We will be starting soon!

Thanks for joining us

Energy Code Implementation: Multi Family

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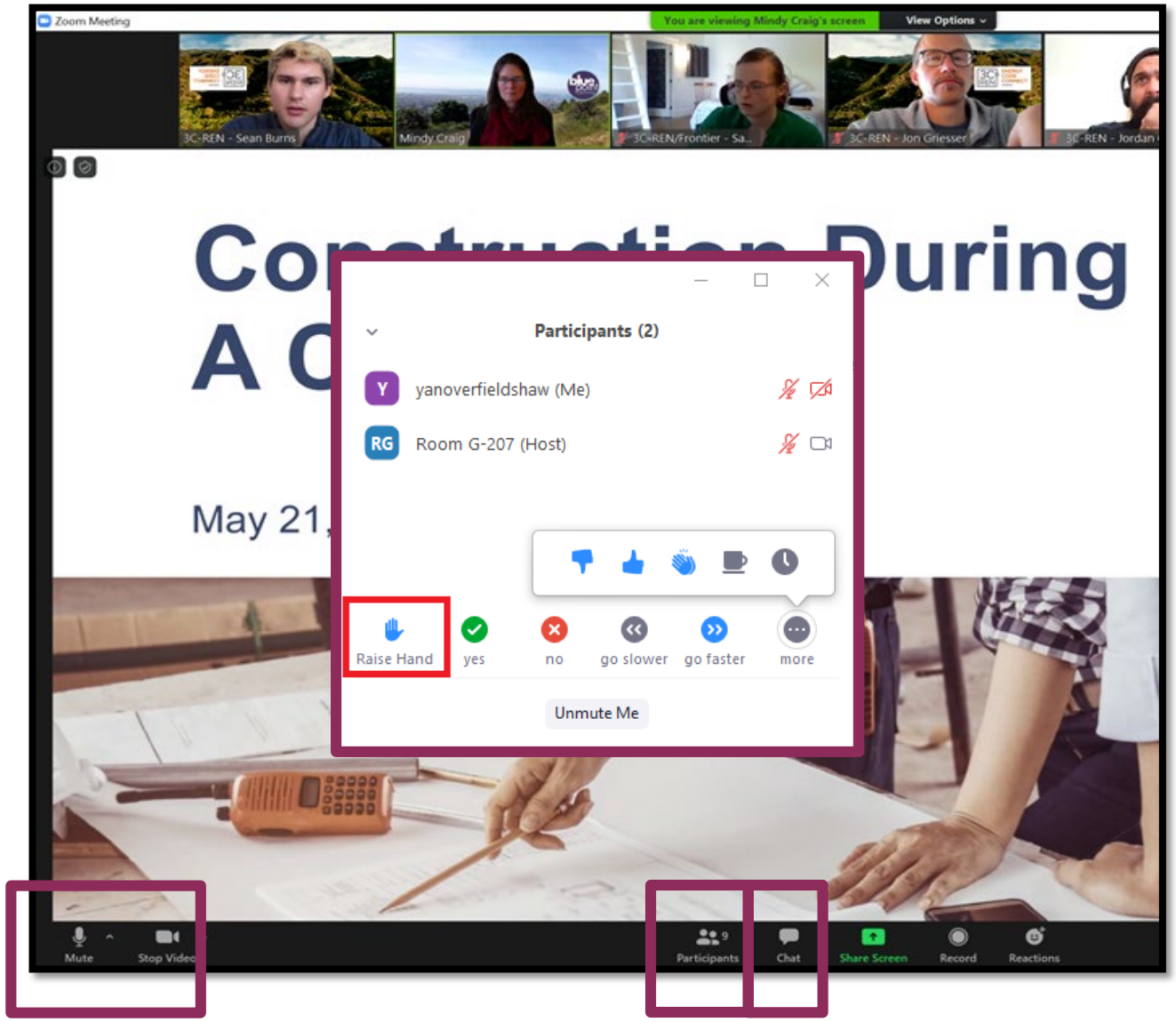
Tatiana Soglin, LEED AP –In Balance Green Consulting

June 12, 2024

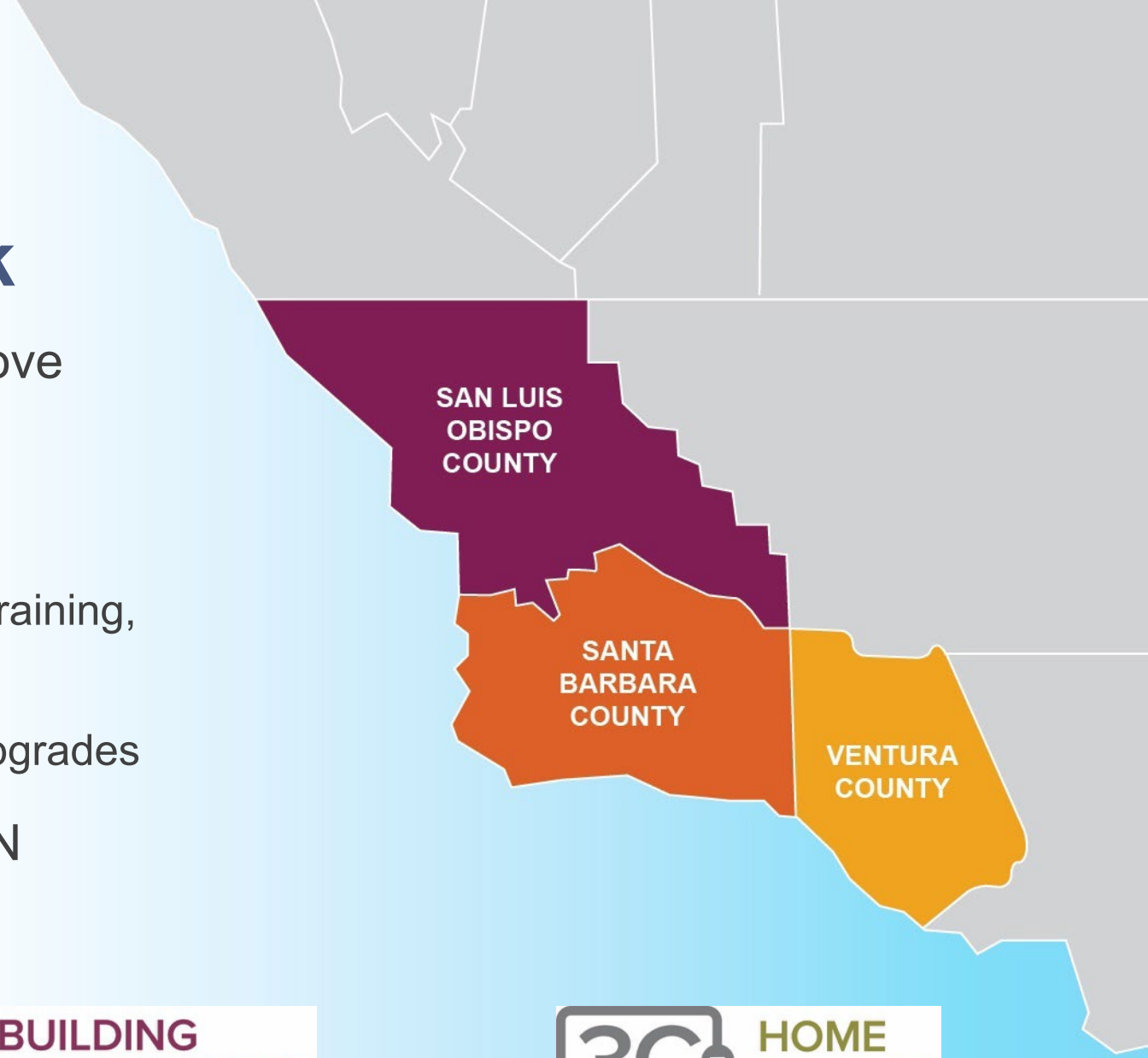
Zoom Orientation

- 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



3C REN ENERGY CODE CONNECT

3C REN BUILDING PERFORMANCE TRAINING

3C REN HOME ENERGY SAVINGS

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
805.781.1201

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

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 and standards used in the energy code for evaluating energy performance and indoor air quality, and how choices for electric or gas equipment may impact compliance with those standards.
- Within each building type, review key mandatory measures related to energy performance, ventilation, refrigerants, and insulation and review potential challenges for integration into design and construction.
- Review the prescriptive "recipe card" approach versus a building performance approach and discuss when to use each strategy to best incorporate energy efficiency and healthy interior environments into the specific project design.
- Recognize where barriers or stumbling blocks may occur within permitting and construction and tips for documentation to smooth out the process, ultimately increasing the energy efficiency, health and safety of our buildings.

