



# We will be starting soon!

*Thanks for joining us*



# Energy Code Implementation: Accessory Dwelling Units (ADUs)



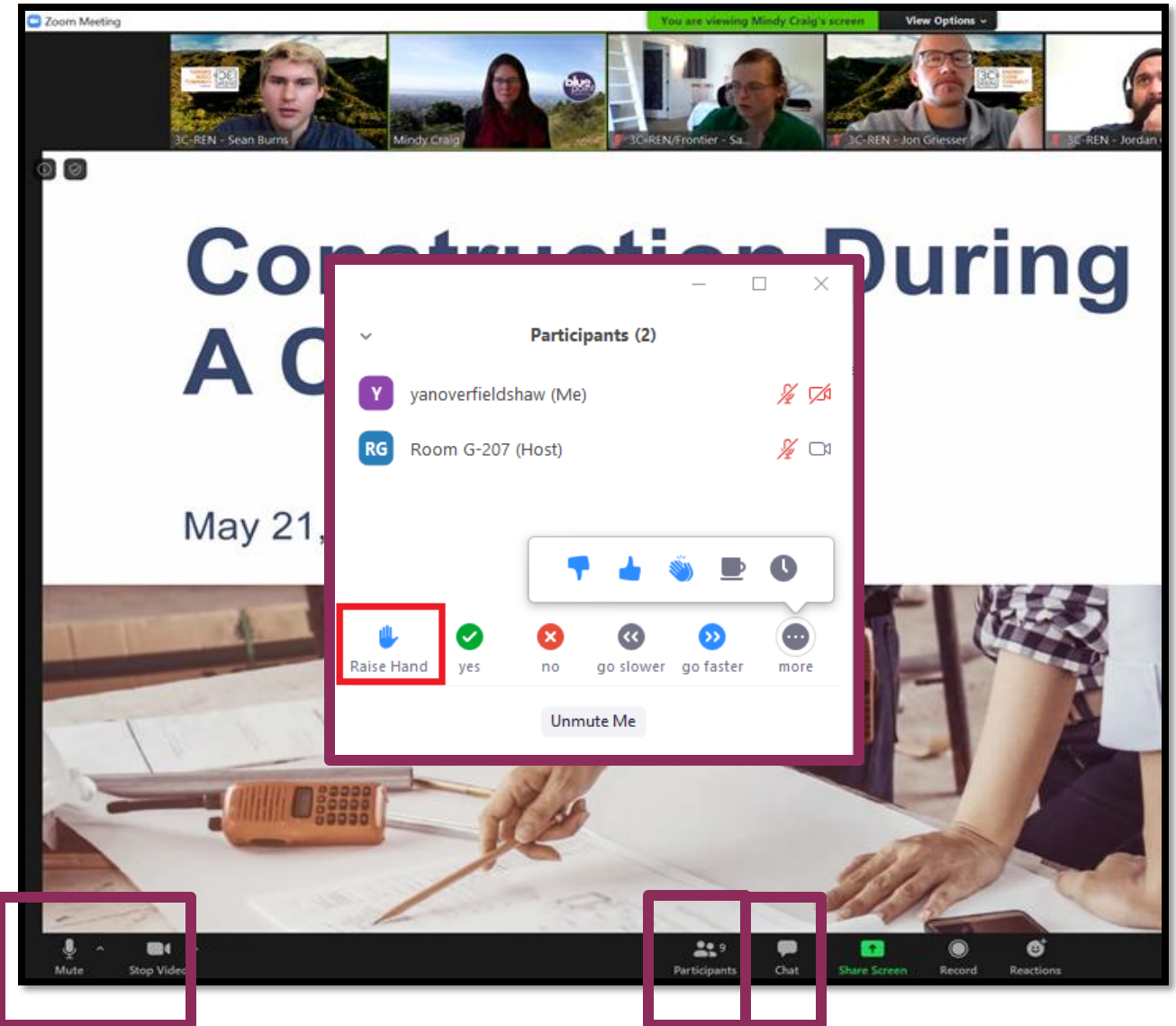
*Jennifer Rennick, AIA, CEA – In Balance Green Consulting*  
*Grant Murphy, CEA – In Balance Green Consulting*

May 8, 2024



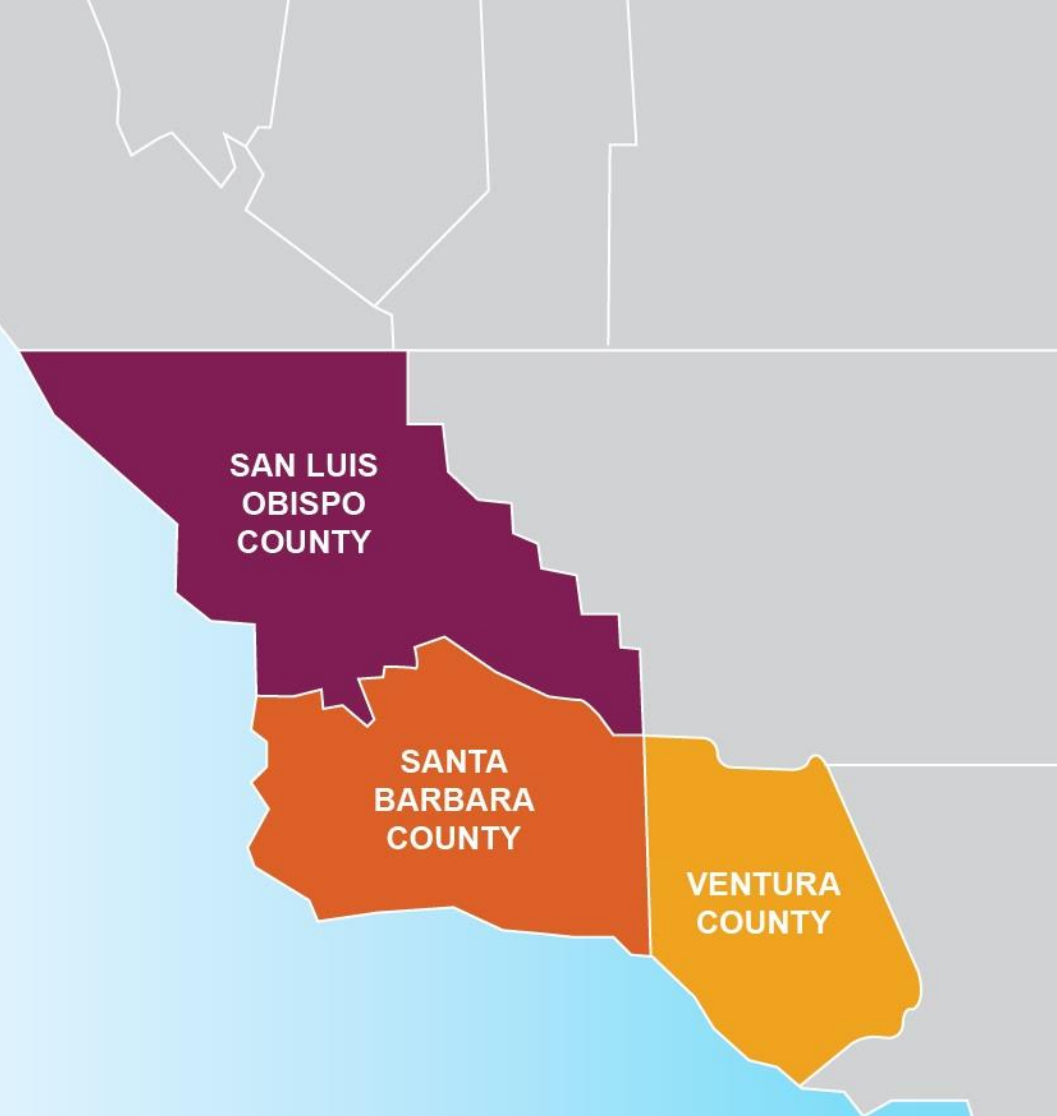
# Zoom Orientation

- 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





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](https://3c-ren.org/codes)  
805.781.1201

Event Registration:  
[3c-ren.org/events](https://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](https://3c-ren.org/events)





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](https://3C-REN.org/contractor-participation)



# Energy Code Implementation Series

Since the energy code update took effect in January 2023, the industry is adjusting to design, detailing and construction to meet compliance. In this series, we'll review the code requirements with a focus on what to include in construction documents to streamline the permitting process and tips for construction to ease sign-offs and occupancy.

- Energy Code Implementation: Single Family New Construction
- Energy Code Implementation: Single Family Additions and Alterations
- **Energy Code Implementation: ADUs**
- Energy Code Implementation: Multi-Family
- Energy Code Implementation: Non-Residential

<https://www.3c-ren.org/calendar-of-events-and-trainings/>





# Today's Learning Objectives

- Understand the current metrics used in the energy code for evaluating compliance, and how choices for electric or gas equipment may impact that compliance.
- Review key mandatory measures, the prescriptive “recipe card” approach, and the options for using the building performance approach.
- Recognize where barriers or stumbling blocks may occur within permitting and construction and tips for documentation to smooth out the process.
- How to access resources for energy code compliance

1.5 AIA HSW LU approved for this course

0.15 ICC CEU approved for this course



# Agenda

1. 2022 Energy Code –Broad Overview
2. ADU Resources and Definitions
3. New Construction:
  - PV / Solar
  - Battery Ready
  - Electric Ready
4. Walls and Fenestration
5. Domestic Water Heating
6. Heat Pump for Space Conditioning –VCHP Credit
7. IAQ Ventilation





**2022 Energy Code:  
CEC Triennial Cycle  
Big-Picture Goals  
Code Reorganization**

# California Energy Commission (CEC)

## Our Responsibilities

- Advancing State Energy Policy
- Achieving Energy Efficiency
- Investing in Energy Innovation
- Developing Renewable Energy
- Transforming Transportation
- Overseeing Energy Infrastructure
- Preparing for Energy Emergencies

EXPLORE OUR CORE RESPONSIBILITIES >



TITLE 24, Part 6

California's Building Energy Efficiency Standards (aka the Energy Code) is updated every three years by the CEC. The process includes engagement with the public, industry experts, in-house expertise, and other stakeholders.



## ABOUT

The California Energy Commission is leading the state to a 100 percent clean energy future. As the state's primary energy policy and planning agency, the Energy Commission is committed to reducing energy costs and environmental impacts of energy use while ensuring a safe, resilient, and reliable supply of energy.

[About the Energy Commission](#)  
[CEC's 45th Anniversary Events](#)

[energy.ca.gov](http://energy.ca.gov)

## DIVISIONS

- Efficiency
- Energy Assessments
- Energy Research and Development
- Fuels and Transportation
- Renewable Energy
- Siting, Transmission, and Environmental Protection

## LEADERSHIP



**Gavin Newsom**  
California Governor

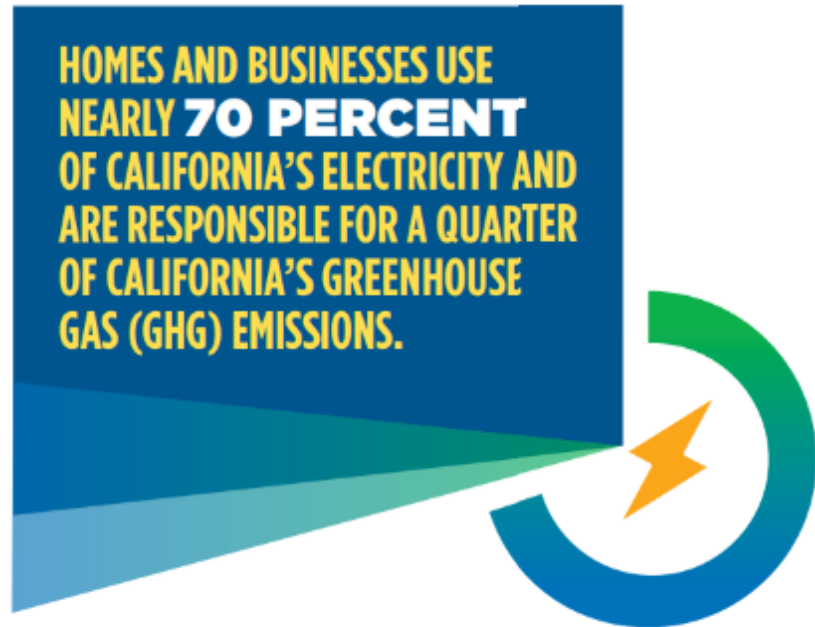


**Wade Crowfoot**  
Secretary for Natural Resources



**David Hochschild**  
Chair, California Energy Commission

# Big Picture Goals for the 2022 Code Updates



- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family homes
- Expand PV systems and battery storage standards
- Strengthen ventilation standards



# Subchapter Reorganization

## 2019 Code

All Buildings -Sections 100 and 110

High-Rise Residential, Nonresidential,  
Hotel/Motel -Sections 120, 130, 140,  
and 141

Low-Rise Residential -Section 150.0-  
150.2

## 2022 Code

All Buildings -Sections 100 and 110

Nonresidential, Hotel/Motel -Sections  
120, 130, 140, and 141

Single-Family Residential -Section  
150.0-150.2 (includes duplexes and  
townhouses)

**New Sections**

Multifamily Buildings -Sections 160,  
170, 180 (low and high rise)

# The Energy Code –Three Compliance Terms

## Mandatory Requirements

Energy efficiency measures that are applicable to all projects.

### Prescriptive Component Package

Mandatory Requirements are applicable

Follow all the parts of the prescriptive package

Note: used to determine the Standard Design Building

Essentially a **checklist** approach

### Performance Method

Mandatory Requirements are applicable

Other components or measures can be traded-off as long as the Proposed Design Building can be shown to be more energy efficiency than a similar sized Standard Design Building (baseline building)

**Energy modeling** approach

# Performance Method (Computer Modeling)



Ductless Systems



Ducted Systems



SanCO2

Water Heating

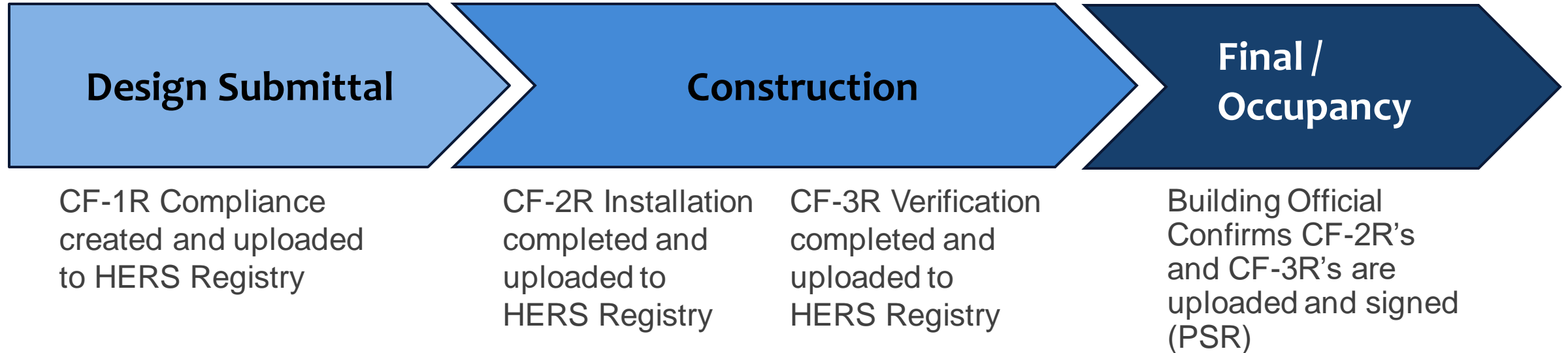
Key Take-Away for 2022:

The **Standard Design** now includes efficient electric heat pump space heating and heat pump water heating.





# Process for Residential Permitting



## HERS – Home Energy Rating System

We have two HERS Providers, CalCERTS and CHEERS, in California. These organization are responsible for training and certifying HERS Raters, and supporting the California Energy Code HERS Registry.





