rated as NEEA Tier 3 (§ 150.2(a)1Dii and § 150.2(b)1Hiiic); **OR**
- ☐ The permit applicant can demonstrate the project complies with Energy Code using the performance method. (§ 150.2(a)2 and § 150.2(b)2)

For Multifamily Residential HPWH replacements IF:

The HPWH meets either of the requirements listed in the Single-Family Residential section above

For Multifamily Residential additions of HPWHs serving individual dwelling units IF:

Adding a HPWH serving an individual dwelling unit:

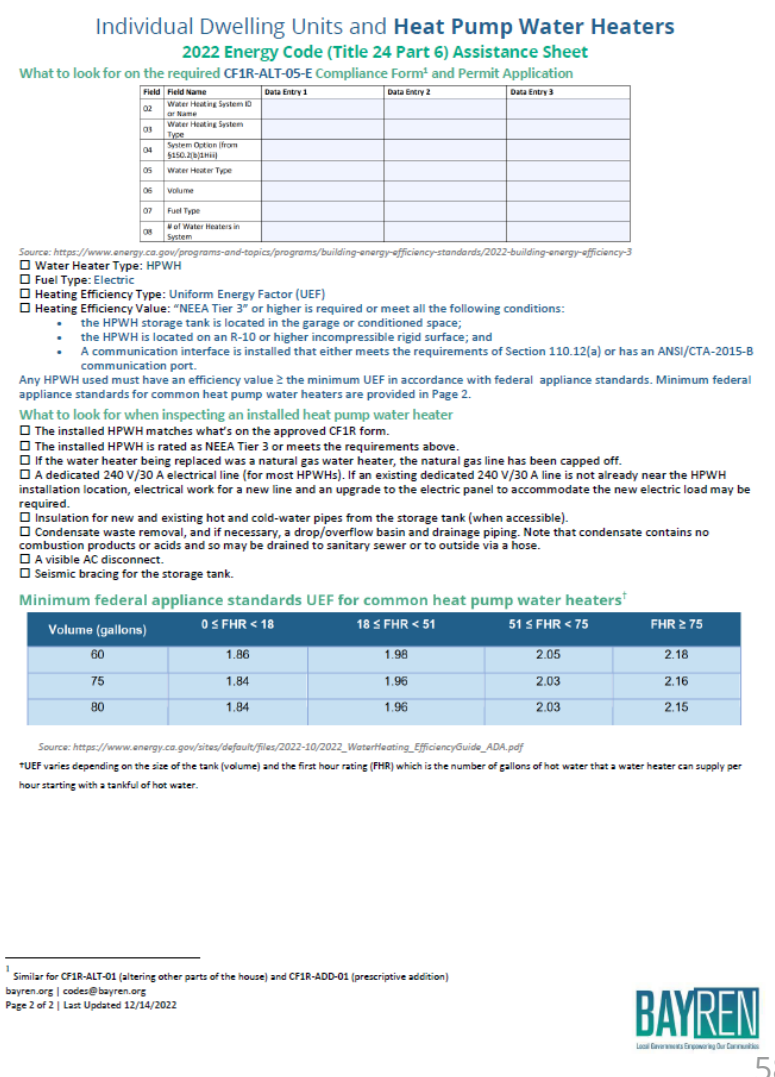
- ☐ The HPWH meets the federal minimum efficiency requirements and the following conditions:
  1. A compact hot water distribution system is installed as specified in Reference Appendix RA4.4.6 in climate zones 1 and 16
  2. A drain water heat recovery system that is field verified is installed as specified in the Reference Appendix RA3.6.9 in Climate Zone 16; **OR**
- ☐ The HPWH is rated as NEEA Tier 3. In addition, for climate zone 16, a drain water heat recovery system that is field verified as specified in Reference Appendix RA3.6.9 (§ 170.2(d)1B); **OR**
- ☐ The permit applicant can demonstrate the project complies with Energy Code using the performance method. (§ 180.1(b))

For Multifamily Residential additions of HPWHs serving multiple dwelling units IF:

- ☐ For heat pump water-heating systems serving multiple dwelling units, the water-heating system shall be installed according to the manufacturer's design and installation guidelines and meet the following requirements:
  1. The hot water return from the recirculation loop shall connect to a recirculation loop tank and shall not directly connect to the primary heat pump water heater inlet or the primary thermal storage tanks.
  2. The fuel source for the recirculation loop tank shall be electricity if auxiliary heating is needed. The recirculation loop heater shall be capable of multi-pass water-heating operation.
  3. For systems with single pass primary heat pump water heater, the primary thermal storage tanks shall be piped in series if multiple tanks are used. For systems with multi-pass primary heat pump water heater, the primary thermal storage tanks shall be piped in parallel if multiple tanks are used.
  4. The primary storage tank temperature setpoint shall be at least 135°F.
  5. The recirculation loop tank temperature setpoint shall be at least 10°F lower than the primary thermal storage tank temperature setpoint such that hot water from the recirculation loop tank is used for the temperature maintenance load before engaging the recirculation loop tank heater.
  6. The minimum heat pump water heater compressor cut-off temperature shall be equal to or lower than 40°F ambient air temperature.
  7. A recirculation system. (Exception to Section 170.2(d)2G: Buildings with eight or fewer dwelling units.)
  8. Design documentation shall be provided in accordance with JA14.4.

NEEA Rated HPWHs

The Northwest Energy Efficiency Alliance (NEEA) maintains a list of products that meets its Advanced Water Heater Specifications. NEEA has recently introduced two new tiers of HPWHs, tiers 4 and 5, which have design and control features that make them more efficient than tier 3 HPWHs. There are already many NEEA tier 4 HPWHs on the market. A list of products that meet NEEA specifications is available online here: https://neea.org/img/documents/qualified-products- list.pdf.



Individual Dwelling Units and **Heat Pump Water Heaters**

2022 Energy Code (Title 24 Part 6) Assistance Sheet

What to look for on the required CF1R-ALT-05-E Compliance Form[1] and Permit Application

Field	Field Name	Data Entry 1	Data Entry 2	Data Entry 3
02	Water Heating System ID or Name			
03	Water Heating System Type			
04	System Option (from §150.2(b)1Hiii)			
05	Water Heater Type			
06	Volume			
07	Fuel Type			
08	# of Water Heaters in System			

Source: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency-3

- ☐ **Water Heater Type:** HPWH
- ☐ **Fuel Type:** Electric
- ☐ **Heating Efficiency Type:** Uniform Energy Factor (UEF)
- ☐ **Heating Efficiency Value:** "NEEA Tier 3" or higher is required or meet all the following conditions:
  - the HPWH storage tank is located in the garage or conditioned space;
  - the HPWH is located on an R-10 or higher incompressible rigid surface; and
  - A communication interface is installed that either meets the requirements of Section 110.12(a) or has an ANSI/CTA-2015-B communication port.

Any HPWH used must have an efficiency value ≥ the minimum UEF in accordance with federal appliance standards. Minimum federal appliance standards for common heat pump water heaters are provided in Page 2.

What to look for when inspecting an installed heat pump water heater

- ☐ The installed HPWH matches what's on the approved CF1R form.
- ☐ The installed HPWH is rated as NEEA Tier 3 or meets the requirements above.
- ☐ If the water heater being replaced was a natural gas water heater, the natural gas line has been capped off.
- ☐ A dedicated 240 V/30 A electrical line (for most HPWHs). If an existing dedicated 240 V/30 A line is not already near the HPWH installation location, electrical work for a new line and an upgrade to the electric panel to accommodate the new electric load may be required.
- ☐ Insulation for new and existing hot and cold-water pipes from the storage tank (when accessible).
- ☐ Condensate waste removal, and if necessary, a drop/overflow basin and drainage piping. Note that condensate contains no combustion products or acids and so may be drained to sanitary sewer or to outside via a hose.
- ☐ A visible AC disconnect.
- ☐ Seismic bracing for the storage tank.