1.5 AIA HSW LU approved for this course
0.15 ICC CEU approved for this course

Agenda

1. 2022 Energy Code –Overview
2. Mandatory Measures: IAQ and Electric Ready
3. Prescriptive and Performance Measures: Envelope, Hot Water, Solar and Battery
4. Additions and Alterations: Ceiling Alterations, Duct Alterations, IAQ

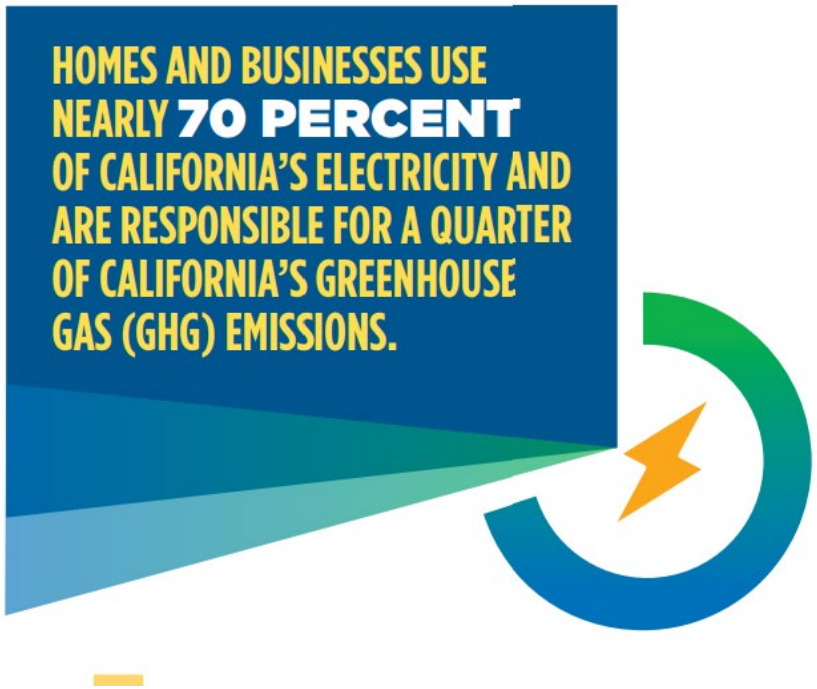
2022 Energy Code Overview

California Energy Commission (CEC)

energy.ca.gov

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

Big Picture Goals for the 2022 Code Updates



- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family and multifamily projects
- 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)

Multifamily High-Level Changes

- Performance method will use two metrics: time dependent valuation (TDV) and source energy
- Dwelling unit ventilation updates
- Domestic hot water requirements
- Space conditioning requirements
- Electric ready
- Photovoltaics and Batteries

The Energy Code –Three Compliance Terms

Mandatory Requirements

Energy efficiency measures that are applicable to all projects.

Performance Method	**Prescriptive Component Package**
Mandatory Requirements are applicable	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)	Follow all the parts of the prescriptive package
	Note: used to determine the Standard Design Building
Energy modeling approach	Essentially a **checklist** approach

Process for Low-Rise Residential Permitting

Projects in low-rise multifamily buildings that require field verification and diagnostic testing (FV&DT) must demonstrate compliance to enforcement agencies using compliance documents registered with an approved data registry, i.e. HERS Registry.

LMCC Compliance created and uploaded to HERS Registry

LMCI Installation completed and uploaded to HERS Registry

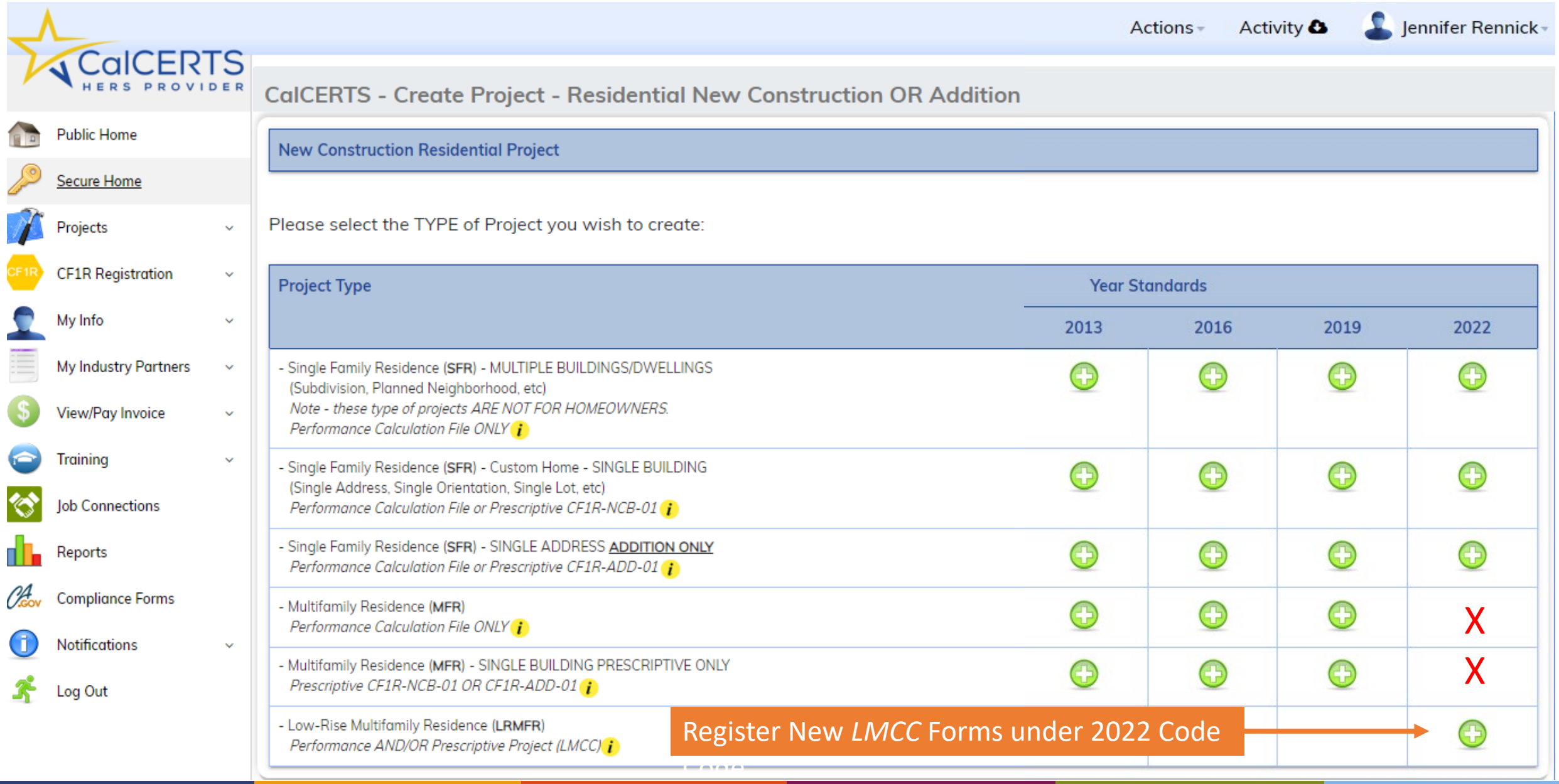
LMCV Verification completed and uploaded to HERS Registry

Building Official Confirms forms are uploaded and signed

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.

Low-Rise Multifamily Residential (LRMFR)—CalCERTS Registry Open



Mixed Occupancies- Section 110.0(f)

When a building is designed and constructed for **more than one type of occupancy (i.e. residential and nonresidential**), the space for **each occupancy** shall meet the provisions of Part 6 applicable to that occupancy.

EXCEPTION 1: If one occupancy constitutes at least **80 percent** of the conditioned floor area of the building, the entire building envelope, HVAC, and water heating may be designed to comply with the provisions of Part 6 applicable to that occupancy, provided that the **applicable lighting requirements** in Sections 140.6 through 140.8, or 150.0(k), or 160.5 and 170.2(e) are met for **each occupancy** and space, and **mandatory measures** in Sections 110.0 through 130.5, and 150.0, and 160.0 through 160.9 are met for **each occupancy** and space.

EXCEPTION 2: to Section 100.0(f): If one occupancy constitutes at least **90 percent** of the combined conditioned plus unconditioned floor area of the building, the entire building **indoor lighting** may be designed to comply **with only** the lighting provisions of Part 6 applicable to **that occupancy**.