# Accessory Dwelling Units (ADUs)

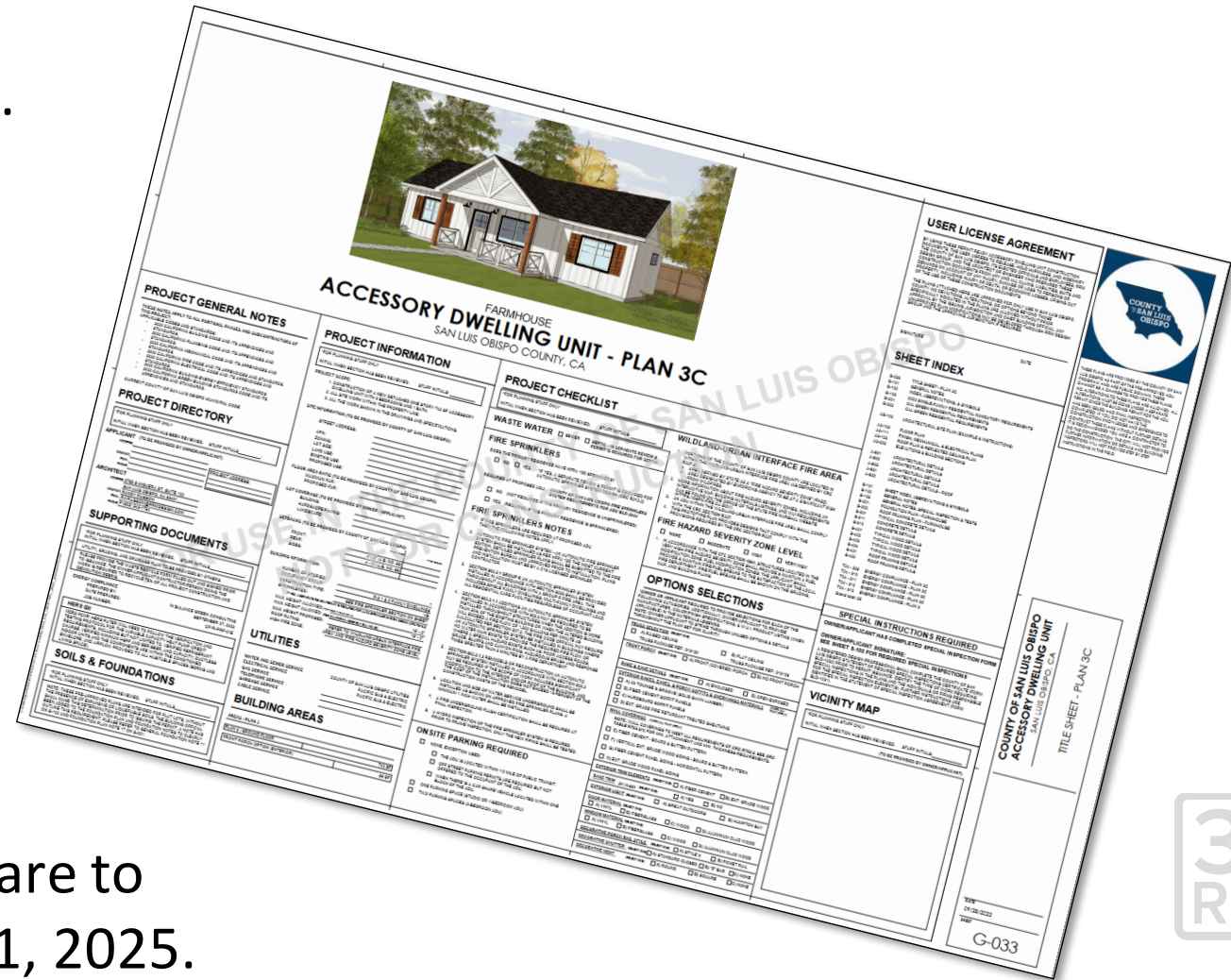
# Benefits of Accessory Dwelling Units



- Affordable
  - No new land purchase
  - No major infrastructure needed
- Family & Community Connection
  - Extended Family
  - Essential Workers
- Flexible Living
  - Aging in Place
  - Home Healthcare
- Rental Income

# “Pre-Reviewed” or “Pre-Approved” Plan Sets

- Title 24 Documentation, i.e. Energy Code Compliance
- HERS Registry
- Note Special Features and HERS Measures Requirements
- HERS Rater



Building/Planning jurisdictions are to have plan sets available by Jan 1, 2025.



# ADU– Resources

<https://www.hcd.ca.gov>



California Department of  
**Housing and  
Community  
Development**

Grants  
&  
Funding

Manufactured  
&  
Mobilehomes

Building  
Standards

Planning &  
Community  
Development

Policy &  
Research

About  
HCD

[Home](#) > [Policy & Research](#) > [Accessory Dwelling Units](#)

## Accessory Dwelling Units

Accessory Dwelling Units (ADUs) and Junior Accessory Dwelling Units (JADUs) are an innovative and effective option for adding much needed housing in California.

ADUs have been known by many names: granny flats, in-law units, backyard cottages, secondary units and more. HCD is the state's leader on local ADU ordinances, which — while optional — have grown exponentially in number as more cities, counties, and homeowners become interested in ADUs as one solution to increasing the supply of affordable housing.



Contact the  
ADU Team:

[Submit a Question](#) ↗

Resources

[Accessory Dwelling Unit Handbook \(PDF\)](#)



CALIFORNIA DEPARTMENT OF HOUSING AND COMMUNITY  
DEVELOPMENT

**ACCESSORY DWELLING UNIT  
HANDBOOK**  
UPDATED JULY 2022



# ADU– Accessory Dwelling Unit

**ADU** is an accessory dwelling unit with **complete independent living facilities** for one or more persons with permanent provisions for living, sleeping, eating, cooking and sanitation.

- Can have a “full” or “efficiency” kitchen, i.e. cooking facility with appliances and reasonably sized food prep counter and storage (*definition: [www.3c-ren.org/efficiency-kitchen](http://www.3c-ren.org/efficiency-kitchen)*)
- Has independent bathroom facilities
- Must have a heating and cooling system that does not sharing air with another dwelling.
- Has its own thermostat, i.e. independent controls



Image Courtesy of Julie Clayton, AIA

# JADU – Junior Accessory Dwelling Units

**Conversion of existing space** that is no more than 500 sq. ft. and is **contained entirely within an existing or proposed single-family residence.**

- May include separate or shared sanitation facilities
- May share central HVAC systems
- Has an “efficiency” kitchen, i.e. cooking facility with appliances and reasonably sized food prep counter and storage
- Has a door to the exterior
- May have an interior access door



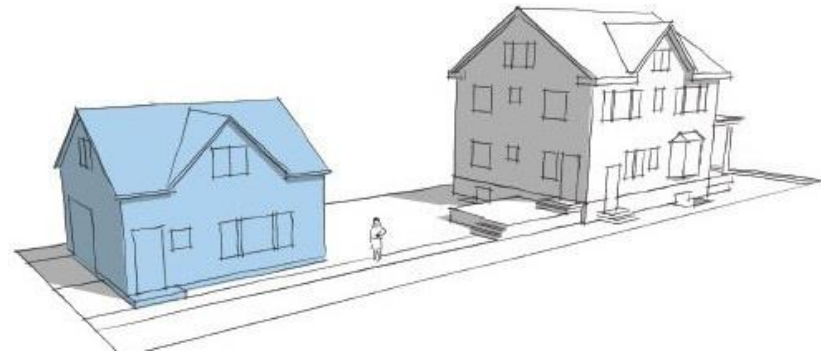
Photo: ADU Resource Center

# Common Allowable ADU and JADU “Types”

In the language of the Energy Code

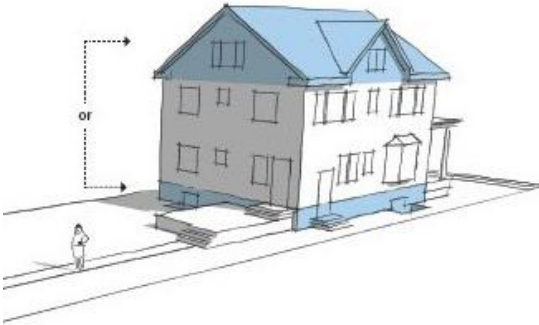
## Energy Code: New Construction

Detached [New Construction]

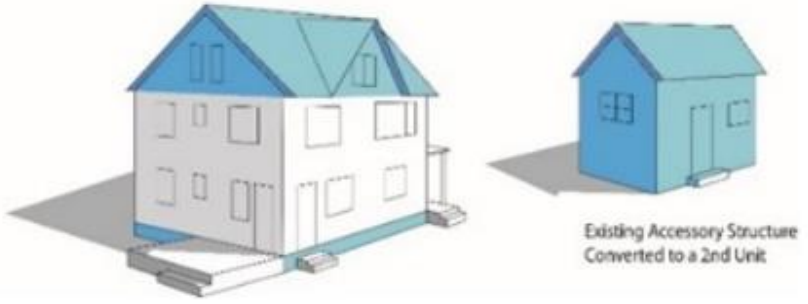


## Energy Code: Alterations and Additions

Attached (Internal)



Internal / [Detached] Conversion



Attached (Addition)

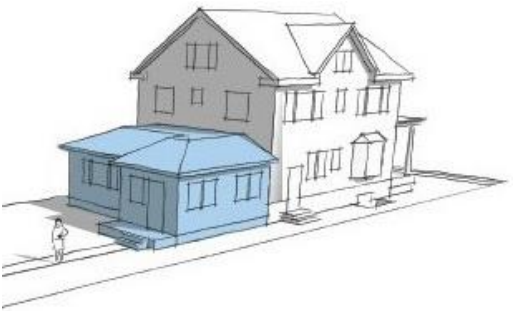
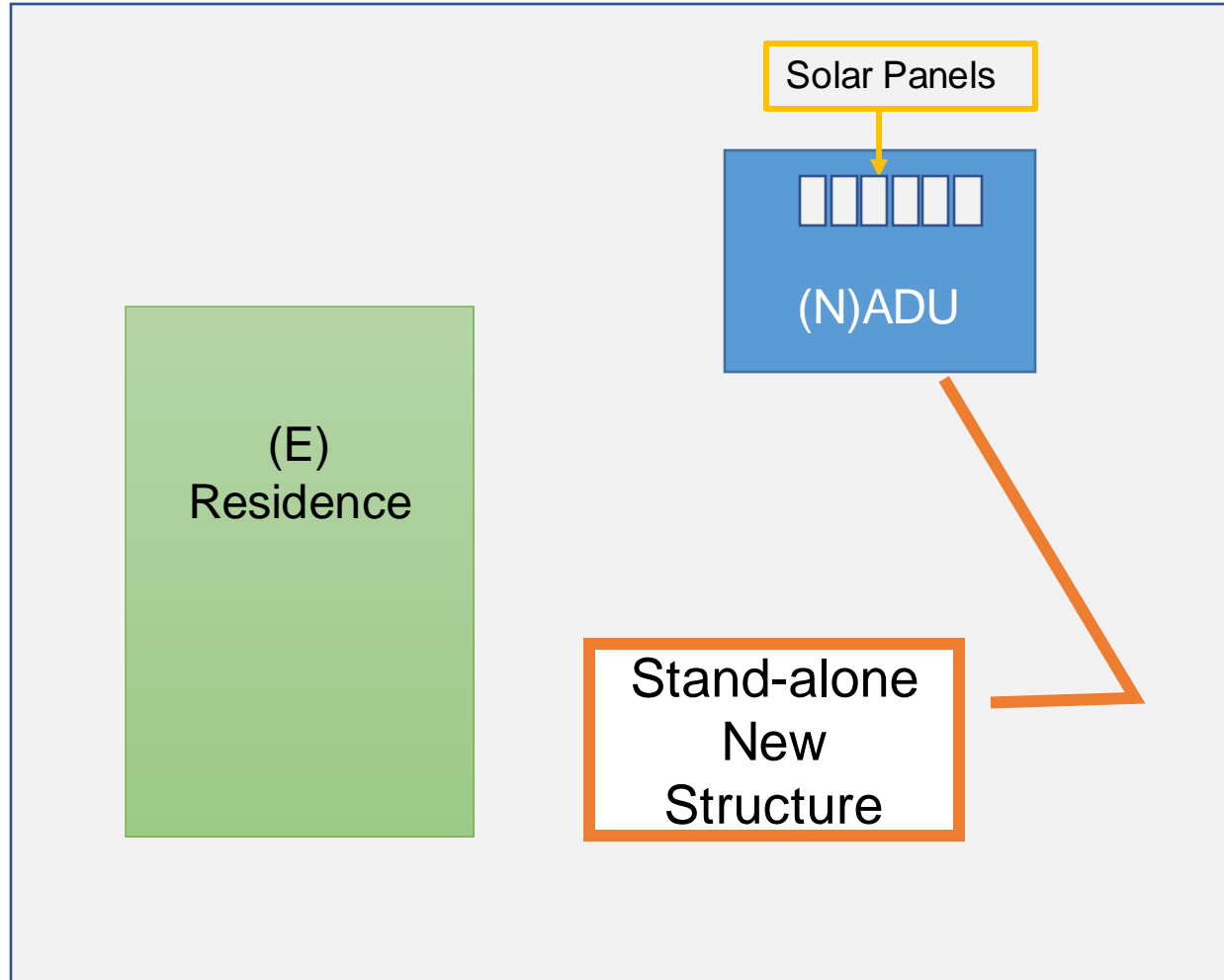


Image: City of Stockton, CA -- ADU Guide

Images: City of Saint Paul, MN



# New Construction: Stand Alone Structure under the Energy Code



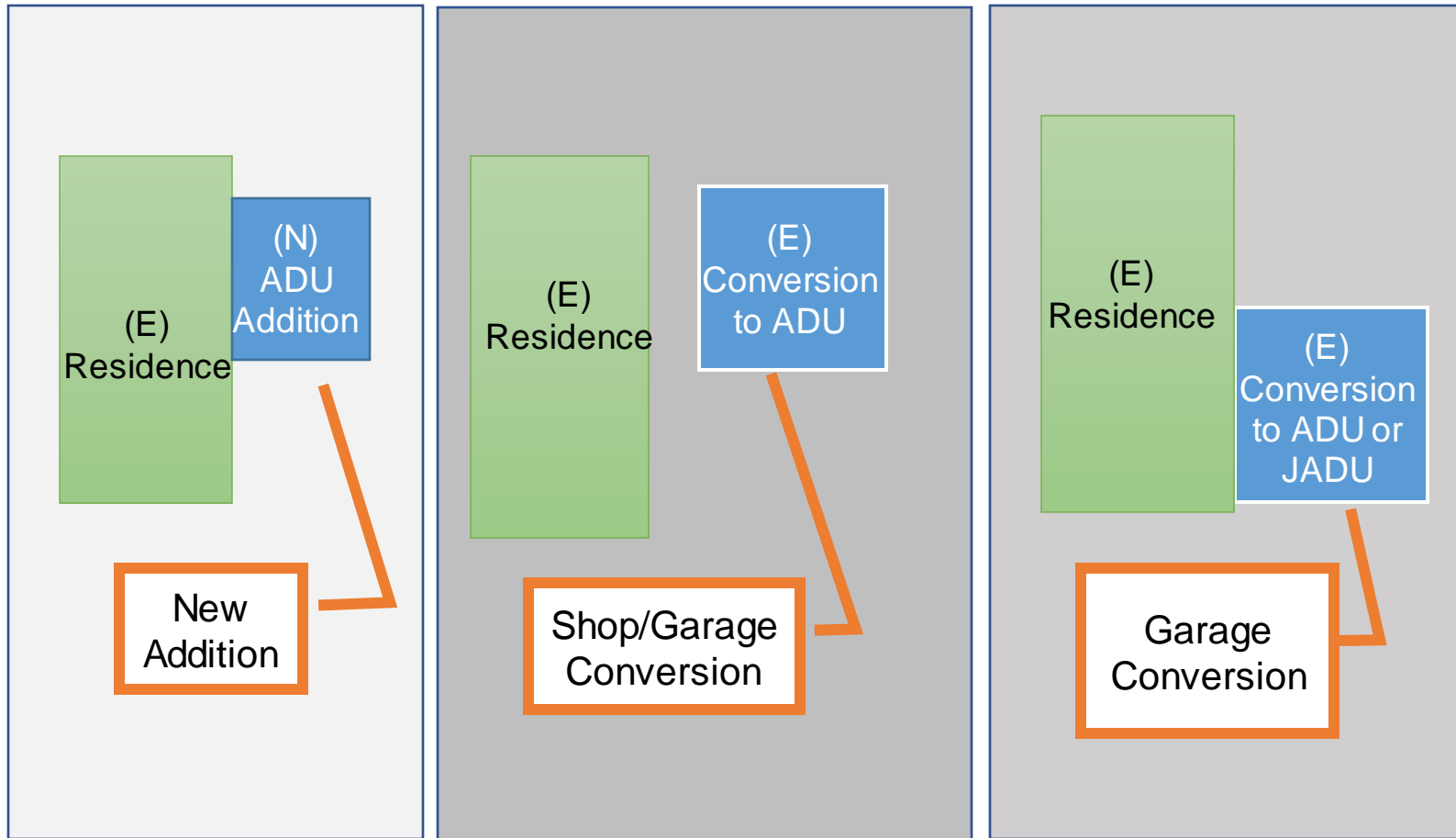
**New Construction –Detached**

## **Section 150.1 –New Construction – Low Rise Residential**

All subsections apply, including:

- Envelope (Walls, Roof, Floor, and Fenestration)
- Ventilation (IAQ –Indoor Air Quality),
- Mechanical Heating and Cooling
- DHW,
- Electric Ready
- Battery Storage Ready
- PV's (Solar Panels)