Minimum federal appliance standards UEF for common heat pump water heaters[†]

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
60	1.86	1.98	2.05	2.18
75	1.84	1.96	2.03	2.16
80	1.84	1.96	2.03	2.15

Source: https://www.energy.ca.gov/sites/default/files/2022-10/2022_WaterHeating_EfficiencyGuide_ADA.pdf

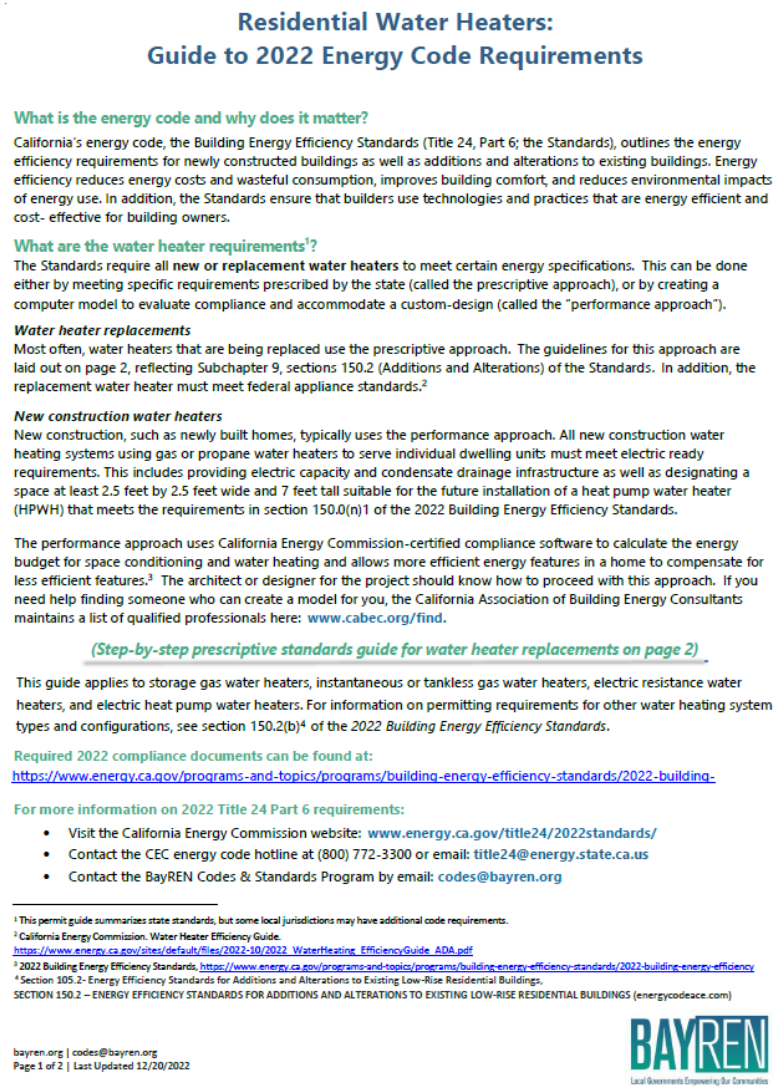
†UEF varies depending on the size of the tank (volume) and the first hour rating (FHR) which is the number of gallons of hot water that a water heater can supply per hour starting with a tankful of hot water.

[1] Similar for CF1R-ALT-01 (altering other parts of the house) and CF1R-ADD-01 (prescriptive addition)

Permit Guide for Replacements for Applicants

Help local enforcing agencies streamline energy code compliance and enforcement.

https://www.bayren.org/sites/default/files/2022-12/2022-res-water-heater-alteration-permit-guide_Final.pdf



Residential Water Heaters: Guide to 2022 Energy Code Requirements

What is the energy code and why does it matter?

California's energy code, the Building Energy Efficiency Standards (Title 24, Part 6; the Standards), outlines the energy efficiency requirements for newly constructed buildings as well as additions and alterations to existing buildings. Energy efficiency reduces energy costs and wasteful consumption, improves building comfort, and reduces environmental impacts of energy use. In addition, the Standards ensure that builders use technologies and practices that are energy efficient and cost- effective for building owners.

What are the water heater requirements[1]?

The Standards require all **new or replacement water heaters** to meet certain energy specifications. This can be done either by meeting specific requirements prescribed by the state (called the prescriptive approach), or by creating a computer model to evaluate compliance and accommodate a custom-design (called the "performance approach").

Water heater replacements

Most often, water heaters that are being replaced use the prescriptive approach. The guidelines for this approach are laid out on page 2, reflecting Subchapter 9, sections 150.2 (Additions and Alterations) of the Standards. In addition, the replacement water heater must meet federal appliance standards.[2]

New construction water heaters

New construction, such as newly built homes, typically uses the performance approach. All new construction water heating systems using gas or propane water heaters to serve individual dwelling units must meet electric ready requirements. This includes providing electric capacity and condensate drainage infrastructure as well as designating a space at least 2.5 feet by 2.5 feet wide and 7 feet tall suitable for the future installation of a heat pump water heater (HPWH) that meets the requirements in section 150.0(n)1 of the 2022 Building Energy Efficiency Standards.