Excerpt from Compliance Report

CERTIFICATE OF COMPLIANCE - LOWRISE MULTIFAMILY MIXED USE PERFORMANCE COMPLIANCE METHOD

Lowrise Multifamily Mixed Use Performance Compliance Method **(Page 3 of 26)**

C1. COMPLIANCE SUMMARY

COMPLIES[3]

	Time Dependent Valuaton (TDV)		Source Energy Use
	Efficiency[1] (kBtu/ft² - yr)	**Total[2] (kBtu/ft² - yr)**	**Total[2] (kBtu/ft² - yr)**
Standard Design	76.36	29.66	11.58
Proposed Design	76.08	29.35	11.51
Compliance Margins	**0.28**	**0.31**	**0.07**
	Pass	**Pass**	**Pass**

[1] *Efficiency measures include improvements like a better building envelope and more efficient equipment*

[2] *Compliance Totals include efficiency, photovoltaics and batteries*

[3] *Building complies when efficiency and total compliance margins are greater than or equal to zero and unmet load hour limits are not exceeded*

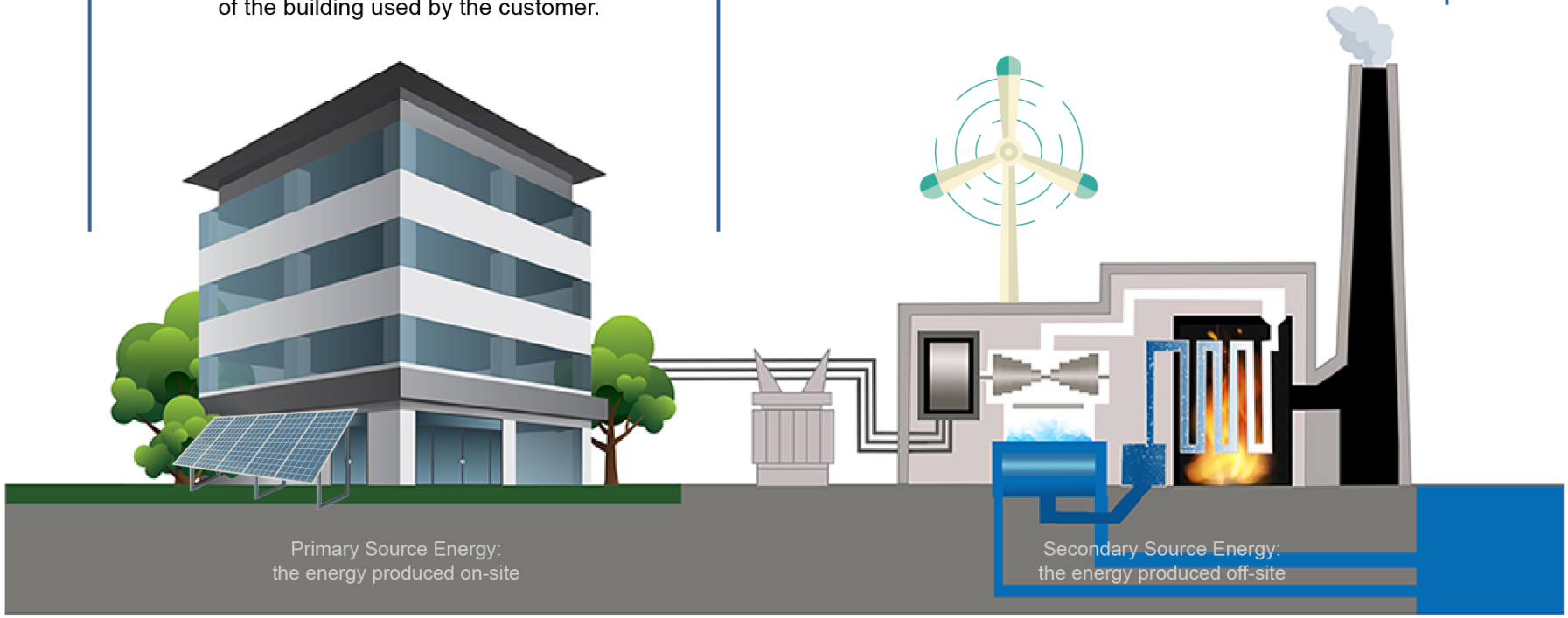
TDV ENERGY

Time Dependent Valuation (TDV) Energy values energy use differently based on WHEN the savings occur to encourage better performance during periods of high energy cost,

TDV continues to be the metric for both 'Efficiency' and 'Total' TDV

SITE ENERGY

Site Energy is the energy consumed in the operation of the building used by the customer.



SOURCE ENERGY

Source Energy looks at the energy required to produce, procure, and distribute the energy used by the building to understand its total carbon consumption.

Source Energy is being used as a proxy for Carbon in New Construction

Mandatory Measures

Section 160

IAQ

Electric Ready

New Multifamily Section 160.0

- Mandatory Measures –applies to new construction (and is referenced for Additions and Alterations in Sec 180.0)
- Apply to dwelling units and common use areas in multifamily buildings.
- Nonresidential occupancies in a mixed occupancy building shall comply with nonresidential requirements in Sections 120.0 through 141.1.

Section 160.0 Mandatory Requirements:

160.0 General Scope
160.1 Building Envelope
160.2 Ventilation and Indoor Air Quality
160.3 Space Conditioning Systems
160.4 Water Heating Systems
160.5 Lighting –Indoor and Outdoor
160.6 Electric Power Distribution Systems
160.7 Covered Process
160.8 Solar Ready Buildings
160.9 Electric Ready Buildings

Ventilation and Indoor Air Quality (IAQ)

Part (a) General Requirements

- Attached **dwellings** units –See part (b) –follows **Residential** Code
- HERS field verification and diagnostic testing for **three habitable stories or less** –See **Residential** Appendices

- Occupiable spaces **other than** attached dwelling units –See part (c) – follows **Non-Res** Code
- HERS for buildings with **four or more habitable stories** –See **Non-residential** Appendices NA1 and NA2.

- **Reminder**: Section 160.2 is **not applicable** to townhouses or dwellings that contain two dwelling units.
- **Reminder**: The outdoor air-ventilation rate and the air-distribution system design shall be **clearly identified on the building design plans**

Big Picture Change: The Multifamily Section addresses **both** the Residential and Non-Residential occupancies

Requirements for Ventilation and Indoor Air Quality (IAQ)

- Part (b) –ASHRAE 62.2 continues to be the basis for dwelling unit (residential) occupancies
- Part (c) –ASHRAE 62.1 continues to be the basis for common space (non-residential) occupancies

2022 Change is under dwelling unit IAQ with Updated or Added Language:

- Central Fan Integrated (CFI) Ventilation Systems
- Kitchen and Bathroom Exhaust
- Prescriptive Ventilation Duct Sizing
- Balanced Ventilation with Heat/Energy Recovery
- Required Testing of Ventilation System Air Flow

Requirements for Ventilation Indoor Air Quality (IAQ)

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

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

Where:
Q_{total} = Total required ventilation rate (CFM)
A_{floor} = Conditioned floor area in square feet (ft^2)
N_{br} = Number of bedrooms (not fewer than one)

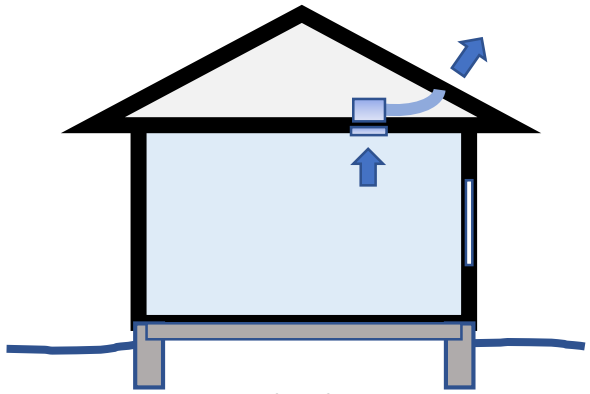
Required IAQ is based on the total required ventilation rate for the dwelling minus the calculated annually averaged infiltration rate.

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.