# Additions: Three Scenarios under the Energy Code



**Addition –Attached**

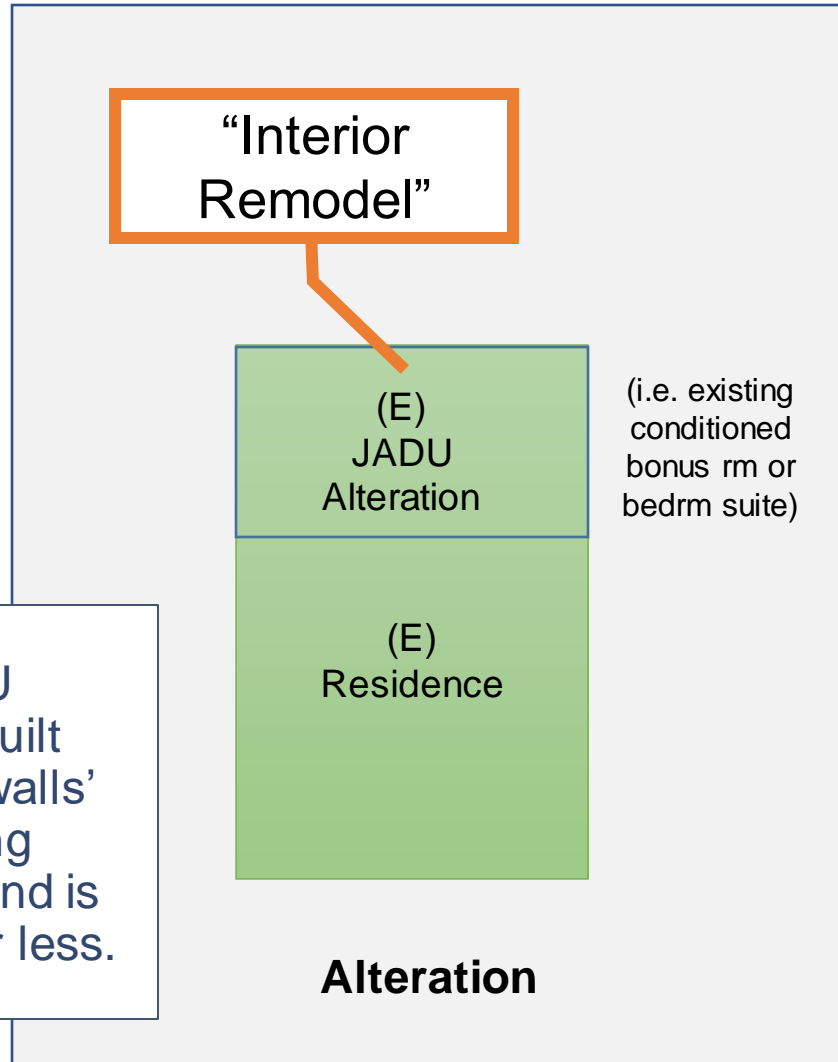
**Addition  
–Detached Conversion**

**Addition  
–Attached Conversion**

## Section 150.2(a) –Additions

- Envelope (Walls, Roof, Floor, and Fenestration)
  - Wall Exceptions
  - Roofing Exceptions
- Ventilation (IAQ –Indoor Air Quality)
  - Bathroom, Kitchens, Floor Area
- Mechanical Heating and Cooling
  - ADU or JADU
- DHW
  - Adding second water heater
  - HPWH Ready

# Alteration: Does *not* Increase Conditioned Floor Area under the Energy Code



\* Junior ADU (JADU) is built within the 'walls' of an existing residence and is 500 sf. ft. or less.

## Section 150.2(b) –Alterations

- Envelope (Walls, Roof, Floor, and Fenestration)
  - Wall Exceptions
  - Ceilings Alterations
- Ventilation (IAQ –Indoor Air Quality)
  - Bathroom, Kitchens, Floor Area
- Mechanical Heating and Cooling
  - Alterations and Duct Extensions
- DHW
  - Water Heater Replacement





# **NEW CONSTRUCTION –**

**PV (Solar Energy)**  
**Battery Ready**  
**Electric Ready**

# Solar Photovoltaic (PV) –New Construction

## Prescriptive PV Sizing:

Equation 150.1-C Annual Photovoltaic Electrical Output

$$\text{System Size kW}_{PV} = (\text{CFA} \times A) / 1000 + (N_{\text{dwell}} \times B)$$

Where:

$\text{kW}_{PV}$  = kW DC size of PV system

CFA = Conditioned Floor Area

A = CFA adjustment factor

$N_{\text{dwell}}$  = Number of dwelling units (1 single, 2 duplex)

B = Dwelling adjustment factor

CZ	A	B
4	0.586	1.21
5	0.585	1.06
6	<b>0.594</b>	<b>1.23</b>
9	0.613	1.36

### **Example: 1000 sf ADU in CZ 6**

$$\text{kW}_{pv} = (1000 \text{ sf} \times 0.594) / 1000 + 1(1.23) = 1.82 \text{ kW system}$$

$$1.82 \text{ kW} / 300 \text{ W panel} = 6 \text{ panels}$$

*[each panel approx. 40"x67"]*

## Exemptions:

- PV not required, when  $\text{kW}_{PV}$  is less than 1.8 kW
- PV not required, when SARA is less than 80 sf
- PV size may be reduced by 25% if a usable battery capacity of 7.5 kWh is installed

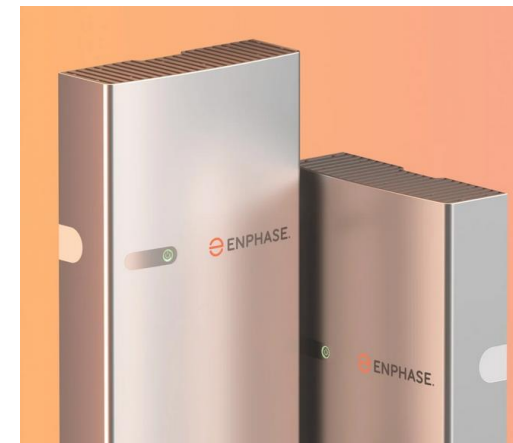


# Energy Storage System (ESS) - “Battery Ready”

- Applicable only to new construction
- Infrastructure is Mandatory
- Battery is an optional credit
- Performance pathway:
  - Min Battery Size of 5 kWh
  - Needs to interface with the ‘Grid’
  - Performance credit is relatively small
  - Battery with PV system can be cost effective

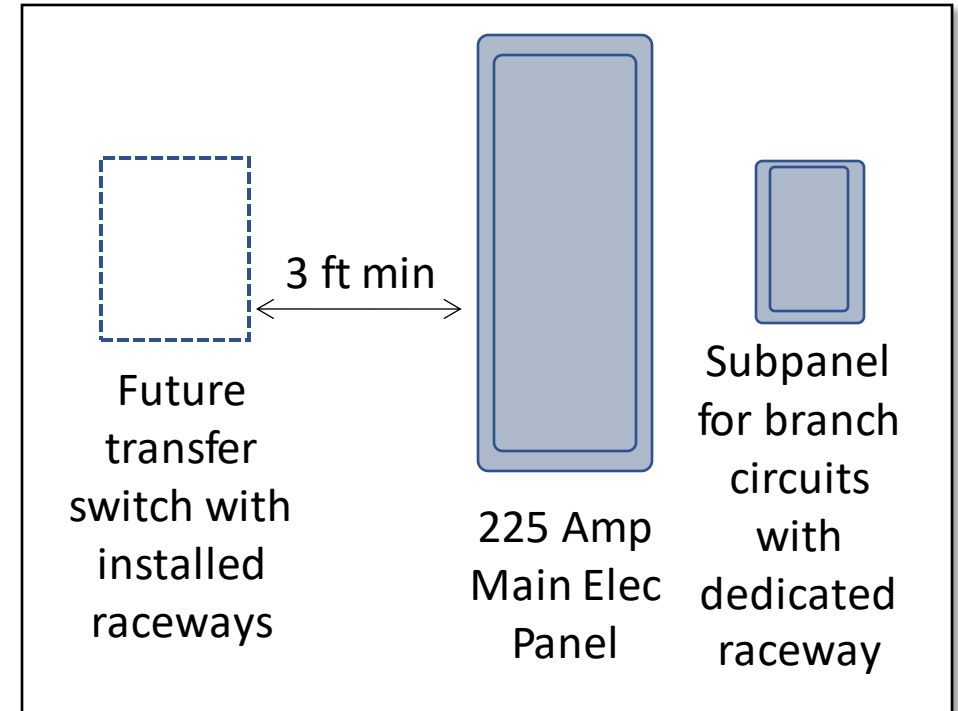
## Key Concept:

Intent is to increase a household’s electric generation and storage system to be able to offset evening **electrical grid** usage and address **resiliency**



# “Battery Ready” – Infrastructure Required

- At least **one** of the following required:
  - **Interconnection equipment** with minimum backed up capacity of 60 amps
  - **Dedicated raceway** (min 1”) from the main service to subpanel that supplies the branch circuits
- A **minimum of 4 branch circuits** shall be identified feeding:
  - **Refrigerator**
  - **One lighting** circuit near the primary egress
  - A **sleeping room receptacle** outlet
- Main panel must have busbar rating of **225 amps minimum**
- Sufficient space shall be reserved to **allow future installation** of a system **isolation equipment or transfer switch** within 3 feet of the main panelboard
- **Raceways** shall be installed between the panelboard and the system isolation equipment or transfer switch location to **allow the connection of backup power source**



# New Construction – 225 amp Busbar Rating



## Could a 200 amp panel meet the mandatory energy storage system (ESS) ready requirements in the 2022 Energy Code § 150.0(s)1B?

Yes. A 200 amp panel could meet the requirement if the busbar rating is 225 amps and it is clearly marked on the panel. However, if there is no specific busbar rating on the panel, the 200 amp panel will not meet the requirement, since the busbar rating will be the same as the panel rating. Panels must also meet applicable requirements in the California Electrical Code.

## Does an ADU need to have its own 225 amp panel if the ADU is built with a subpanel connected to the existing main residence?

No. The subpanel to the ADU from the main panel could meet § 150.0(s)1B, as long as the main panel has the 225 amp busbar rating.

## Does installing a battery storage system in a newly constructed single-family home meet the mandatory ESS ready requirements in § 150.0(s)?

Yes. If the newly built home's energy storage system meets all the necessary wiring and other electrical components required to support a fully operating energy storage system, this will satisfy the mandatory requirements in § 150.0(s).



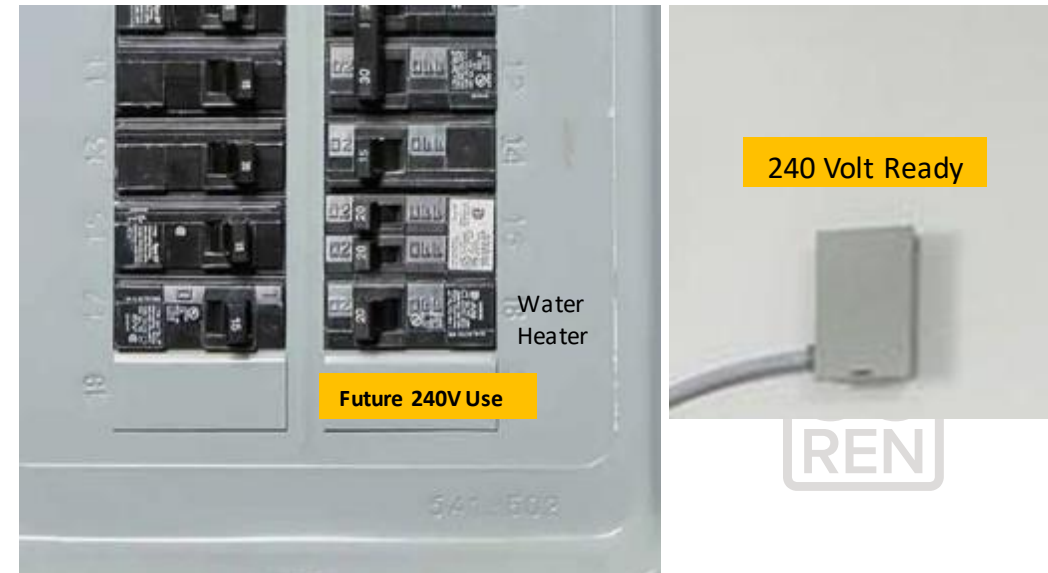
<https://www.energy.ca.gov/newsroom/blueprint-newsletter>



## “Electric Ready” Infrastructure Required *only where* propane or natural gas appliances are installed in new construction

- **Water heaters**: gas or propane water heaters must be installed in or adjacent to a space large enough for a heat pump water heater HPWH. (2.5' x 2.5' x 7') Must install 240v/20amp or 240v/30amp circuit depending on location - **150.0(n)**
- **Furnaces**: provide conductors rated at 240 volt/ 30 amp to the furnace for future heat pump installation- **150.0(t)**
- **Cooktops**: provide conductors rated at 240 volt/ 50 amp for future cooktop- **150.0(u)**
- **Dryers**: provide conductors rated at 240 volt/ 30 amp feed to dryer - **150.0(v)**

Electric ready items require breaker space and labeling in panel  
AND  
Electrical feed within 3 ft of non-electric appliance location





**NEW CONSTRUCTION –  
Walls and Fenestration**

**ADDITIONS –Wall Extensions**

**ALTERATIONS –  
Walls and Fenestration**

# Walls

TABLE 150.1-A COMPONENT PACKAGE – Single-Family Standard Building Design

Single-Family			Climate Zone																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
			Building Envelope Insulation																
Walls	Above Grade	Framed <sup>3</sup>	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.065	U 0.065	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	
		Mass Wall Interior <sup>4,5</sup>	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.059 R 17
		Mass Wall Exterior <sup>4,5</sup>	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0
	Below Grade	Below Grade Interior <sup>6</sup>	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.067 R 15
		Below Grade Exterior <sup>6</sup>	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19

3. Assembly U-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly U-factor equal to or less than the U-factor shown. Use [Reference Joint Appendices JA4](#) Table 4.3.1, 4.3.1(a), or Table 4.3.4 to determine alternative insulation products to be less than or equal to the required maximum U-factor.

4. Mass wall has a heat capacity greater than or equal to 7.0 Btu/h-ft<sup>2</sup>.

5. "Interior" denotes insulation installed on the inside surface of the wall. "Exterior" denotes insulation installed on the exterior surface of the wall.

6. Below grade "interior" denotes insulation installed on the inside surface of the wall, and below grade "exterior" denotes insulation installed on the outside surface of the wall.



# Walls Assemblies Meeting Prescriptive U-0.065 and U-0.048

**Table 3-10: Examples of Wood-Framed Wall Assemblies and U-Factors, Assuming Gypsum Board Interior**

Stud (16" oc)	Cavity Insulation	Cavity Insulation Type	Exterior Insulation	U-Factor
2x4	R15	High density batt	R4	0.065
2x4	R13	Open-cell spray foam (ocSPF)	R5	0.064
2x4	R15	High density batt	R8	0.050
2x6	R21	Loose-fill cellulose or high density batt	R4	0.051
2x6	R19	Low density batt	R5	0.051
2x6	R31	Closed-cell spray foam (ccSPF)	R2	0.049
2x6	R23	High density batt or mineral wool	R4	0.049
2x6	R21	Loose-fill cellulose or high density batt	R5	0.048
2x6	R19	Low density batt	R6	0.048
2x6	R23	High density bat or mineral wool	R5	0.047