The performance approach uses California Energy Commission-certified compliance software to calculate the energy budget for space conditioning and water heating and allows more efficient energy features in a home to compensate for less efficient features.[3] The architect or designer for the project should know how to proceed with this approach. If you need help finding someone who can create a model for you, the California Association of Building Energy Consultants maintains a list of qualified professionals here: **www.cabec.org/find.**

(Step-by-step prescriptive standards guide for water heater replacements on page 2)

This guide applies to storage gas water heaters, instantaneous or tankless gas water heaters, electric resistance water heaters, and electric heat pump water heaters. For information on permitting requirements for other water heating system types and configurations, see section 150.2(b)[4] of the *2022 Building Energy Efficiency Standards*.

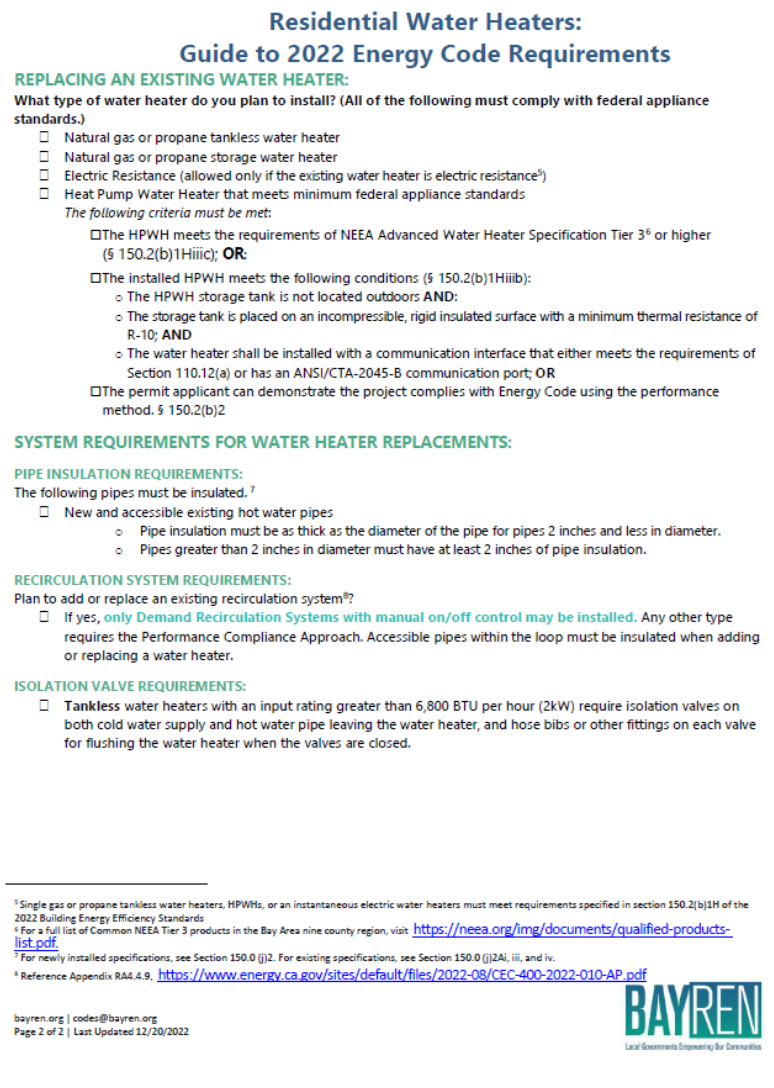
Required 2022 compliance documents can be found at:

https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-

For more information on 2022 Title 24 Part 6 requirements:

- Visit the California Energy Commission website: **www.energy.ca.gov/title24/2022standards/**
- Contact the CEC energy code hotline at (800) 772-3300 or email: **title24@energy.state.ca.us**
- Contact the BayREN Codes & Standards Program by email: **codes@bayren.org**

[1] This permit guide summarizes state standards, but some local jurisdictions may have additional code requirements.
[2] California Energy Commission. Water Heater Efficiency Guide. https://www.energy.ca.gov/sites/default/files/2022-10/2022_WaterHeating_EfficiencyGuide_ADA.pdf
[3] 2022 Building Energy Efficiency Standards, https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency
[4] Section 105.2- Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings.
SECTION 150.2 – ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS (energycodeace.com)



Residential Water Heaters: Guide to 2022 Energy Code Requirements

REPLACING AN EXISTING WATER HEATER:

What type of water heater do you plan to install? (All of the following must comply with federal appliance standards.)