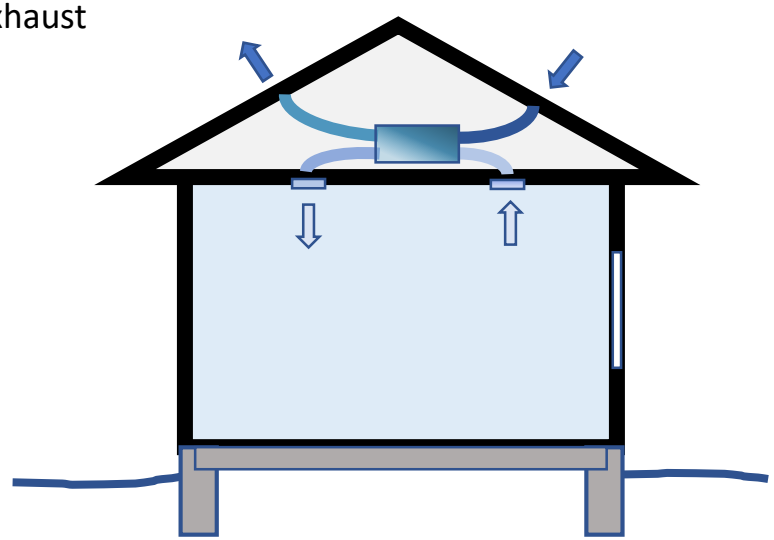
Mechanical Exhaust –Kitchens and Bathrooms

Local Mechanical Exhaust shall be installed in each kitchen and bathroom. Systems shall be rated for airflow in accordance with ASHRAE 62.2 section 7.1.

- **Open (Non-enclosed) Kitchens:** demand controls and meet min ventilation
- **Enclosed Kitchens and Bathrooms:** can use continuous ventilation systems that are part of ERV/HRV systems



Local Exhaust



ERV/HRV Balanced Ventilation with **fan efficacy of ≤1.0 W/cfm**

All systems must have occupant **accessible ON-OFF** switches –and if part of IAQ ventilation system be label , "This switch controls the indoor air quality ventilation for the home. Leave it switch in the "on" position at all times unless the **outdoor air quality is very poor**."

Kitchen –Range Hood and Other Exhaust Fans

New Tables 160.2-E, F and G

- Table 160.2-G based on home size and fuel type
- Capture Efficiency (CE) performance standard or rated air flow rate

Table 160.2-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

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

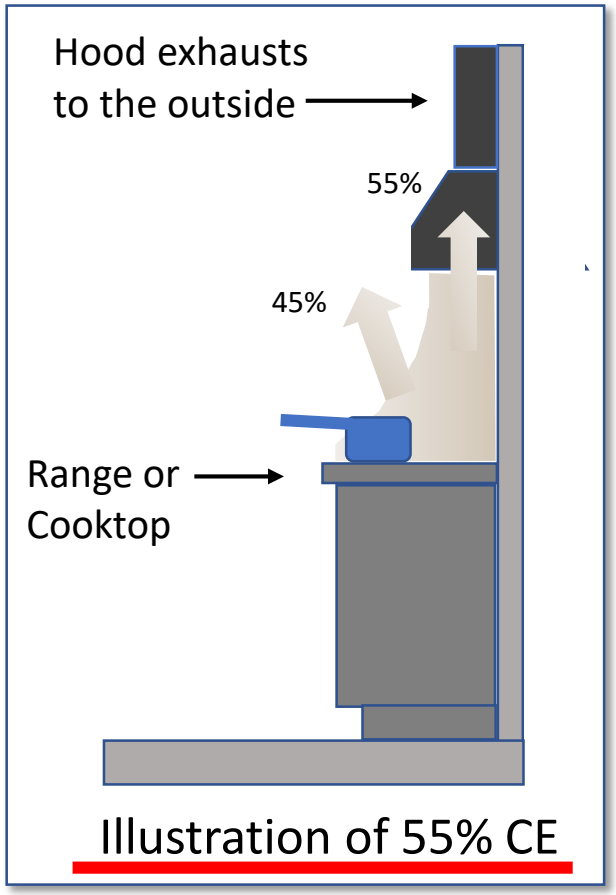


Illustration of 55% CE

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

Mechanical Exhaust –Kitchen and Bathrooms Con't

- Installer to field test with air flow hood/grid, or
- Follow **Table 160.2-H** Prescriptive Ventilation System Duct Sizing (ASHRAE 62.2 Table 5-3)
  - Reference cfm of the ventilation exhaust system
  - Minimum duct diameter for both rigid and flex duct
  - Where Duct System:
    - Total duct length is ≤ 25ft
    - Duct system has no more than 3 elbows
    - Duct system has exterior termination fitting with a hydraulic diameter ≥ to the minimum duct diameter and > than the hydraulic diameter of the fan outlet.

Air Flow Testing Equipment

3C REN

Indoor Air Quality and Mechanical Ventilation for Low-rise Multifamily LMCI-MCH-27-H

INDOOR AIR QUALITY AND MECHANICAL VENTILATION

CALIFORNIA ENERGY COMMISSION — CEC-LMCI-MCH-27-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF INSTALLATION

Note: This table completed by HERS Registry.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

Title 24, Part 6, Section 160.2(b)2 **Ventilation and Indoor Air Quality for Attached Dwelling Units.** All dwelling units shall meet the requirements of ANSI/ASHRAE Standard 62.2-2019 Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified by Title 24, Part 6, Section 160.2(b)2A

A. Whole-Dwelling Mechanical Ventilation - General Information

Note:

Non-dwelling units do not meet the definition for a dwelling unit as defined in Section 100.1(b). Non-dwelling units are not designed to provide independent living facilities and do not provide permanent provisions for living

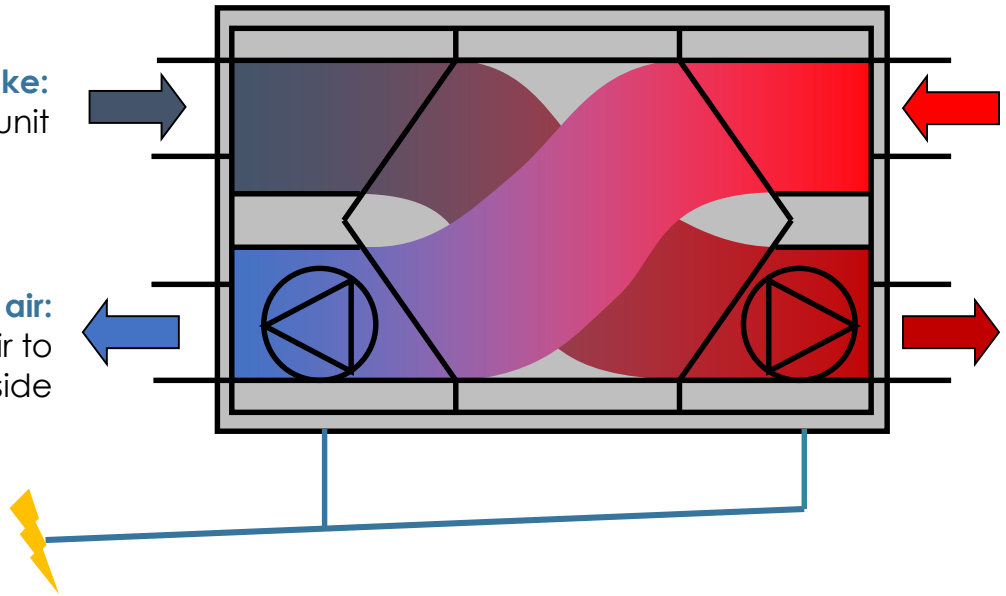
03	**7.3 Exhaust Ducts.** 7.3.1 **Multiple Exhaust Fans Using One Duct.** Exhaust fans in separate dwelling units shall not share a common exhaust duct. If more than one of the exhaust fans in a single dwelling unit shares a common exhaust duct, each fan shall be equipped with a backdraft damper to prevent the recirculation of exhaust air from one room to another through the exhaust ducting system. 7.3.2 **Single Exhaust Fan Ducted to Multiple Inlets.** Where exhaust inlets are commonly ducted across multiple dwelling units, one or more exhaust fans located downstream of the exhaust inlets shall be designed and intended to run continuously, or a system of one or more backdraft dampers shall be installed to isolate each dwelling unit from the common duct when the fan is not running.
04	**7.4 Supply Ducts.** Where supply outlets are commonly ducted across multiple dwelling units, one or more supply fans located upstream of all the supply outlets shall be designed and intended to run continuously, or a system of one or more backdraft dampers shall be installed to isolate each dwelling unit from the common duct when the fan is not running.

Forms are similar to Single Family. Some big differences include backdraft dampers and air sealing to stop air movement between dwellings.