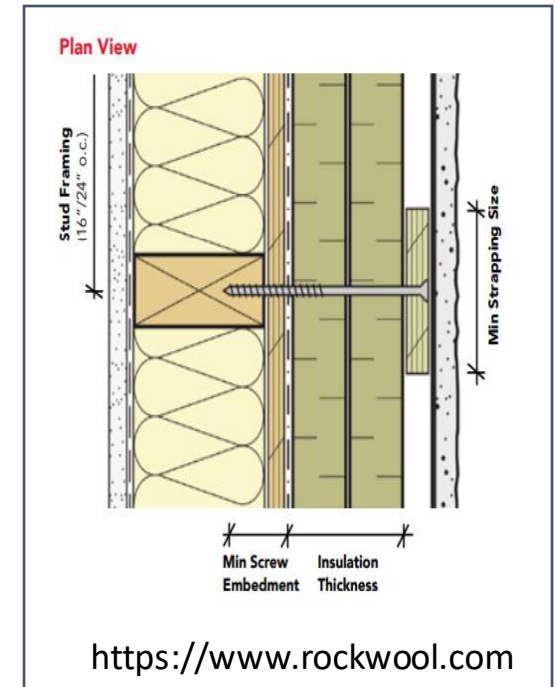
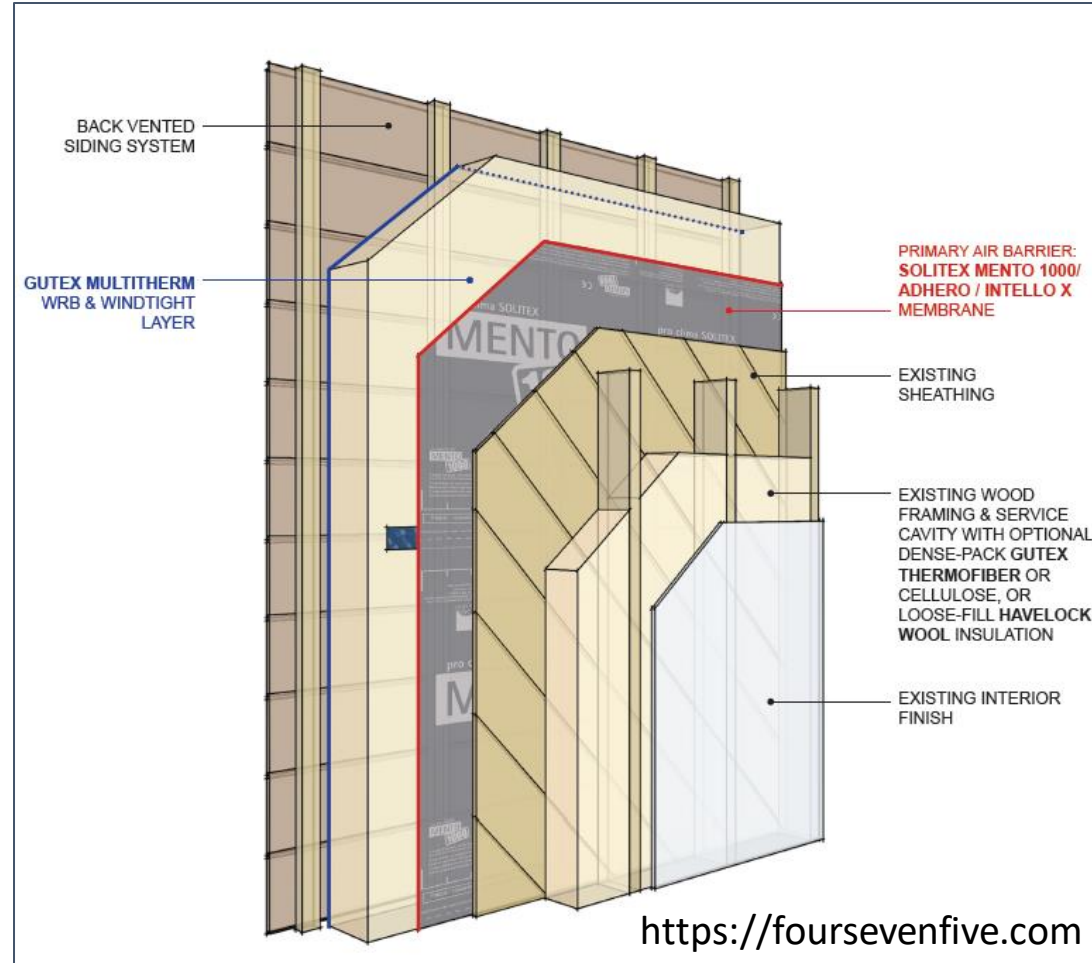
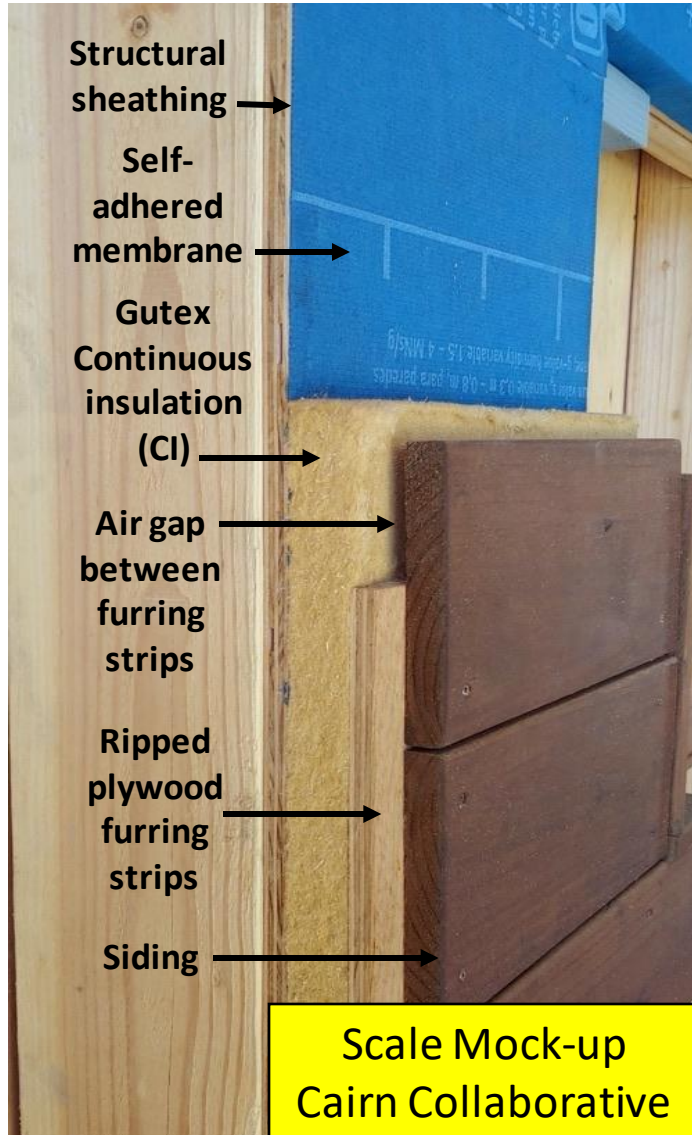
← CZ 6,7

← CZ 1-5  
CZ 8-16

*Note: Under the Performance Method projects will have to find trade-off credit to remove the CI.*



# Wall Assemblies with Continuous Insulation (CI)



Example of layered wall assembly looking from interior to exterior

# Fenestration and Doors

**TABLE 150.1-A COMPONENT PACKAGE – Single- Family Standard Building Design (continued)**

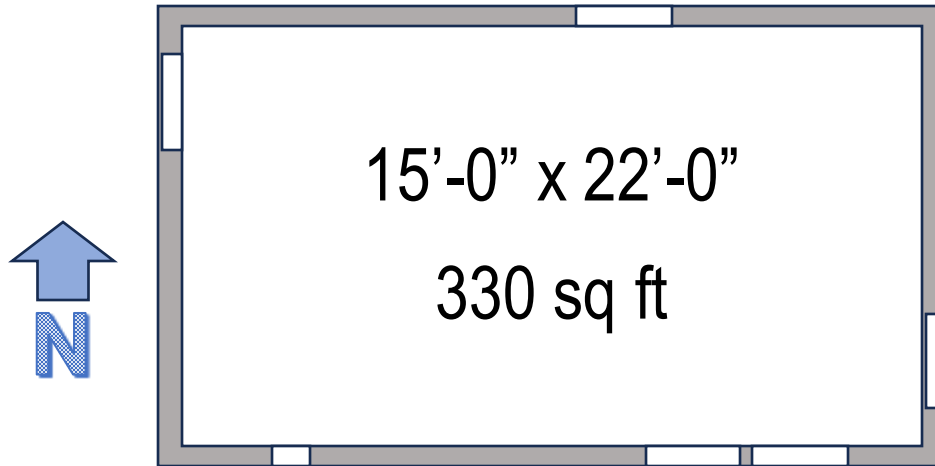
		Climate Zone															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fenestration	Maximum U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Maximum SHGC	NR	0.23	NR	0.23	NR	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	NR
	Maximum Total Area	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Maximum West Facing Area	NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
Door	Maximum U-factor	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

NR = Not Required

**Fenestration Ratio (%)** = Window Area to Conditioned Floor Area (CFA)



# Prescriptive Example for Window Area:



Example of Prescriptive Solution:

(3) 3.5x5 windows = 52.5 sq ft

(1) 3x3 window = 9 sq ft

(1) 3x1 window = 3 sq ft

(1) 1x1 window = 1 sq ft

Total Area = 65.5 sq ft

For all climate zones, 20% Win/Flr Ratio:

$330 \text{ sq ft} \times 20\% = \mathbf{66 \text{ sq ft total allowable}}$

For CZ 2, 4, and 6-15, up to 5% west-facing Win/Flr Ratio

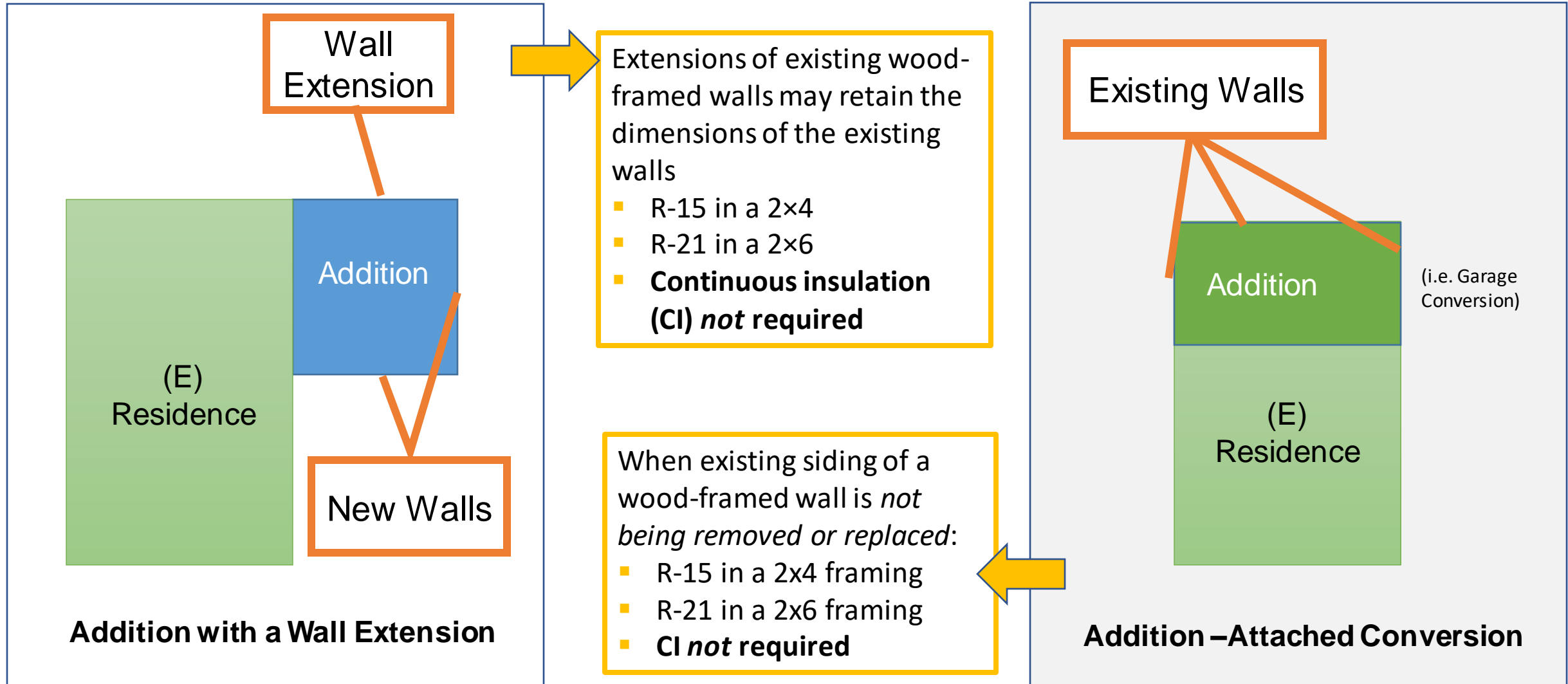
$330 \text{ sq ft} \times 5\% = \mathbf{16.5 \text{ sq ft west-facing allowable}}$

## Performance Method Trade-Offs:

Can use the Performance Method to gain more windows and/or avoid continuous insulation...



# Additions –Wall Extensions and Existing Framed Walls





# Wall Extension –Where a (N) Wall *aligns* with an (E) Wall

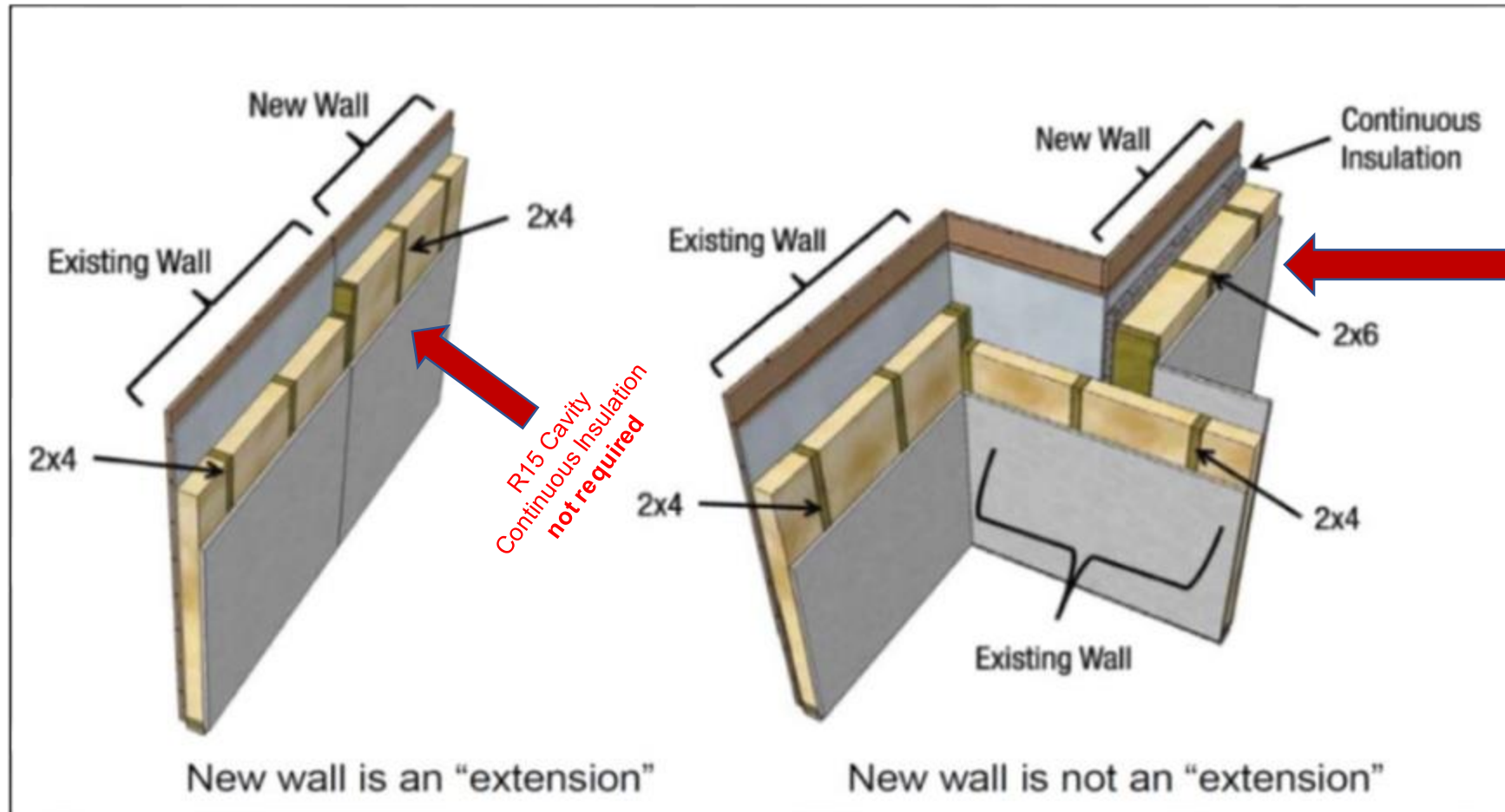


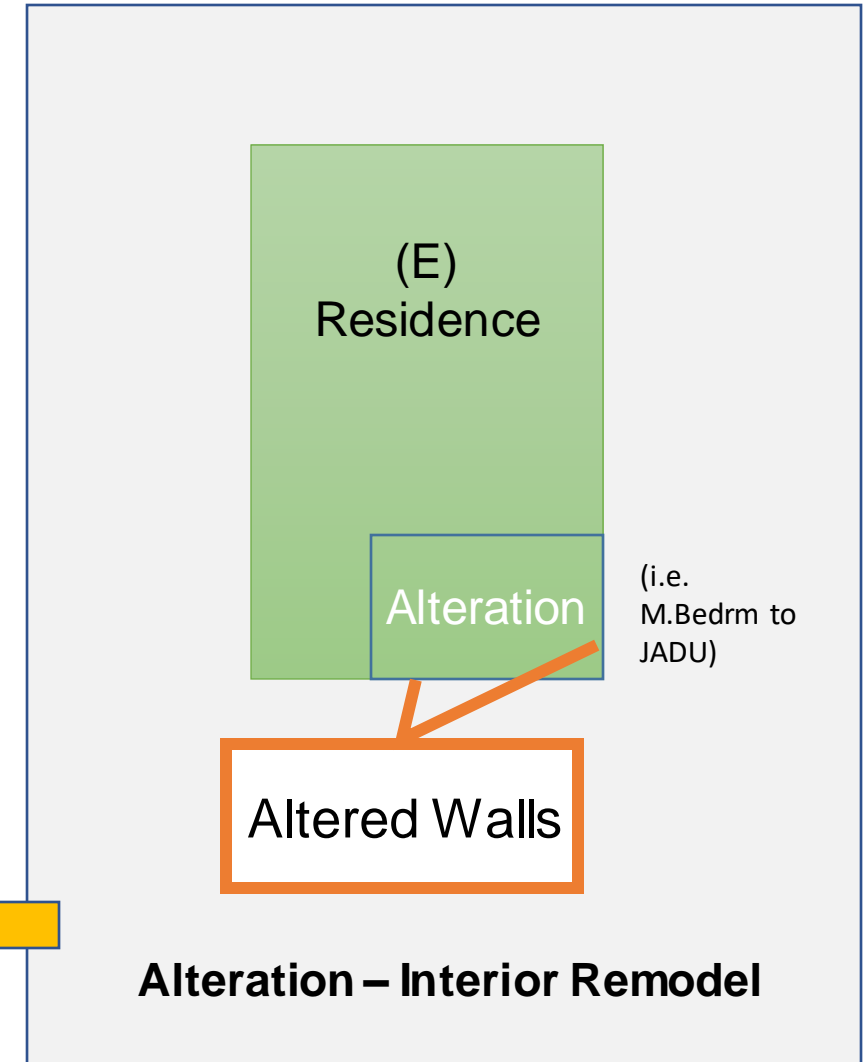
Image from CEC's BluePrint

Wall Extension: R-15 for 2x4 walls and R-21 for 2x6 walls



# Alterations – Existing Walls with Window Replacements

Fenestration (Windows and Skylights)	U-factor All CZ	SHGC CZ 2, 4, 6-15	SHGC CZ 1, 3, 5 & 16
Window Replacement 75 sq ft or less	0.40	0.35	NR
Skylight Replacement	0.55	0.30	0.30
Window Replacement > 75 sq ft or New Additional Fenestration	0.30	0.23	NR
Total Glazing as a % of Floor Area	20%		
West Facing Glazing	5%		NR