- ☐ Natural gas or propane tankless water heater
- ☐ Natural gas or propane storage water heater
- ☐ Electric Resistance (allowed only if the existing water heater is electric resistance[5])
- ☐ Heat Pump Water Heater that meets minimum federal appliance standards

The following criteria must be met:

- ☐ The HPWH meets the requirements of NEEA Advanced Water Heater Specification Tier 3[6] or higher (§ 150.2(b)1Hiiic); **OR:**
- ☐ The installed HPWH meets the following conditions (§ 150.2(b)1Hiiib):
  - The HPWH storage tank is not located outdoors **AND:**
  - The storage tank is placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10; **AND**
  - The water heater shall be installed with a communication interface that either meets the requirements of Section 110.12(a) or has an ANSI/CTA-2045-B communication port; **OR**
- ☐ The permit applicant can demonstrate the project complies with Energy Code using the performance method. § 150.2(b)2

SYSTEM REQUIREMENTS FOR WATER HEATER REPLACEMENTS:

PIPE INSULATION REQUIREMENTS:

The following pipes must be insulated. [7]

- ☐ New and accessible existing hot water pipes
  - Pipe insulation must be as thick as the diameter of the pipe for pipes 2 inches and less in diameter.
  - Pipes greater than 2 inches in diameter must have at least 2 inches of pipe insulation.

RECIRCULATION SYSTEM REQUIREMENTS:

Plan to add or replace an existing recirculation system[8]?

- ☐ If yes, **only Demand Recirculation Systems with manual on/off control may be installed.** Any other type requires the Performance Compliance Approach. Accessible pipes within the loop must be insulated when adding or replacing a water heater.

ISOLATION VALVE REQUIREMENTS:

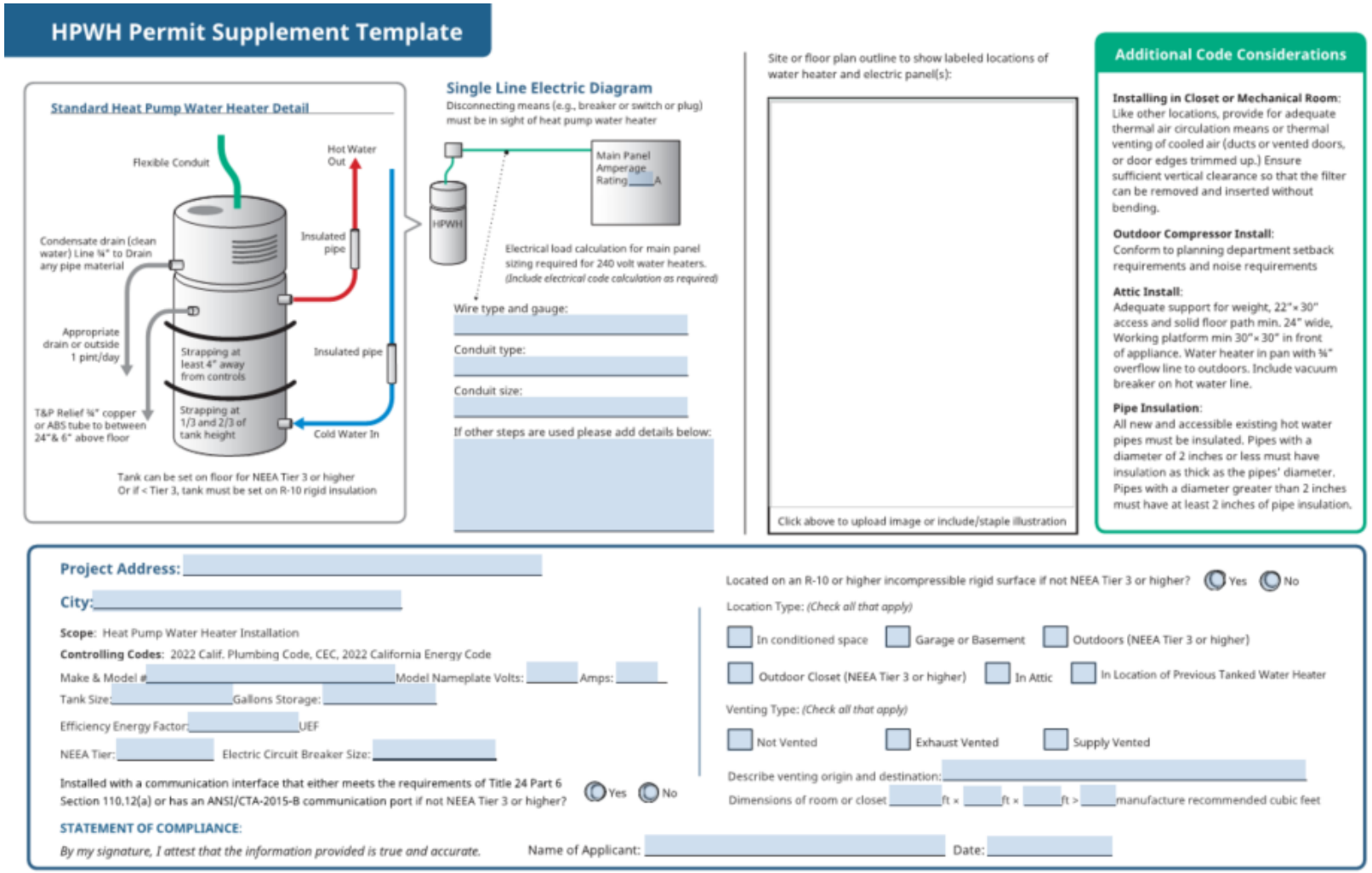
- ☐ **Tankless** water heaters with an input rating greater than 6,800 BTU per hour (2kW) require isolation valves on both cold water supply and hot water pipe leaving the water heater, and hose bibs or other fittings on each valve for flushing the water heater when the valves are closed.