Illustration of Energy / Heat Recovery Ventilation (ERV / HRV)

Outdoor air intake:
fresh air into unit

Exhaust / Extract air:
post-recovery air to outside



Exhaust / Extract air:
From inside conditioned space

Supply air (Outdoor air):
outside air into living rooms, offices, classrooms

HRV –Heat Recovery Ventilator
ERV –Energy Recovery Ventilator

- Thin membrane, multi-channel pathway for the Outdoor/Supply air going in and the Exhaust/Extracted air going out
- The air pathways do not mix

IAQ – Indoor Air Quality Ventilation – HRV or ERV
LMCI-MCH-27-H

INDOOR AIR QUALITY AND MECHANICAL VENTILATION

CALIFORNIA ENERGY COMMISSION CEC-LMCI-MCH-27-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF INSTALLATION

Note: This table completed by HERS Registry.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

Title 24, Part 6, Section 160.2(b)2 **Ventilation and Indoor Air Quality for Attached Dwelling Units.** All dwelling units shall meet the requirements of ANSI/ASHRAE Standard 62.2-2019 Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified by Title 24, Part 6, Section 160.2(b)2A

A. Whole-Dwelling Mechanical Ventilation - General Information

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INDOOR AIR QUALITY AND MECHANICAL VENTILATION

CALIFORNIA ENERGY COMMISSION CEC-LMCI-MCH-27-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

C2. HRV or ERV serving Individual Dwelling Unit

- Heat or Energy Recovery Systems must have a fan efficacy of ≤ 1.0 W/cfm in all climate zones (Section 160.2(b)2Biii).

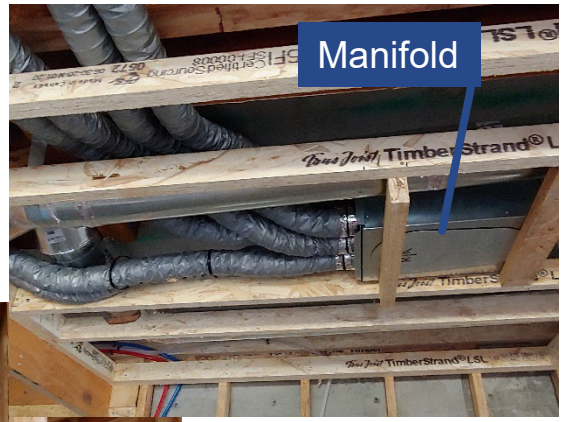
Heat or Energy Recovery Systems must prescriptively have a fan efficacy of ≤ 0.6 W/cfm and a minimum sensible heat recovery of 67% in climate zones 1, 2, and 11-16 (Section 170.2(c)3Biva).

01	02	03	04
Manufacturer Make	Manufacturer Model Number	Fan Efficacy Performance Rating (W/CFM)	Sensible Recovery Efficiency (%)

D. Additional Envelope Requirements

01	Envelope Leakage

Duct System 'Home Runs' to the Heat Exchanger and Fan Unit



Heat Exchanger and Fan Unit

ERV / HRV Balanced Ventilation Example
ERV = Energy Recovery Ventilation
HRV = Heat Recovery Ventilation

Multifamily IAQ:
Balance Ventilation per Each Dwelling Unit vs Dwelling Unit Compartmentalization

Balanced Ventilation
ERV Provides Outside Air (OA)

VS

Blower Door Compartmentalization Testing

Exhaust Only Fan System: Depends on leaky outside walls for OA and sealed interior shared walls to eliminate transferred air between dwelling units.

High-Rise Dwelling Units –HERS or ATT Acceptance Testing
IAQ Ventilation NRCA-MCH-20c-H

Similar to Commercial Projects – '**Functional Testing**' of Systems is Required

CALIFORNIA ENERGY COMMISSION **IAQ VENTILATION** 2022-CEC-NRCA-MCH-20c-H

Project Name and Address	**Authority Having Jurisdiction**
Name: Project Name	Enforcement Agency: Agency
Address: Project Address	Permit Number: Permit Number
City, Zip: City, Zip Code	Permit Application Date: Date

Value	Room: Enter Value	Control/tag: Value

tional testing comply	Date Submitted to AHJ: Date

See 'Intent' and Code References for more information

Intent:	• This acceptance test is intended for multifamily dwelling units where CONTINUOUS ventilation is used. This acceptance test is not permitted for Central Fan Integration (CFI) systems or other intermittent ventilation systems. • Submit one Certificate of Acceptance for each ventilation system installed to verify conformance with the requirements of the Energy Standards §160.2(b)2, Nonresidential Reference Appendices NA7.18.1.1 and NA2.2, and California Energy Commission adopted version of ANSI/ASHRAE Standards 62.2-2019. • NRCA-MCH-20a-H must be completed prior to beginning NRCA-MCH-20c-H. • If using Supply-only or Exhaust-only ventilation, Certificate of Acceptance NRCA-MCH-21-H must be completed prior to beginning NRCA-MCH-20c-H. NOTE: HERS verification or ATT acceptance testing required

Table B-1: Functional Testing – IAQ Ventilation System

Step	Entry	Functional Test	Code Reference
1	☐ Pass ☐ Fail ☐ N/A	If multiple fans are specified to operate simultaneously to provide the total required ventilation airflow, the measurements within this functional test must be made with all applicable fans operating simultaneously. Verify that all fans are operational. (Pass, Fail, N/A)	NA2.2.4.1
2	☐ Pass ☐ Fail	Activate the ventilation system using the system control and record all values in Table B-2	NA2.2.4.1 NA2.2.4.1.1(b)

CALIFORNIA ENERGY COMMISSION **IAQ VENTILATION** 2022-CEC-NRCA-MCH-20c-H

Table B-3: Functional Testing – Required Calculations

Step	Entry	Functional Test	Code Reference
1	Enter Value	Record the design ventilation air flow rate for the dwelling unit. (CFM)	NRCC-MCH-E Table J
2	Percent or N/A	**BALANCED SYSTEM Only**: Calculate the percent difference between the exhaust and supply airflow rates. Calculate 100x(B-2,6.1–B-2,6.2)÷B-2,6.1 (Enter value in units of percent or N/A)	NA2.2.4.1.1.2(e)

Table B-4: Functional Testing – Conditions for Passing
Conditions for passing ventilation systems that serve one dwelling unit

Step	Entry	Functional Test	Code Reference
1	☐ Pass ☐ Fail ☐ N/A	**Supply Only or Exhaust Only** Ventilation System passes if ALL of the following are true: • B-2,6.2 >= B-3,1, AND • NRCA-MCH-21-H is completed and complies. (Pass, Fail, N/A)	NA2.2.4.1.1(c) §160.2(b)2Aivb2
2	☐ Pass ☐ Fail ☐ N/A	**Balanced Only Ventilation** System passes if ALL of the following are true: • B-3,2 < 20%, AND • Exhaust(B-2,7.1) >= B-3,1, AND • Supply(B-2,7.2) >= B-3,1 (Pass, Fail, N/A)	NA2.2.4.1.1(g) §160.2(b)2Aivb1

See Code References for more information

Table B-5: Functional Testing – Conditions for Passing
Conditions for passing ventilation systems that serve multiple dwelling-units

Step	Entry	Functional Test	Code Reference
		Supply Only or Exhaust Only Ventilation	

MORE USED FOR COMPLIANCE. CONTACT YOUR LOCAL BUILDING OFFICIAL FOR COMPLIANCE DOCUMENTS
MORE USED FOR COMPLIANCE. CONTACT YOUR LOCAL BUILDING OFFICIAL FOR COMPLIANCE DOCUMENTS

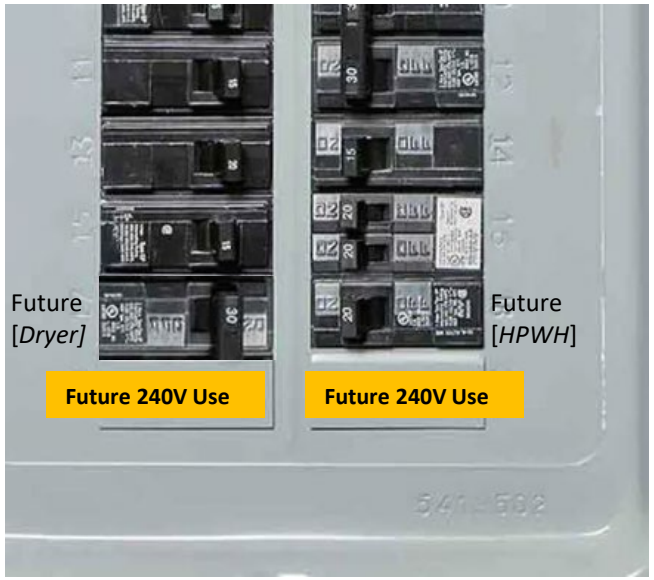
Water Heater 160.4 and Electric Ready Buildings 160.9