Existing Walls being Altered:

- R-13 in a 2x4 framing
- R-20 in a 2x6 framing



# Domestic Hot Water



## Water Heaters – Prescriptive

### New Construction:

- A **240V heat pump water heater\*** –CZ 2-15; additional requirements apply for CZ 1 and 16.
- A **120V HPWH** may be installed in place of a 240V HPWH for **new dwelling unit with 1 bedroom or less.**
- A **gas or propane instantaneous\*** water heater with an input of 200 kBtu/h or smaller –CZ 3, 4, 13 and 14



\*Allowable for Additions in any climate zone

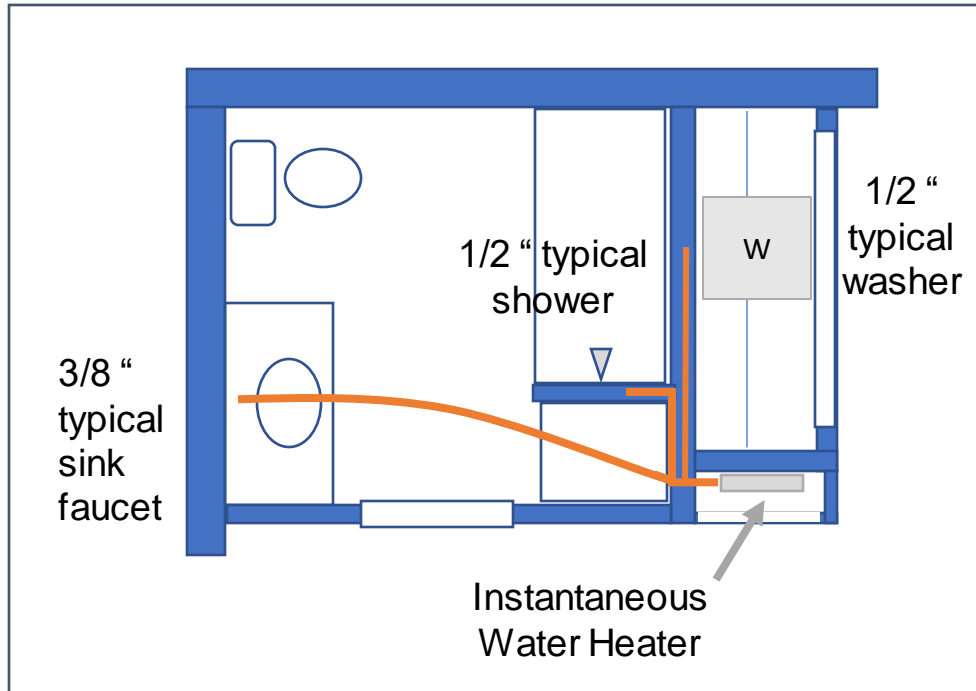
### New Construction and Additions

500 sq ft or less

- An **instantaneous electric water heater** with ***point of use distribution*** as specified in RA4.4.5 is allowable



# Point of Use (POU) – Requirement for ELEC TANKLESS



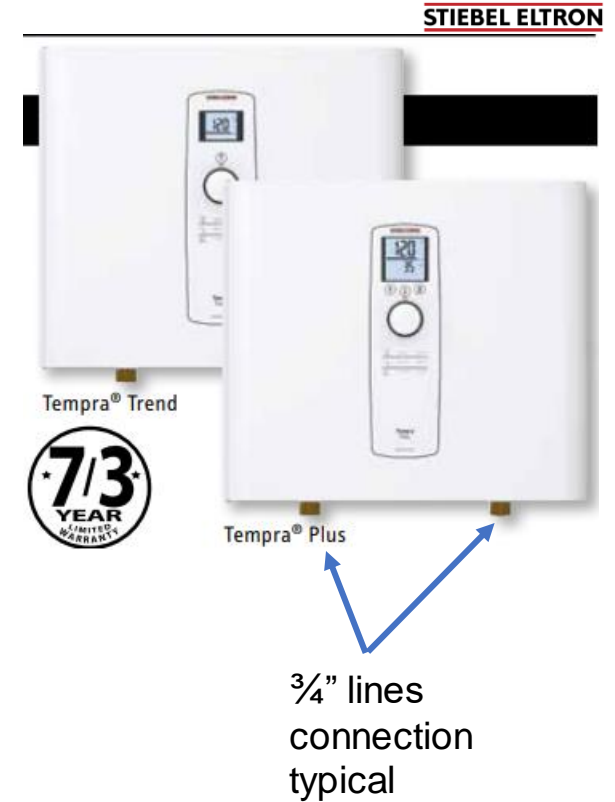
POU - Point of Use Distribution

Table 4.4.5

Size Nominal (Inch)	Length of Pipe (feet)
3/8"	15
1/2"	10
3/4"	5

Line size vs Length for each run

Take most direct path with truck-branch line. If two pipe sizes are used in a single run, half the length of pipe shall be considered for each pipe size.



# Performance Credit: With GAS or HEATPUMP Point of Use (POU) or Compact Plumbing

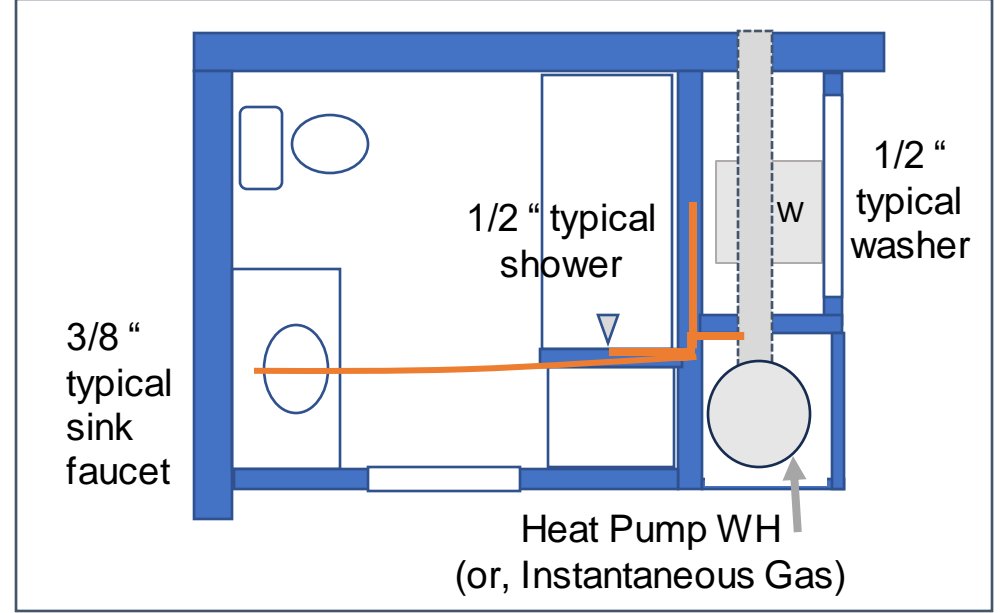
**HERS VERIFIED SINGLE DWELLING UNIT HOT WATER SYSTEM DISTRIBUTION**  
CALIFORNIA ENERGY COMMISSION CEC-CF3R-PLB-22-H

**HERS VERIFIED SINGLE DWELLING UNIT HOT WATER SYSTEM DISTRIBUTION**  
CALIFORNIA ENERGY COMMISSION CEC-CF3R-PLB-22-H

**SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS**

**M. Point of Use Requirements (POU) (RA4.4.5)**  
Systems that utilize this distribution type shall comply with these requirements.  
**The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.**

01	All hot water supply pipe run lengths are equal to or less than the maximum values shown below, based on the pipe diameter. If a combination of piping is used in a single run, then one half the allowed length of each size is the maximum installed length. The maximum allowed length of piping for the longest run terminating in:
	3/8 inch - For only one pipe size - max length allowed is 15 feet For combination pipe sizes the max allowed length of 3/8-inch piping is 7.5 feet, of 1/2 inch piping is 5 feet, and 3/4 inch piping is 2.5 feet.
	1/2 inch - For only one pipe size – max length allowed is 10 feet For combination pipe sizes the allowed length of 1/2-inch piping is 5 feet, and 3/4 inch piping is 2.5 feet.
	3/4 inch - For only one pipe size = 5 feet



**POU - Point of Use Distribution**

**Table 4.4.5**

Size Nominal (Inch)	Length of Pipe (feet)
3/8"	15
1/2"	10
3/4"	5

Line size vs Length for Each Run

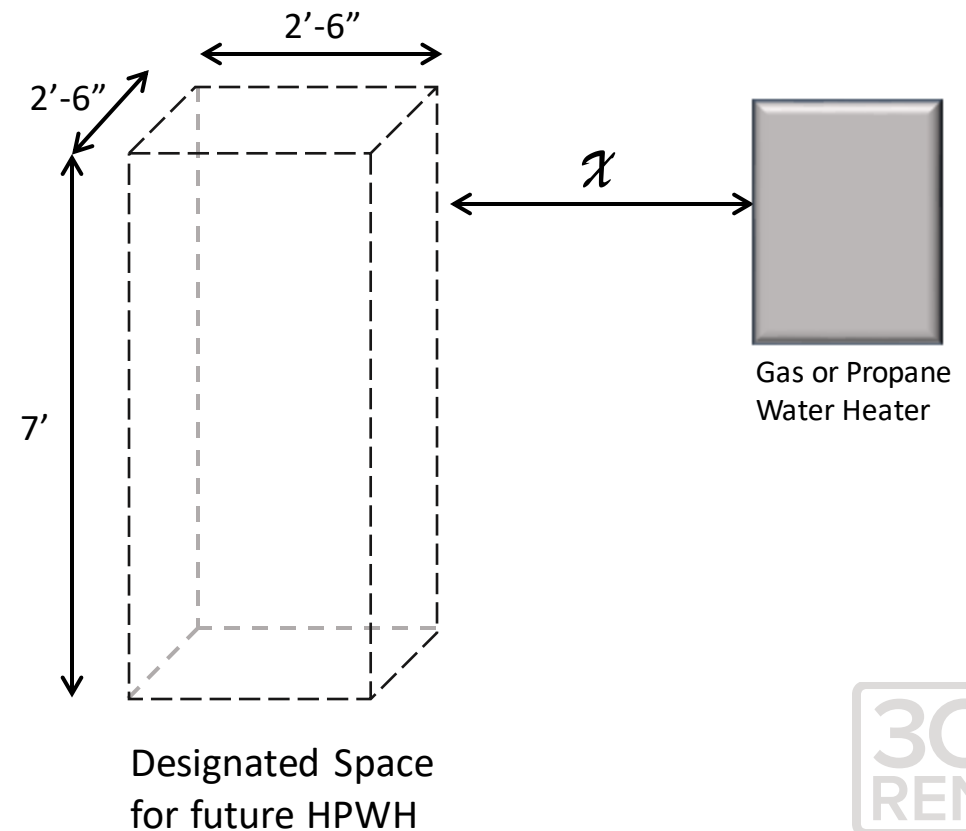


Piping must take the most direct path with truck-branch line.

# Heat Pump Water Heater (HPWH) Ready

—triggered when installing a gas or propane water heater in *new construction*

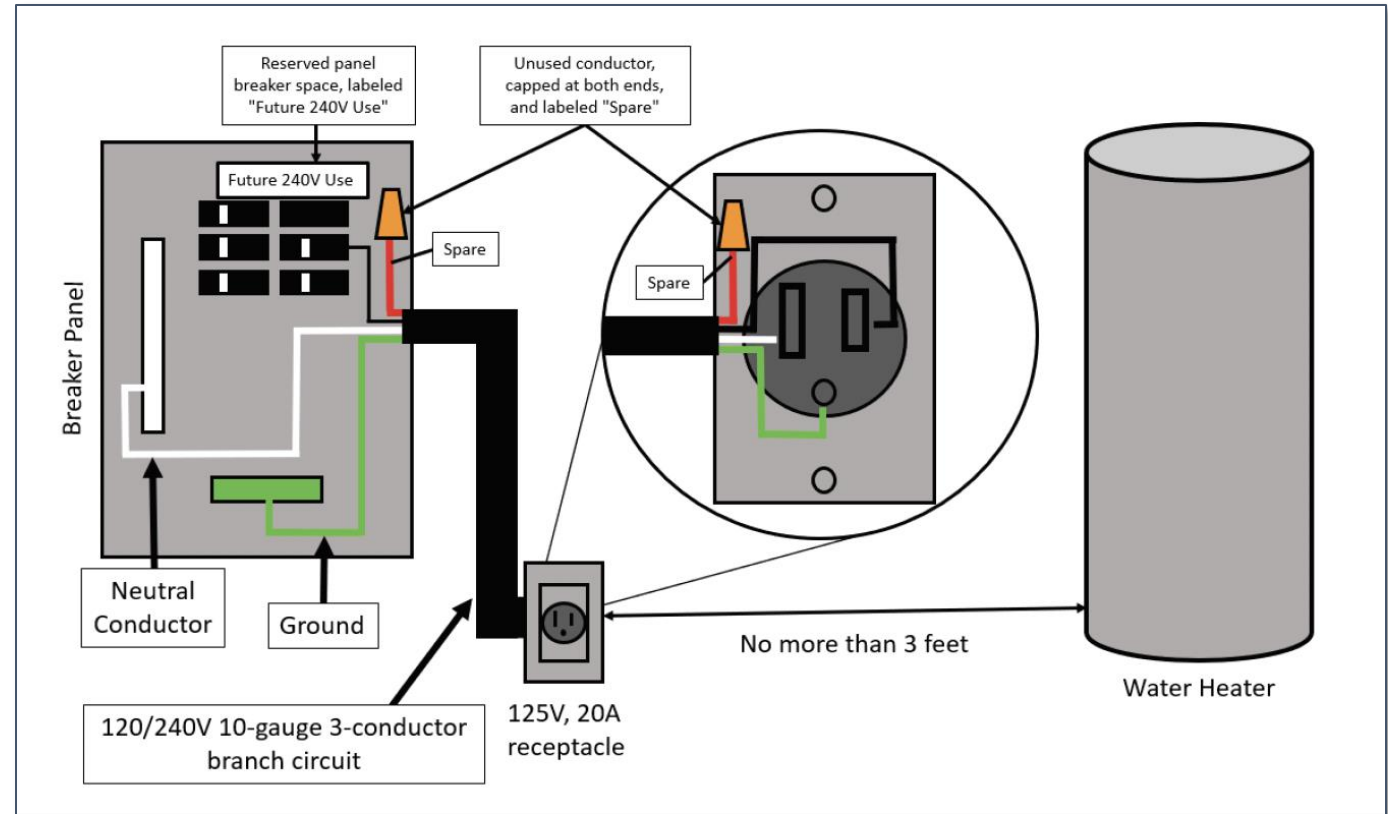
- Dedicated space for future HPWH: **30" x 30" x 7'**
- All electrical components shall be installed in accordance with the ***California Electrical Code***.
- Specific electrical and plumbing requirements depend on **relative location** to the gas or propane water heater:
  - Use option A when  $\chi$  is 3 ft or less
  - Use option B when  $\chi$  is greater than 3 ft



# Pre-Wired for Future HPWH – Option A

**A.** If the designated space is **within 3 feet from the water heater**, then this space shall include the following:

- i.** 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
- ii.** Both ends of the unused **conductor shall be labeled** with the word “spare” and be electrically isolated; and
- iii.** 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
- iv.** 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.