[5] Single gas or propane tankless water heaters, HPWHs, or an instantaneous electric water heaters must meet requirements specified in section 150.2(b)1H of the 2022 Building Energy Efficiency Standards
[6] For a full list of Common NEEA Tier 3 products in the Bay Area nine county region, visit https://neea.org/img/documents/qualified-products-list.pdf.
[7] For newly installed specifications, see Section 150.0 (j)2. For existing specifications, see Section 150.0 (j)2Ai, iii, and iv.
[8] Reference Appendix RA4.4.9, https://www.energy.ca.gov/sites/default/files/2022-08/CEC-400-2022-010-AP.pdf

Additional Permit Resources

HPWH Permit Supplemental Template

Electrical Load Estimator



HPWH Permit Supplement Template

Standard Heat Pump Water Heater Detail

Flexible Conduit
Hot Water Out
Condensate drain (clean water) Line ¾" to Drain any pipe material
Insulated pipe
Appropriate drain or outside 1 pint/day
Strapping at least 4" away from controls
Insulated pipe
T&P Relief ¾" copper or ABS tube to between 24"& 6" above floor
Strapping at 1/3 and 2/3 of tank height
Cold Water In

Tank can be set on floor for NEEA Tier 3 or higher
Or if < Tier 3, tank must be set on R-10 rigid insulation

Single Line Electric Diagram

Disconnecting means (e.g., breaker or switch or plug) must be in sight of heat pump water heater

Main Panel Amperage Rating ___A
HPWH

Electrical load calculation for main panel sizing required for 240 volt water heaters. *(Include electrical code calculation as required)*

Wire type and gauge:
Conduit type:
Conduit size:
If other steps are used please add details below:

Site or floor plan outline to show labeled locations of water heater and electric panel(s):

Click above to upload image or include/staple illustration

Additional Code Considerations

Installing in Closet or Mechanical Room: Like other locations, provide for adequate thermal air circulation means or thermal venting of cooled air (ducts or vented doors, or door edges trimmed up.) Ensure sufficient vertical clearance so that the filter can be removed and inserted without bending.

Outdoor Compressor Install: Conform to planning department setback requirements and noise requirements

Attic Install: Adequate support for weight, 22"× 30" access and solid floor path min. 24" wide, Working platform min 30"× 30" in front of appliance. Water heater in pan with ¾" overflow line to outdoors. Include vacuum breaker on hot water line.