–update to Water Heater 160.4(a)
–new Sections 160.9(a), (b), and (c)1,2

For all propane/natural gas installed appliances:

- Water heaters: serving individual dwellings must install 125v/20amp outlet with spare conductor to allow for a 240v circuit - **160.4(a)**
- Furnaces: serving individual dwellings provide conductors rated at 240 volt/ 30 amp to the furnace for future heat pump installation- **160.9(a)**
- Cooktops: provide conductors rated at 240 volt/ 50 amp for future cooktop- **160.9(b)**
- Dryers –dwelling units: provide conductors rated at 240 volt/ 30 amp feed dryer - **160.9(c)1**
- Dryers –common space: provide conductors rated at 240 volt/ 24 amp feed per dryer or 2.6 kVA for each 10 kBtu/h gas dryer capacity- **160.9(c)2**

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



Example situation for a dwelling subpanel

Electric Clothes Dryer Ready –Common Space Laundry

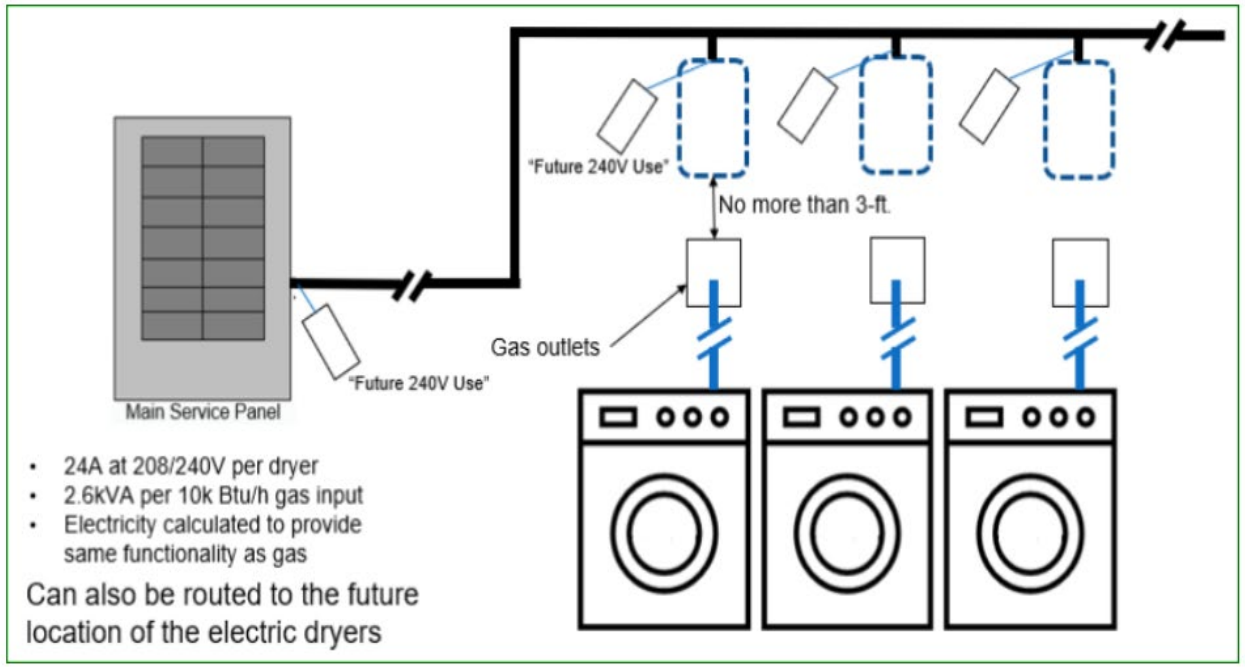


Figure 1: Example of electric ready system configuration for clothes dryers in common use area.

CALIFORNIA ENERGY COMMISSION

https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center/2022-3?utm_medium=email&utm_source=govdelivery

Electric Ready:

- Termination points for the conductors or raceways installed at the main panel, to a location 3 feet or less from each gas outlet
- Electrical conductors, raceway, panels, switchboards, and busbars must be sized to meet the future electric power requirements at the service voltage to the point at which the conductors serving the building connect to the utility distribution system
- The capacity requirements may be adjusted for demand factors in accordance with the California Electric Code and must meet one of the following:
    - 24 amps at 208V/240V per clothes dryer;
    - 2.6 kVA for each 10,000 Btu/hr of rated gas input or gas pipe capacity; or
    - The electrical power required to provide equivalent functionality of the gas-powered equipment, as calculated and documented by a project participant

Note: Gas flow rates must be determined in accordance with the California Plumbing Code

New Construction Prescriptive and Performance

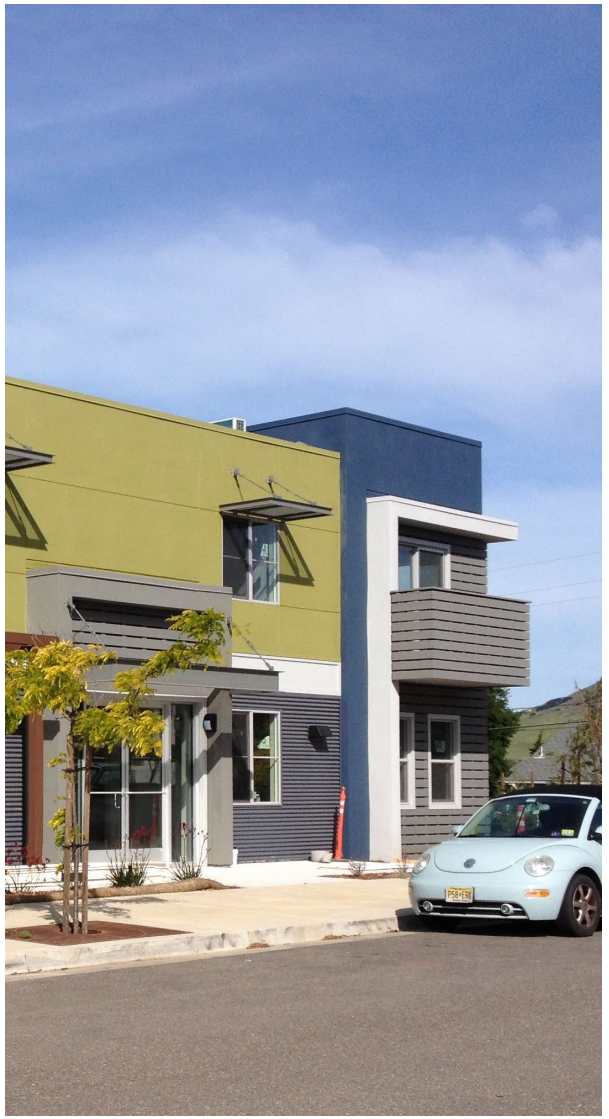
Section 170.0
Performance 170.1 and Prescriptive 170.2(a through (f)
Minor changes to Insulation and Envelope, Space Heating, Domestic Hot Water, IAQ Ventilation and Solar Electric

New Multifamily Section 170.0

- Section 170. –General
- Section 170.1 –Performance Approach
- Section 170.2 –Prescriptive Approach
- Apply to dwelling units and common use areas in multifamily buildings.
- Nonresidential occupancies in a mixed occupancy building shall comply with nonresidential requirements in Sections 120.0 through 141.1.

Section 170.2 Prescriptive Approach:

(a) Building Envelope
(b) Daylighting –Large Enclosed Spaces
(c) Space Conditioning Systems
(d) Water Heating Systems
(e) Lighting –Indoor, Outdoor, Signs
(f) Photovoltaic (PV/Solar) -3 Stories or less
(g) Photovoltaic (PV/Solar) -4 Stories or more
(h) Battery Storage Systems



Roof and Ceiling Insulation

- New **Table 170.2-A** outlines prescriptive multifamily requirements by climate zone and Roof Type
- Option B: Attic –Ducts in attic
- Option C: Attic –Ducts in conditioned space
- Option D: Non-Attic Roof

Few changes between 2019 and 2022

Note: Option B and C roof types are described with R-values, but Option D is described with U-factors.

Roof and Ceiling Insulation –Ducts in Attic

Option B for Attic- Insulation is at Ceiling and Below Roof Deck, Ducts in Attic

ii. Option B: A minimum R-value of insulation installed between the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 170.2(c)3Biia

170.2(c)3Biia –High performance attics. Air handlers or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation level meet Option B in TABLE 170.2-A.