Credit: Blueprint, California Energy Commission, Issue120 Apr/June 2020

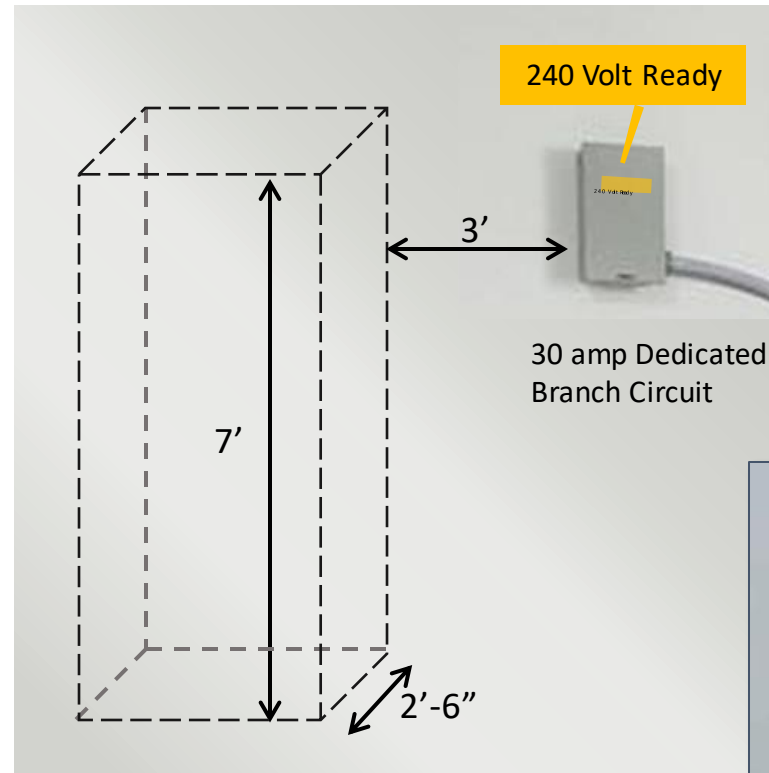
<https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center>



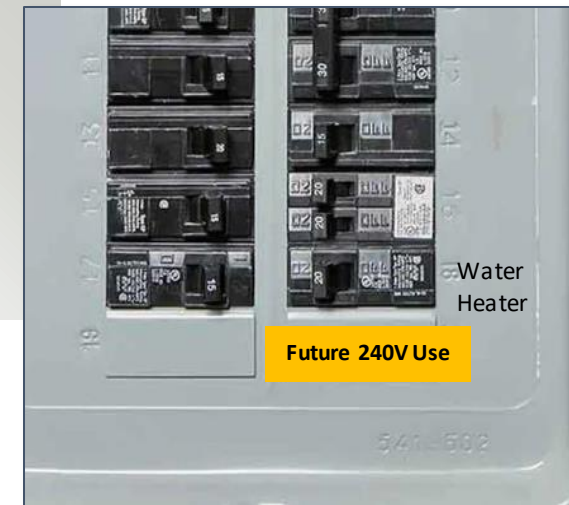
# Pre-Wired for Future HPWH – Option B

**B.** If the designated space is **more than 3 feet from the water heater**, then this space shall include the following:

- i. 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
- ii. 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
- iii. 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
- iv. 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
- v. The hot and cold water piping at the designated HPWH location shall be **exposed and readily accessible** for future installation of an HPWH
- vi. 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.



Designated Space for future HPWH

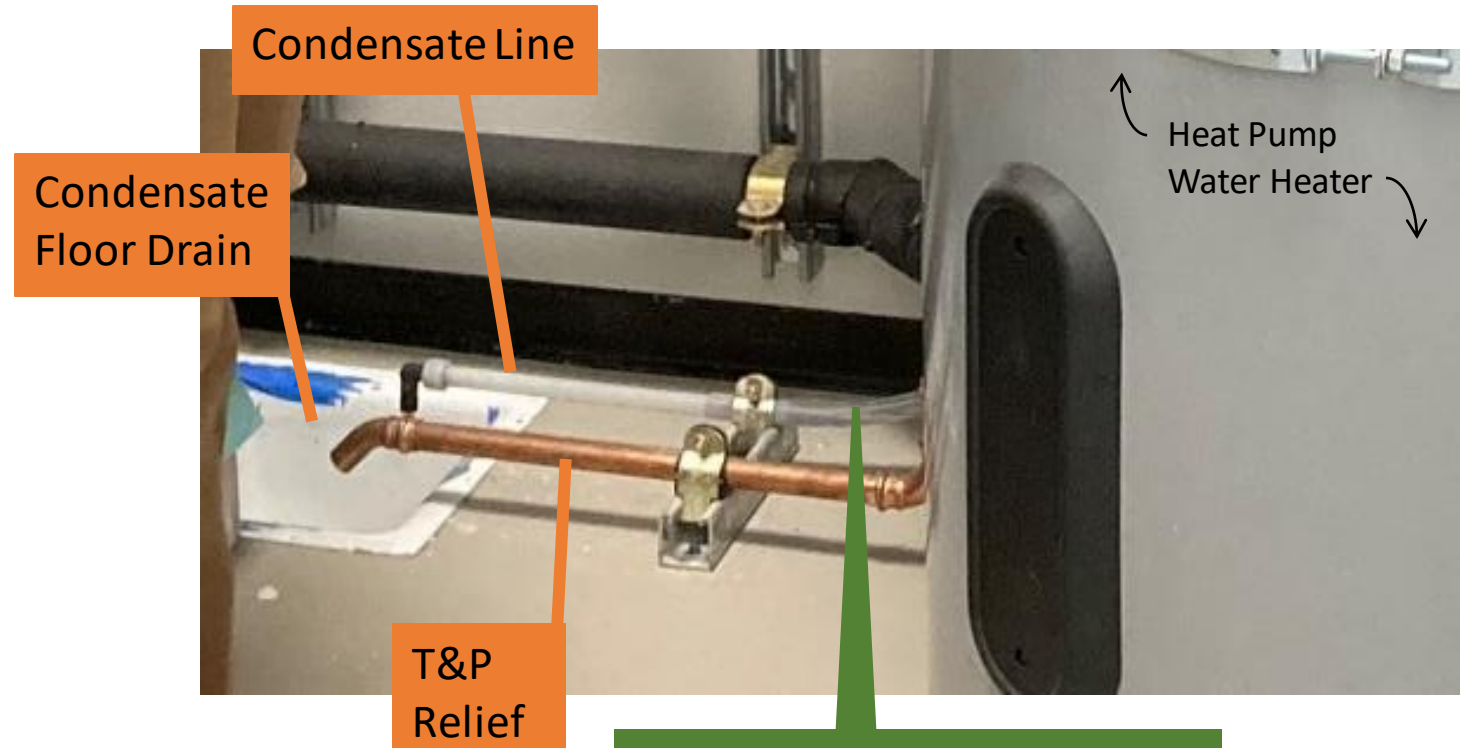


Main Panelboard

## Condensate Drain –Required Under Both Option A and B

### Additional Requirement:

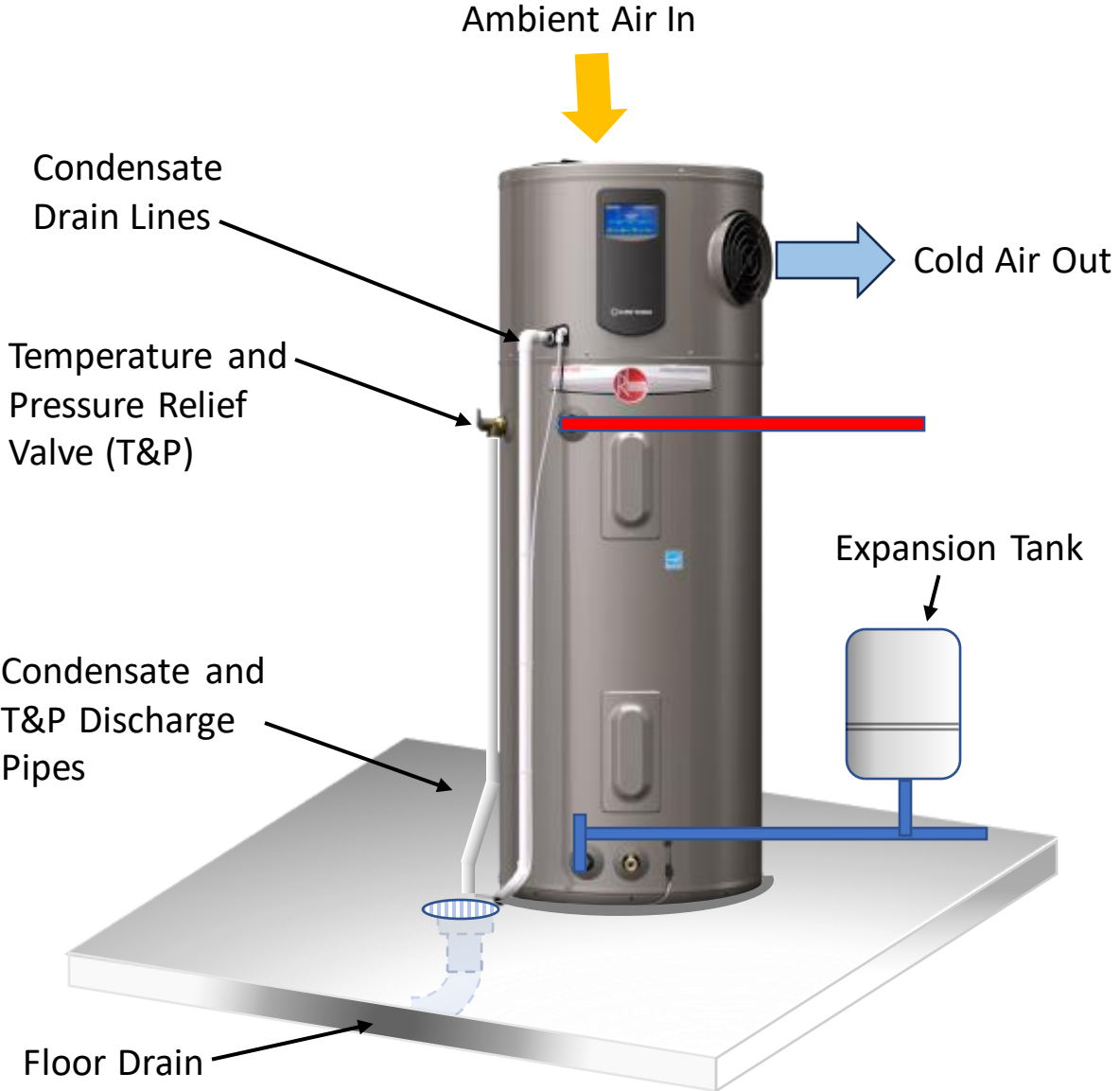
- **Under Option A.v. and B.vi.:** A **condensate drain** that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance.
- **Note:** The *condensate* is non-acidic. It is condensation from the surrounding air.



**Tip:** Use a portion of clear piping –easier to trouble shoot condensate drainage



# Integrated Heat Pump Water Heater (also known as a Hybrid Water Heater)

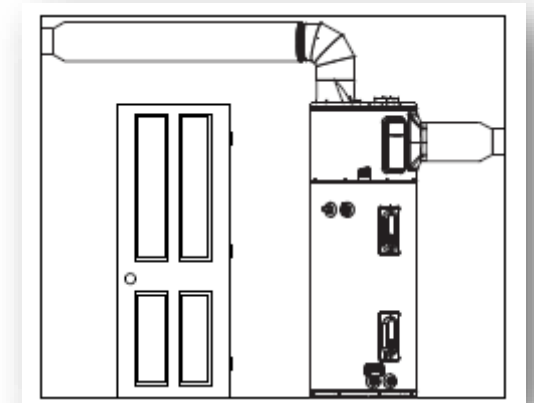


# Design Considerations – Integrated HPWH

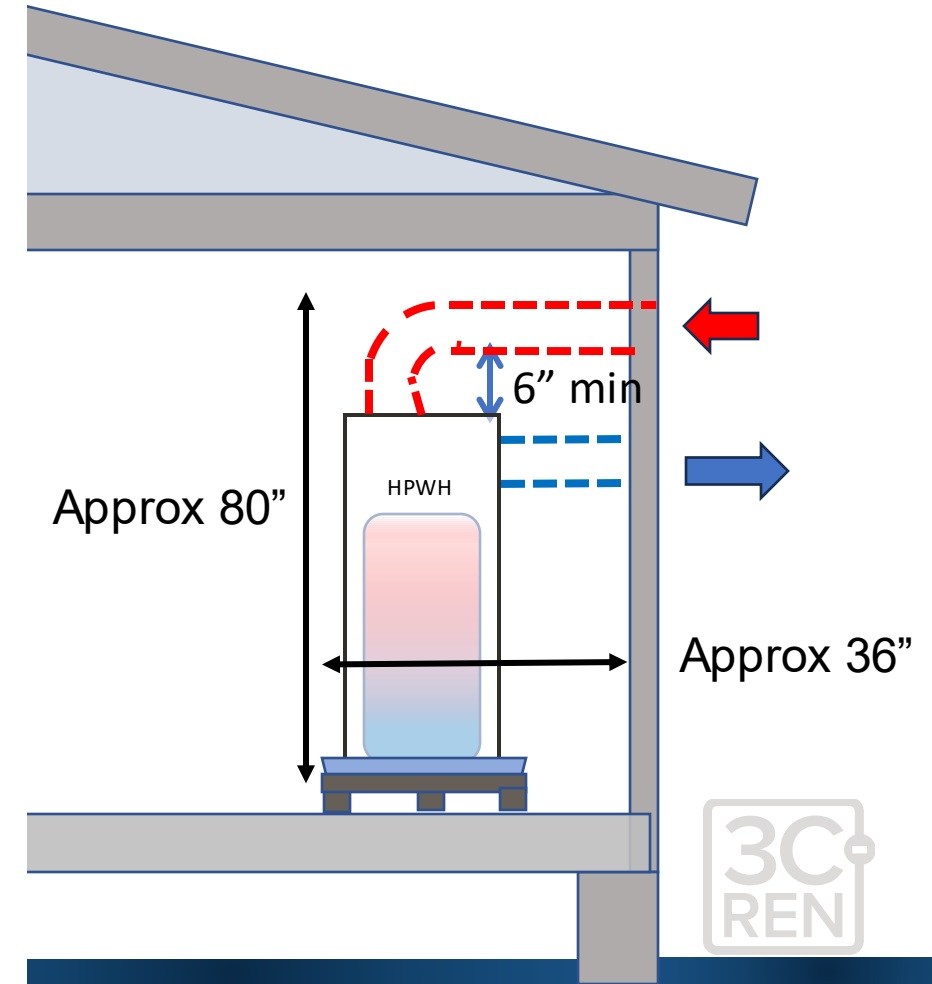
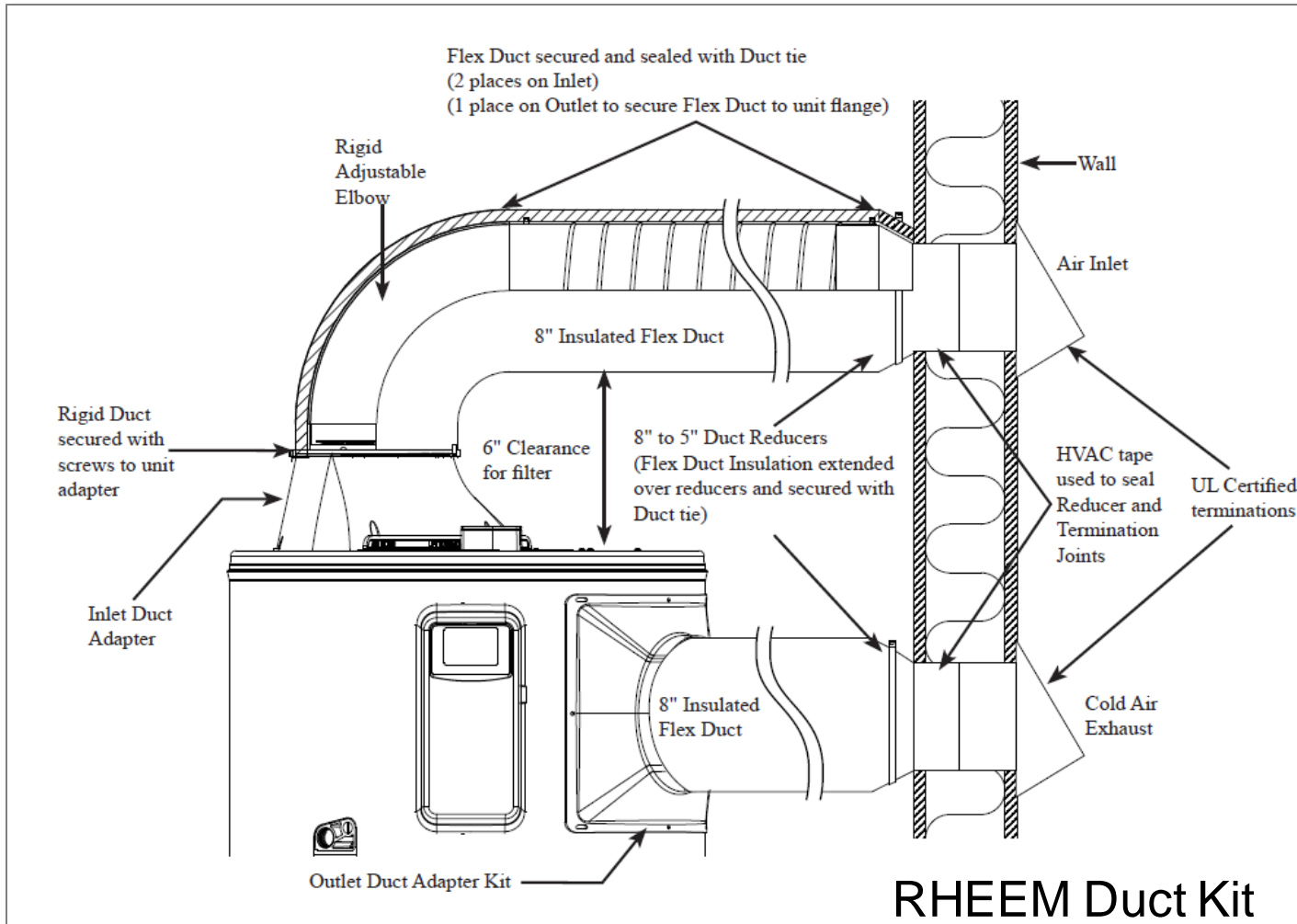