Pipe Insulation: All new and accessible existing hot water pipes must be insulated. Pipes with a diameter of 2 inches or less must have insulation as thick as the pipes' diameter. Pipes with a diameter greater than 2 inches must have at least 2 inches of pipe insulation.

Project Address: _____

City: _____

Scope: Heat Pump Water Heater Installation

Controlling Codes: 2022 Calif. Plumbing Code, CEC, 2022 California Energy Code

Make & Model #_____ Model Nameplate Volts: _____ Amps: _____

Tank Size: _____ Gallons Storage: _____

Efficiency Energy Factor: _____ UEF

NEEA Tier: _____ Electric Circuit Breaker Size: _____

Installed with a communication interface that either meets the requirements of Title 24 Part 6 Section 110.12(a) or has an ANSI/CTA-2015-B communication port if not NEEA Tier 3 or higher? ◯ Yes ◯ No

Located on an R-10 or higher incompressible rigid surface if not NEEA Tier 3 or higher? ◯ Yes ◯ No

Location Type: *(Check all that apply)*

☐ In conditioned space ☐ Garage or Basement ☐ Outdoors (NEEA Tier 3 or higher)

☐ Outdoor Closet (NEEA Tier 3 or higher) ☐ In Attic ☐ In Location of Previous Tanked Water Heater

Venting Type: *(Check all that apply)*

☐ Not Vented ☐ Exhaust Vented ☐ Supply Vented

Describe venting origin and destination: _____

Dimensions of room or closet _____ ft × _____ ft × _____ ft > _____ manufacture recommended cubic feet

STATEMENT OF COMPLIANCE:

By my signature, I attest that the information provided is true and accurate. Name of Applicant: _____ Date: _____

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Best Practices for Energy Code Enforcement

Photo credit: Eco-$mart

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Best Practices for Code Compliance- Forms

- Require and review CF1R at permit application
- Encourage use of Individual Dwelling Units and Heat Pump Water 2022 Building Code Assistance Sheet to ensure compliance
- Provide permitting assistance documents (Residential Water Heater Alteration Permit Guide, HPWH Permit Supplement)
- Installer or HERS verification should be completed prior to final inspection and complete CF2Rs/CF3Rs at final inspection

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Best Practices for Code Compliance – Field

- Building Inspection at final inspection to confirm:
  - Collect CF2R
  - If gas/propane water heater- confirm location for future HPWH
  - HPWH meets efficiency requirements
  - Mandatory measures are met
  - Additional prescriptive measures are met
  - Installation meets manufacturer's recommendations/specifications