New Table 170.2-A, but same values from 2019 Table 150.1-B

Multifamily			Climate Zone														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Option B (meets § 170.2(a)1Bii)	Below Roof Deck Insulation [1,2] (With Air Space)		NR	NR	NR	R19	NR	NR	NR	R19	R19	R13	R19	R19	R19	R19	R19	R13
	Ceiling Insulation		R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38
	Radiant Barrier		NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
		Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	75	NR	75	NR
	Steep-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0. 75	0.75	0.75	0.75	0.75	0.75	NR
		Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	16	16	16	16	16	16	NR

Roof and Ceiling Insulation – Ducts Interior

Option C for Attic- Insulation at Ceiling **and** Ducts in Conditioned Space

iii. Option C: A minimum R-value of ceiling insulation located between the attic and the conditioned space when meeting Section 170.2(c)3Biib

170.2(c)3Biib – Duct and air handlers located in conditioned space. Duct systems and air handlers of HVAC systems shall be located in conditioned space, and confirmed by field verification and diagnostic testing to meet the criterion of Reference Residential Appendix RA3.1.4.3.8.

New Table 170.2-A, but same values from 2019 Table 150.1-B

Multifamily			Climate Zone														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Option C (meets § 170.2(a)1Biii)	Ceiling Insulation		R 38	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38
	Radiant Barrier		NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
		Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	75	NR	75	NR
	Steep-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0. 75	0.75	0.75	0.75	0.75	0.75	NR
		Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	16	16	16	16	16	16	NR

Roof and Ceiling Insulation – 'Cathedral Ceiling'

Option D for Non-Attic Roof (expressed as U-Factor)

- Metal Building
- Wood Framed or Other

- New Table 170.2-A,
- New roof types,
- Expanded Cool Roof climate zones

iv. Option D: A minimum U-factor for roof assemblies above conditioned space without attic space

Multifamily			Climate Zone														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Option D (Non Attic Roof)	Metal Building U-factor		0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
	Wood Framed and Other U-factor		0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	0.63	0.63	0.63	NR	0.63	0.63	0.63	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
		Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	75	75	75	NR	75	75	75	NR
	Steep-sloped	Aged Solar Reflectance	NR	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
		Thermal Emittance	NR	0. 75	0. 75	0. 75	0. 75	0. 75	0. 75	0. 75	0. 75	0. 75	0.75	0.75	0.75	0.75	0.75	NR
		Solar Reflectance Index (SRI)	NR	16	16	16	16	16	16	16	16	16	16	16	16	16	16	NR

Wall Insulation

- Varies by wall type, and fire rating
- Wall insulation expressed as U-Factor

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Walls	Metal-Building, any fire rating	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057
	Framed, (wood, metal, and others) >1hr fire rating	0.059	0.059	0.059	0.059	0.059	0.065	0.065	0.059	0.059	0.059	0.051	0.059	0.059	0.051	0.051	0.051
	Framed (wood, metal and others), ≤1hr fire rating[3]	0.051	0.051	0.051	0.051	0.051	0.065	0.065	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
	Mass Light [4,5]	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 Heavy	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160

New

No change

New

Floors and Soffits Insulation

- Varies by floor type

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Floors/Soffits	Slab Perimeter, Three Habitable Stories or less	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
	Wood Framed	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
	Raised Mass	U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U- 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0
	Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039

No change

New

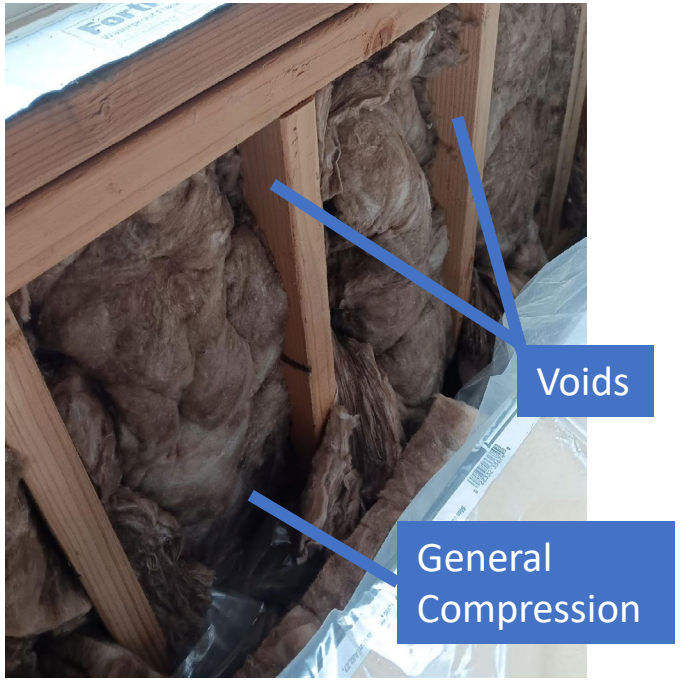
Quality Insulation Installation

Required for new construction projects with:

- 3 habitable stories or less
- Prescriptive approach
- CZ 1-6 and 8-16 Required
- CZ 7 is exempt

No change from 2019. Still does not apply to multifamily building 4 stories or more

QII – Eliminate the Voids, Gaps, Compression and “No Stuffing”



Insulation was compressed and “stuffed,” and not cut to size.

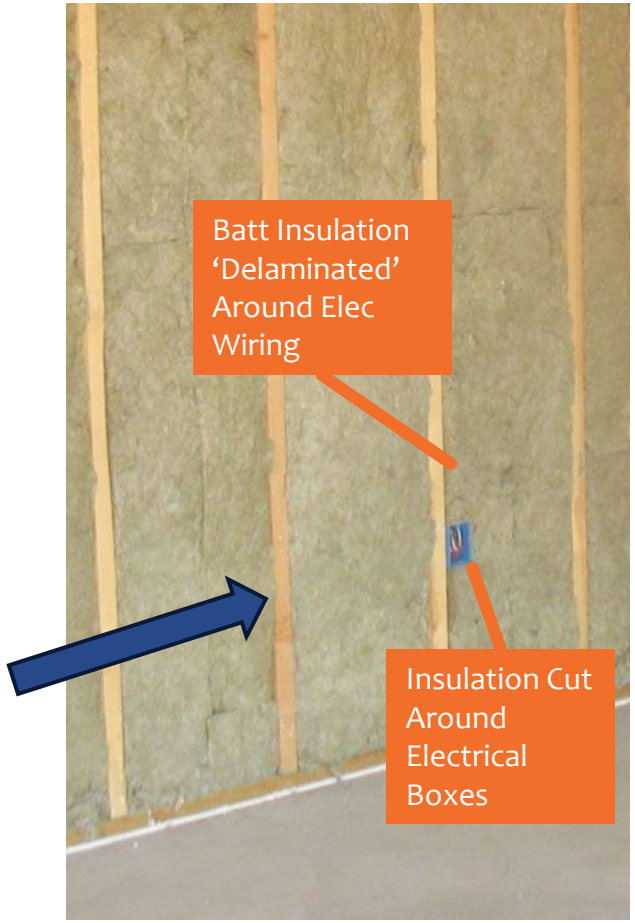
Insulation was compressed at the framing members.

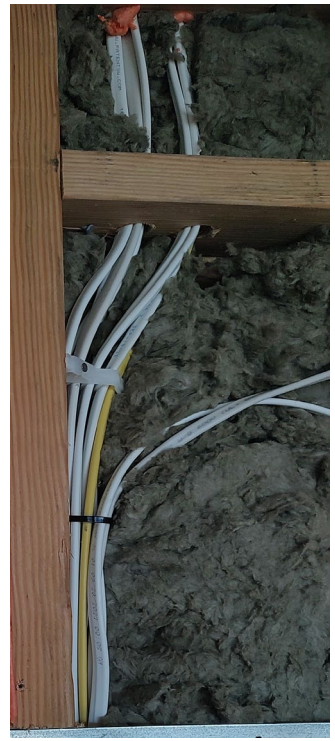
Insulation needs to be in tight contact with the studs.

-- All of these would FAIL QII

QII – Blown in Insulation and Electrical Wiring

Mandatory and part of QII





Unfinished Job: Electrical Wiring is on the surface of the batt insulation.

QII – Made Easy with Blown-in Products

-- PASS on the Left, FAIL on the Right.

Fenestration

Fenestration performance requirements based on product type and # of floors

"Residential Windows"

Fenestration area allowance based on window to floor and window to wall area.