Image source: Silicon Valley Clean Energy

- Integrated HPWH tanks taller than standard gas or electric units
- Requires clearances on the sides, top and back, for air flow and access to the air filters
- Operating Temp between 45 F and 90 -110F
- Noise typically around 50 db
- System creates cold dehumidified air and condensate
- Needs 750 – 1000 cubic feet volume, or ducted vent kit



# Integrated HPWH shall be located indoors or in the garage [...small homes need an indoor ducted solution]

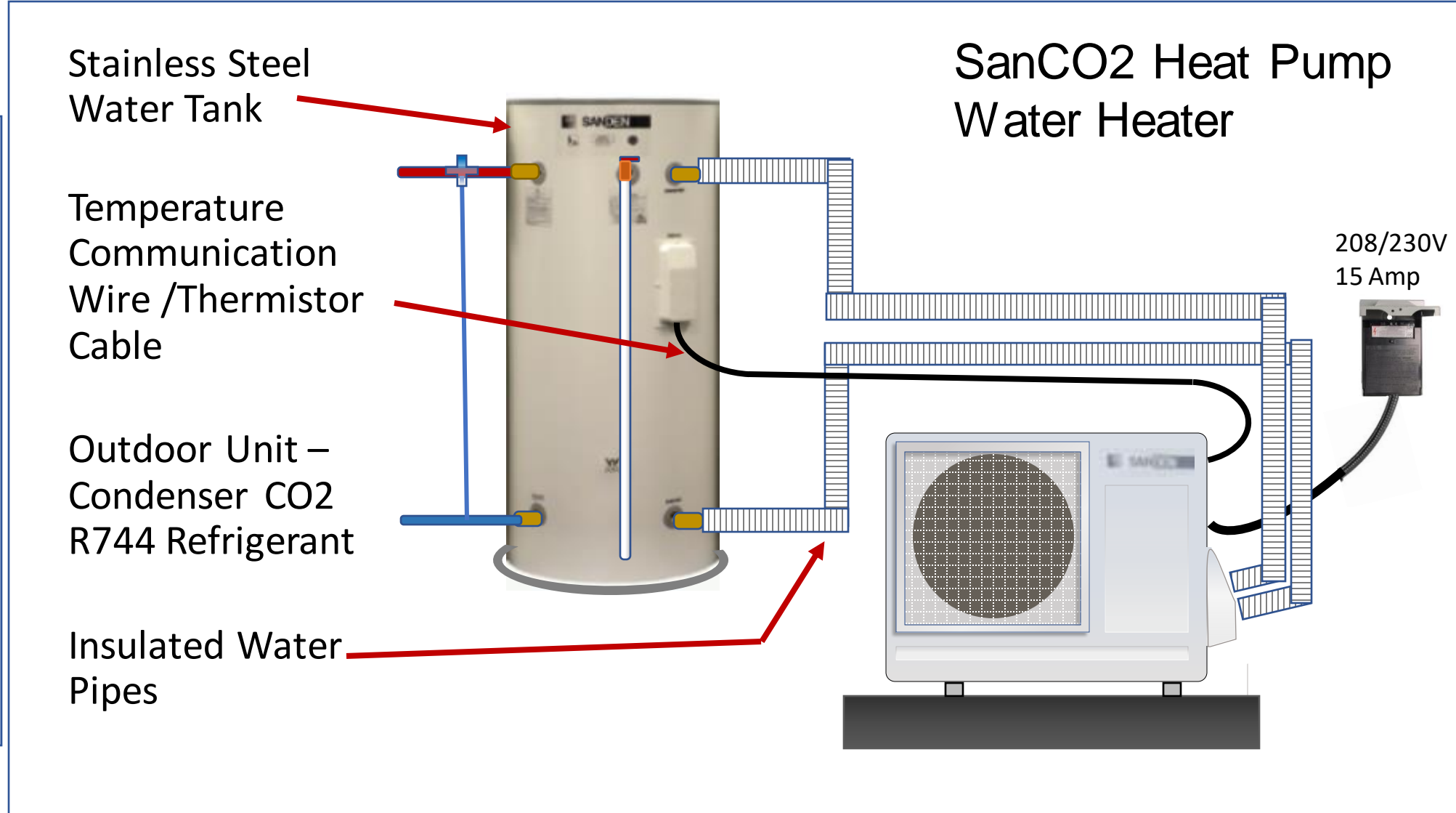


# Tank shall be located indoors, and the condenser outdoors

## Under Stair Installation



eco2waterheater.com





# Heat Pumps for Space Conditioning and the VCHP Credit

# Additions – both JADU's and Attached ADU's

**Space heating system:** New or replacement space heating system serving an addition may be a **heat pump** or **gas heating** system.

Indoor Unit Wall Mount



One to one heat pump with programable thermostat



Outdoor Unit / Condenser



**Reminder:** For New Construction (CZ 3, 4, 13, and 14) heat pumps (HP) for space heating are Prescriptively required, but under the Performance pathway HP and/or Gas Furnaces are allowable.

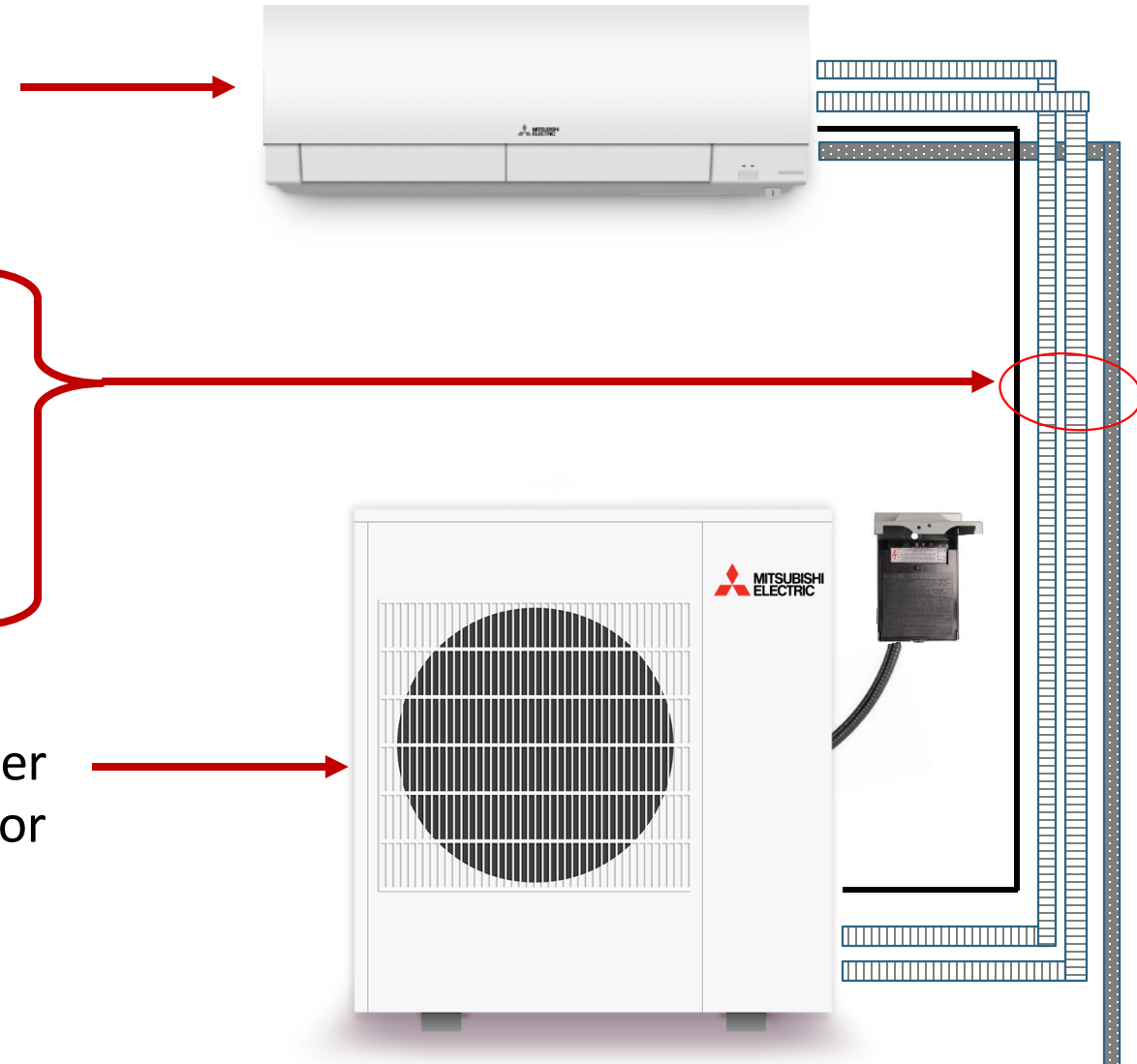


# Ductless 'Mini-Split' Heat Pump with Variable Capacity

Indoor Unit –Head with multi-speed fan controls

- Line Set Pair/Piping –Insulated Copper Refrigerant Tubing
- Condensate Line –Drain Hose
- Power Cord –Connecting to the Indoor Unit (aka Communication Wire)

Outdoor Unit –Compressor/Condenser  
Includes electronic expansion valve for variable refrigerant flow and multi-speed compressor and fan



Note: Can typically have four indoor units per each outdoor unit.

## Important Reminders – Heating and Cooling for ADU's

- ADU's may ***not share return air with the primary dwelling*** through the heating or cooling system.
- **Separate thermostats** are required



### Mini-Split Raised Floor Example

- Mini-Split system heat pumps can offer a straight forward solution
- Condenser can be ground or wall mounted
- One condenser can be shared by the main dwelling and the ADU
- Each dwelling has its own indoor unit and thermostat



Line Set

# Variable Capacity Heat Pump (VCHP) Compliance Option – High Credit, Required Special Features and HERS Triggered

## CF1R-PRF-01-E

### REQUIRED SPECIAL FEATURES

The following are features that must be installed as condition for meeting the modeled energy performance for this computer analysis.

- Variable capacity heat pump compliance option (verification details from VCHP Staff report, Appendix B, and RA3)
  - Compact distribution system basic credit
  - Northwest Energy Efficiency Alliance (NEEA) rated heat pump water heater; specific brand/model, or equivalent, must be installed

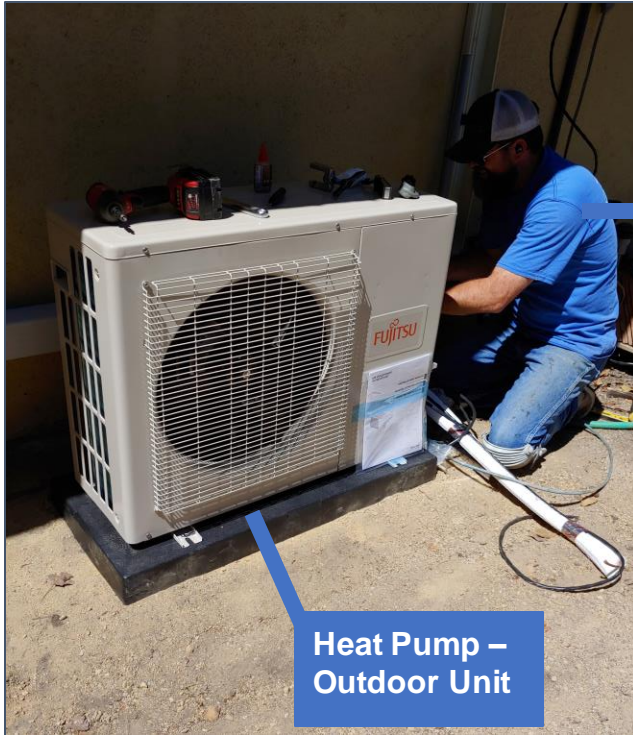
### HERS FEATURE SUMMARY

The following is a summary of the features that must be field-verified by a certified HERS Rater as a condition for meeting the modeled energy performance for this computer analysis. Additional detail is provided in the building tables below. Registered CF2Rs and CF3Rs are required to be completed in the HERS Registry

- Quality insulation installation (QII)
- Indoor air quality ventilation
- Kitchen range hood
- Verified EER/EER2
- Verified SEER/SEER2
- Verified Refrigerant Charge
- Airflow in habitable rooms (SC3.1.4.1.7)
- Verified HSPF2
- Verified heat pump rated heating capacity
- Wall-mounted thermostat in zones greater than 150 ft<sup>2</sup> (SC3.4.5)
- Ductless indoor units located entirely in conditioned space (SC3.1.4.1.8)

# Heat Pumps Installation and HERS

Best time to verify refrigerant charge and equipment capacity, efficiency, etc. is during the installation



Installing Contractor

Heat Pump –  
Outdoor Unit



Specs in the Box  
Needed by HERS Rater



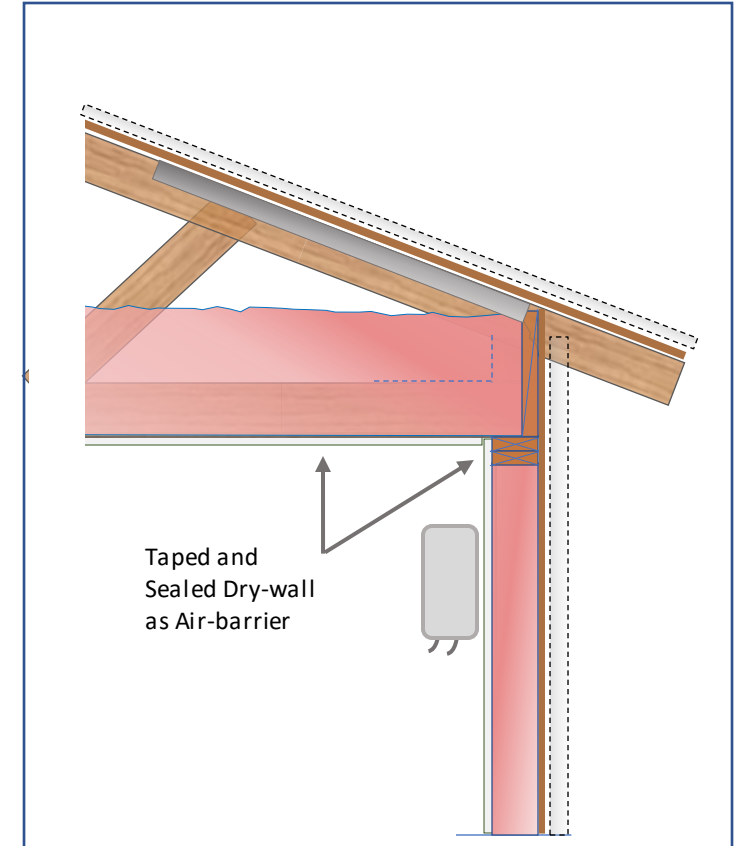
Refrigerant Line Set

Indoor units shall be installed within the air and thermal boundaries, with air flow to each habitable room, i.e. ea bedrm and living area; wall thermostats required in zones larger than 150 sq ft..

Wall and Ceiling Penetrations for the Mechanical System Refrigerant, Condensate, and Communication Lines need to be Air Sealed.