Polls and Resources

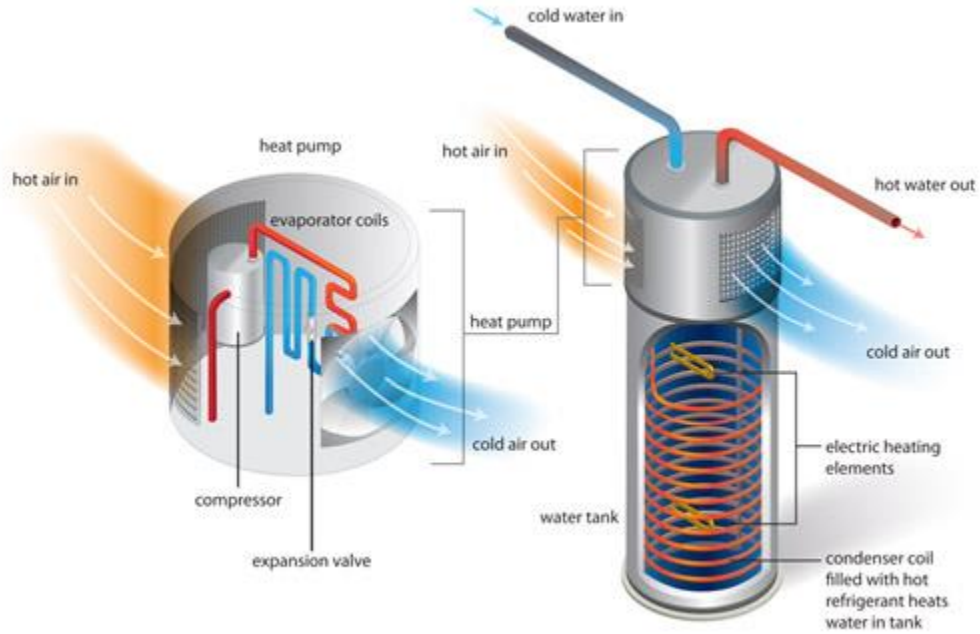

Photo credit: EnergyStar

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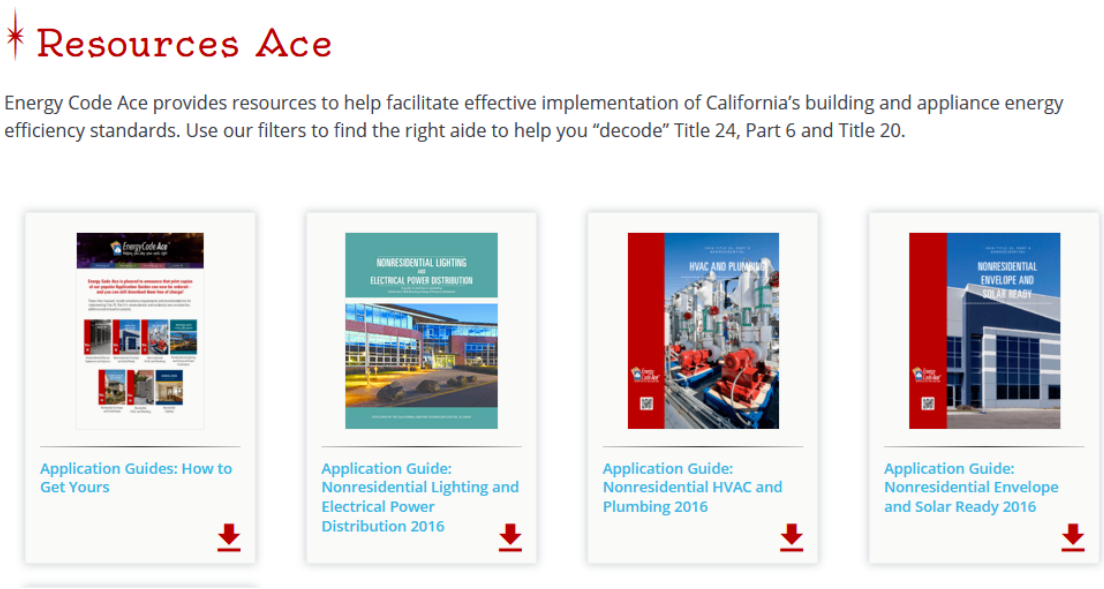
Additional Resources: Energy Code Ace

Ace Forms™

The Forms Ace™ tool helps applicants (and building departments) determine which forms are applicable to a specific project. Use this tool to identify:

- Necessary compliance steps
- The compliance path that is least cumbersome to pursue
- Which forms will be required & generate a checklist
- Whether or not a project requires HERS verification

The Energy Code Ace Application Guides are also very useful



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Additional Trainings

BayREN Trainings: https://www.bayren.org/events-training

- Free, **online** (**on-site in future)** sessions for building department staff
- Usually, 60-90 minutes to fit with a staff meeting or lunch
- Topics include: HERS Registry, Navigating the Energy Code, Residential Additions, How the Energy Code Treats Electrification and more

Energy Code Ace Trainings: https://energycodeace.com/training

- Free training at the Pacific Energy Center or on-site
- Usually half-day or full-day in-depth classes for different audiences
- Includes full day trainings for Plans Examiners and Building Inspectors on the Residential Standards and Nonresidential Standards

Thank you for attending!

- Final Questions
- Class Evaluation Poll
  - Slides from this presentation and ICC Certificate will be provided after completion of evaluation poll, approx. 1 week from today
- Contact information:

  BayREN Codes & Standards Program

  - www.bayren.org
  - codes@bayren.org

Closing

- Continuing Education Units Available
  - Contact ggautereaux@co.slo.ca.us for AIA LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - 2022 Energy Code: Multi-Family (4/6)
  - High Performance Buildings & Careers – Class 1 (4/6)
  - Heat Recovery Ventilation in Existing Multifamily Buildings (4/11)
  - Electrification Products for the Central Coast Climate (4/18)
  - Intro to Residential HVAC Design (ACCA) (4/25)

Thank you!

For more info:
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For questions:
info@3c-ren.org

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