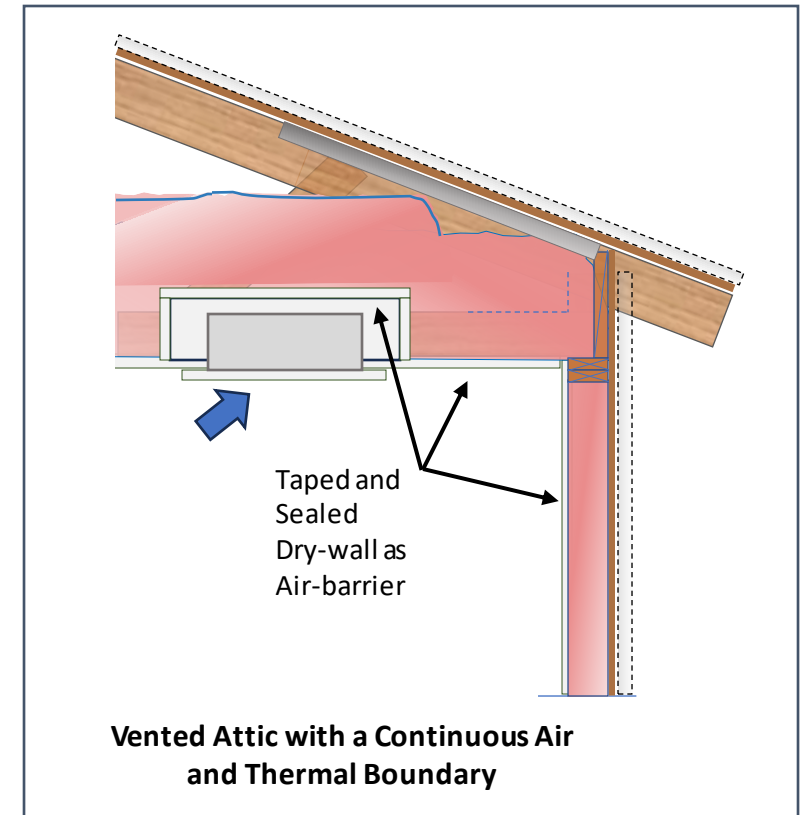
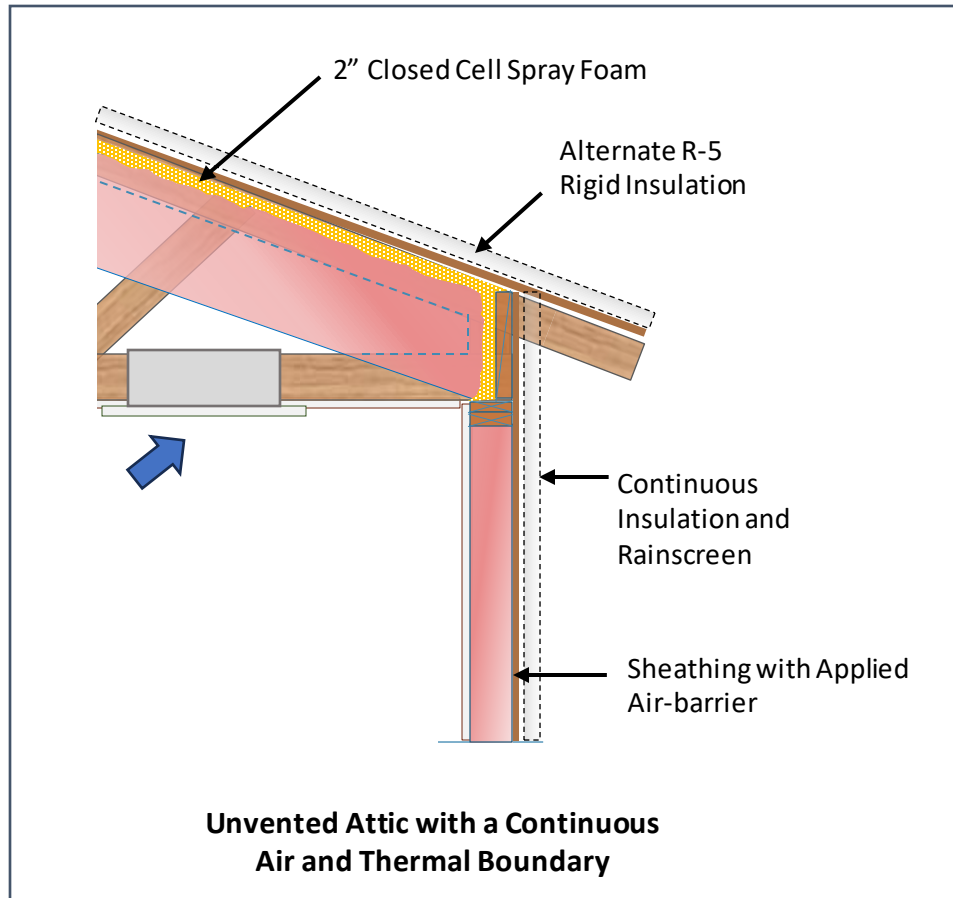
Ductless Wall Mount



Vented Attic with a Continuous Air and Thermal Boundary

# VCHP Compliance Credit Impacts the Envelope Enclosure

Indoor units shall be installed within the air and thermal boundaries





# Indoor Air Quality Ventilation



# Ventilation –Indoor Air Quality (IAQ)

ASHRAE 62.2 continues to be the basis for Section 150.0(o):

- Quantity of outside air (OA) ventilation,
- Allowable methods of meeting the OA ventilation; and
- Field verification of IAQ system(s)

## Section 150.0(o)

- Kitchen Hood Exhaust
- Bathroom Exhaust
- Outside Air (OA)
  - Mechanically Induced
  - Infiltration

For New Construction and Additions greater than 1,000 ft<sup>2</sup>





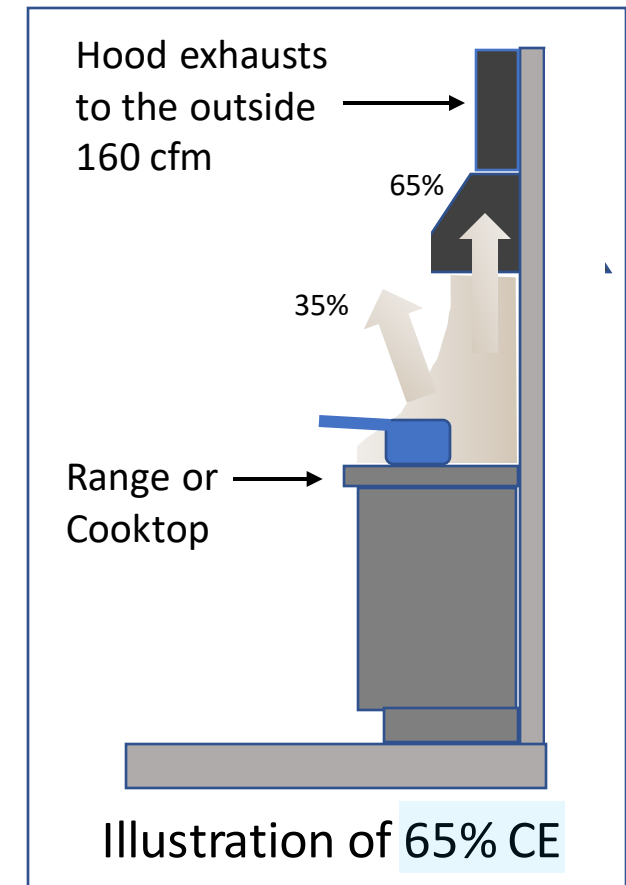
# Kitchen –Range Hood

*Table 150.0-G Kitchen Range Hood Airflow Rates (cfm) and ASTM E3087 Capture Efficiency (CE) Ratings  
According to Dwelling Unit Floor Area and Kitchen Range Fuel Type*

<u>Dwelling Unit Floor Area (ft<sup>2</sup>)</u>	<u>Hood Over Electric Range</u>	<u>Hood Over Natural Gas Range</u>
<u>&gt;1500</u>	<u>50% CE or 110 cfm</u>	<u>70% CE or 180 cfm</u>
<u>&gt;1000 - 1500</u>	<u>50% CE or 110 cfm</u>	<u>80% CE or 250 cfm</u>
<u>750 - 1000</u>	<u>55% CE or 130 cfm</u>	<u>85% CE or 280 cfm</u>
<u>&lt;750</u>	<u>65% CE or 160 cfm</u>	<u>85% CE or 280 cfm</u>

**Note:**  
In this example, a hood CE of 65% or 160 cfm minimum airflow would comply for only electric ranges.

Other exhaust fans, such as downflow, shall be 300 cfm or 5 ACH for enclosed kitchens



## Mechanical Exhaust –Kitchen

- Installer to **field test** with air flow hood/grid, or
- Follow **Table 150.0-H Prescriptive** Ventilation System Duct Sizing (ASHRAE 62.2 Table 5-3)
  - Total duct length is  $\leq 25$  ft
  - Duct system has no more than 3 elbows
  - Duct system has exterior termination fitting



### Key Take Aways:

- Applies to new or complete replacement of kitchen hood and ducting,
- Field test exhaust ducts or follow Prescriptive design,
- Kitchen range hood - HERS field verification required,
- **Exception:** Alteration that only replaces the hood and does not alter, add or replace the existing ductwork.

## Requirements for Ventilation Indoor Air Quality (IAQ)

This equation is for calculating the  
'Total required ventilation rate' for the dwelling:

$$Q_{\text{total}} = 0.03A_{\text{floor}} + 7.5(N_{\text{br}} + 1)$$

Where:

$Q_{\text{total}}$  = Total required ventilation rate (CFM)

$A_{\text{floor}}$  = Conditioned floor area in square feet (ft<sup>2</sup>)

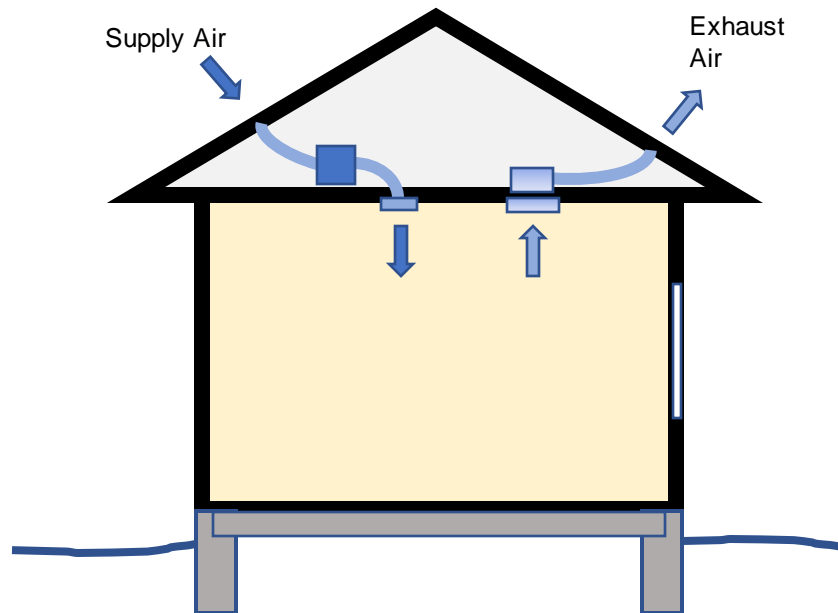
$N_{\text{br}}$  = Number of bedrooms (not fewer than one)

This equation can be a good *estimate* for the required IAQ Ventilation. The calculated required IAQ Ventilation is also dependent on several infiltration rate equations, which can lower the required IAQ Ventilation rate overall.

Required IAQ is based on the total required ventilation rate for the dwelling minus the calculated annually averaged infiltration rate.

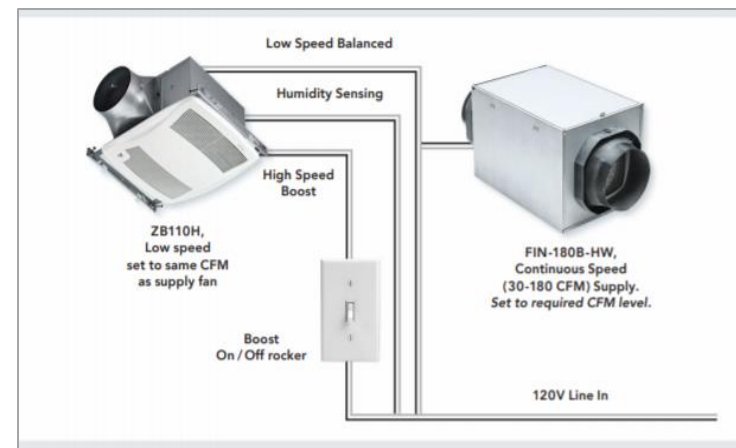


# Balance Ventilation



**Balanced Ventilation**

- Avoid uncontrolled air infiltration and/or exfiltration, i.e. leaky envelope
- Does *not* depend on construction assemblies that leak
- Air-Leakage Sealing is a Mandatory Requirement
- HERS Quality Insulation Installation (QII) – includes visual confirmation of air sealing – is now a Prescriptive Requirement

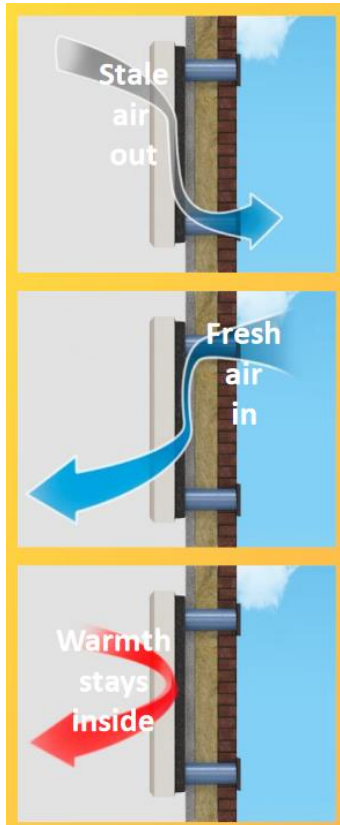


<https://www.broan-nutone.com/>



# Balanced Ventilation with Heat Recovery

## Through the Wall without Ducting



Fresh-r



Lunos

TwinFresh



TwinFresh Comfo RA1-50-2

## Ceiling Recessed with 3" Ducts



Panasonic ERV



# Performance Credit: Balance Ventilation with Heat/Energy Recovery

- Must be HVI Certified. See Products Directory [www.HVI.org](http://www.HVI.org)

**Indoor Air Quality and Mechanical Ventilation**  
CALIFORNIA ENERGY COMMISSION CEC-CF3R-MCH-27-H

**Indoor Air Quality and Mechanical Ventilation**  
CALIFORNIA ENERGY COMMISSION CEC-CF3R-MCH-27-H  
**SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS**

**C. Ventilation - Total Ventilation Rate**  
A mechanical supply system, exhaust system, or combination thereof shall provide whole-dwelling ventilation with outdoor air each hour at no less than the rate in 150.0(o)1Ci

01	Total Required Ventilation rate, ( $Q_{tot}$ )	
02	Enclosure Leakage Rate ( $Q_{50}$ )	
03	Effective Annual Average Infiltration Rate ( $Q_{inf}$ )	
04	Total Exterior Envelope Surface Area	
05	Unshared Exterior Envelope Surface Area (exclude surface areas attached to garages or other dwelling units)	
06	Required Mechanical Ventilation Rate ( $Q_{fan}$ )	

**D. Installed Ventilation - Total Ventilation Rate**  
A mechanical supply system, exhaust system, or combination thereof shall provide whole-dwelling ventilation with outdoor air each hour at no less than the rate in 150.0(o)1Ci

01	02	03	04	05
Fan Name	Fan Location	Runtime (Min/Hr)	Installed Mechanical Ventilation Rate (CFM)	Equivalent Continuous Ventilation (CFM)
06	Total Installed Equivalent Continuous Ventilation (CFM)			

**D2. HRV or ERV Information**  
Balanced ventilation systems shall comply with appropriate requirements in 150.0(o)2C.

01	02	03
Manufacturer Make	Manufacturer Model Number	Fan Efficacy Performance Rating (W/CFM)

**B. Single Family Attached/Detached General Information**



# Consider Including Key Energy Measures on the Cover Sheet

If a project design includes HERS measures (See CF1R or LMCC) consider calling that out on the Cover Sheet, suggested locations:

- 'Code Summary'
- 'Code Analysis'
- 'Supporting Documents'
- 'HERS Summary'

Also, consider including additional notes from the sample CF2R's that directly address insulation and air sealing details.

**EXAMPLE PROJECT**  
4630 NOGALES AVE, ATASCADERO, CA 93422  
INITIAL SUBMITTAL DATE: \_\_\_\_\_  
PICT # \_\_\_\_\_

**GENERAL NOTES**

**PROJECT DATA**

**SHEET INDEX**

**GOVERNING CODE**

**SUPPORTING DOCUMENTS**

**VICINITY MAP**

**EXAMPLE PROJECT**

**T1.1**

## SUPPORTING DOCUMENTS

- TITLE 24 ENERGY REPORT
- NOTE: **HERS MEASURES REQUIRED ON THIS PROJECT:**
  - QII (*Quality Insulation Installation*) AND AIR SEALING REQUIRED
  - HVAC EQUIPMENT VERIFICATION –HERS VCHP (*Variable Capacity Heat Pump*) – CREDIT
  - ERV / HRV BALANCED IAQ VENTILATION –HERS CREDIT

# Questions about Title 24?

3C-REN offers a *free* Code Coach Service



Online:  
[3c-ren.org/codes](https://3c-ren.org/codes)

Call:  
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 questions. Coaches have decades of experience in green building and energy efficiency improvements. They can provide citations and offer advice for your project to help your plans and forms earn approval the first time.



# Closing

- Continuing Education Units Available
  - Contact [nnewman@countyofsb.org](mailto:nnewman@countyofsb.org) for AIA and ICC LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - May 15 - [3C-REN Regional Forum: The Past, Present, and Future of HERS Raters](#)
  - May 16 - [Tiny Homes & ADUs for Architects and Installers](#) – In person!
  - May 21 - [Performance Testing of Forced Air HVAC Systems](#)
  - May 30 - [When Title 24 Modeling and HVAC Design Meet – Real World Case Studies](#)
  - May 31 - [Practical Ways to Address Embodied Carbon](#) – In person!
  - May 31 - [Higher Performance Residential Remodels](#) – In person!
- Visit [www.3c-ren.org/events](http://www.3c-ren.org/events) for our full catalog of trainings.





**Thank you!**

For more info:  
[3c-ren.org](https://3c-ren.org)

For questions:  
[info@3c-ren.org](mailto:info@3c-ren.org)



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SAN LUIS OBISPO • SANTA BARBARA • VENTURA