Fenestration

Climate Zone		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Maximum U-factor	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.38
Curtain Wall/ Storefront	Maximum RSHGC, three or fewer habitable stories	NR	0.26	NR	0.26	NR	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.26	NR
	Maximum RSHGC, four or more habitable stories	0.35	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.26	0.25
	habitable stories	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
NAFS 2017 Performance Class AW[6]	Maximum U-factor	0.38	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38
	Maximum RSHGC, three or less habitable stories	NR	0.24	NR	0.24	NR	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	NR
	Maximum RSHGC, four or more habitable stories	0.35	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
	Minimum VT, four or more habitable stories	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
All Other Fenestration	Maximum U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.34	0.34	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Maximum RSHGC, three or less habitable stories	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 RSHGC, four or more habitable stories	0.35	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Maximum Window to Floor Ratio		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Maximum Window to Wall Ratio		40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Maximum Skylight Roof Ratio		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%

Note: All climate zones for Multifamily, the West facing widow allowance is dropped. But a Win-Floor area of 20% or Win-Wall area of 40%, whichever is less, has been added as the new window allowance.

Prescriptive Compliance Example - LMCC-ENV-01-E

Residential (Dwelling Unit) Windows

STATE OF CALIFORNIA

Envelope Component Approach

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE		LMCC-ENV-01-E
Project Name: Patterson Point	**Report Page:**	(Page 7 of 10)
	Date Prepared: 02/21/2024	

K. FENESTRATION AND GLAZED DOOR SCHEDULE

Vertical Fenestration And Glazed Doors- U-factor, Solar Heat Gain Coefficient (RSHGC/ SHGC), Visible Transmittance (VT)

04	05	06	07	08	09		10	11	12	13
Tag/Plan Detail ID	Fenestration Type	Occupancy & Status	U-factor/ (R)SHGC Compliance Method	VT Compliance Method	Calculation Method for Performance Values per Design[2]		Product Performance Unit	Required Product Performance	Product Performance per Design	Area ft^2
Typical Window (Common)	Fixed window	Nonresidential: : New	Table 140.3-B/C/D	Equation 140.3-B (new only)	NFRC Certified		U-factor (max)	0.36	0.29	11.06
					☐	Overhang/ Slats used for RSHGC	(R)SHGC (max)	0.25	0.22	
							VT (min)	0.4	0.5	
Typical Window (Dwelling)	Architectural Window - Operable (Multifamily only)	Dwelling Units <=3 stories: : New	Table170.2-A		NFRC Certified		U-factor (max)	0.3	0.29	11.09
					☐	Overhang/ Slats used for RSHGC	(R)SHGC (max)	0.23	0.22	
							VT (min)			
Typical Glazed Door	Glazed door	Nonresidential: : New	Table 140.3-B/C/D	Table 140.3-B/C/D	NFRC Certified		U-factor (max)	0.45	0.36	22.6
					☐	Overhang/ Slats used for RSHGC	(R)SHGC (max)	0.23	0.23	
							VT (min)	0.17	0.17	

Exterior Doors

Table 170.2-A

- Max U-factor based on type of door

Dwelling Unit

or Common Use Area

		Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Exterior Doors[6]	Maximum U-factor	Dwelling Unit Entry	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
		Common Use Area Entry Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
		Common Use Area Entry Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

Differentiating common area doors versus dwelling unit doors.

Space Conditioning –Dwelling Units Only

- **3 Stories or less**
  - CZ 1-15: space conditioning shall be a **heat pump**
  - CZ 16: space conditioning shall be a **furnace with air conditioner**
- **4+ Stories**
  - CZ 2-15: space conditioning shall be a **heat pump**
  - CZ 1 and 16: space conditioning shall be **a dual-fuel heat pump**

Note: No space conditioning equipment requirement for the common areas

Performance Baseline is heat pump for space conditioning

- Required to comply with Energy Budget for Source and TDV

Low Leakage Ducts in Conditioned Space Performance Credit - LMCV-MCH-21-H

DUCT LOCATION

CALIFORNIA ENERGY COMMISSION CEC-LMCV-MCH-21-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF VERIFICATION

Note: This table completed by HERS Registry.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. General Information

Note: Submit one Installation Certificate for each duct system that is taking credit for duct location.

01	SC System Identification or Name	
02	SC System Location or Area Served	
03	Indoor Unit Name or Description of Area Served	
04	Status – Less than 12 ft Ducts in Conditioned Space Performance Credit	
05	Status – Ducts Located In Conditioned Space Performance Credit	
06	Status – Duct System Located Entirely in Directly Conditioned Space, No Insulation Requirement	
07	Status – Portions of Ducts Located in Conditioned Space, R-6 Exception	

B. 12 Linear Feet or Less of Duct Located Outside of Conditioned Space - RA3.1.4.1.2

01	A visual inspection shall confirm space conditioning systems with air handlers located outside the conditioned space have 12 linear feet or less of duct located outside the conditioned space including air handler and plenum.	
02	Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable
03	Correction Notes:	

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Correction Notes.

C. Ducts Located In Conditioned Space - RA3.1.4.1.3

01	A visual inspection shall confirm the space conditioning system is located entirely in conditioned space.	
02	Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable

Form information will data collection
Not valid until registered with a
HERS provider

Benefits:

- Performance Method 'Credit' for improved energy efficiency
- Trade-Off 'Credit' can be used to off-set other energy losing features
- Ducts entirely in conditioned space - insulation not required

HERS Scope:

- Visual Inspection of Duct Location
- Testing: Duct Leakage to Outside from Fan Pressurization of Ducts

Variable Capacity Heat Pump Compliance Credit
LMCI-MCH-33-H

VARIABLE CAPACITY HEAT PUMP COMPLIANCE CREDIT

CALIFORNIA ENERGY COMMISSION

CEC-LMCI-MCH-33-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF INSTALLATION

Note: This table completed by HERS Registry.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. VCHP System Information

Procedures for verification of VCHP compliance credit eligibility are described in the Energy Code Reference Appendices Section RA3.4.4.3.

01	SC System ID/Name from LMCC	
02	SC System Description of Area Served	
03	Conditioned Floor Area Served by the System (ft²)	
04	Status: Refrigerant charge verification from MCH-25	
05	Verification: Is conditioned airflow supplied to all habitable rooms in accordance with the procedure in RA3.1.4.1.7?	
Notes:		

B. VCHP Indoor Unit Information

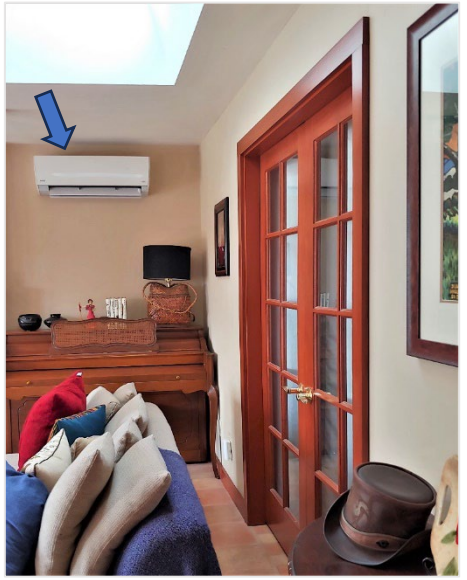
Ducted indoor units are required to be certified to the Energy Commission as low static systems, and included in the list of certified indoor units published on the Energy Commission website at https://www.energy.ca.gov/rules-and-regulations/building-energy-efficiency/manufacturer-certification-building-equipment

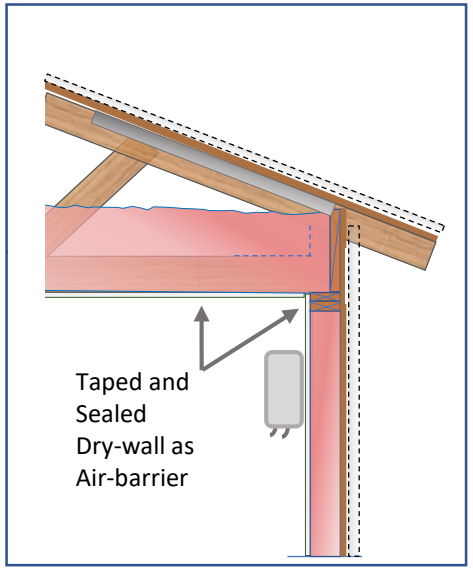
01	02	03	04	05	06	07	08	09
Indoor Unit Name or Description of Area Served	Installed Indoor Unit Type	Indoor Unit Duct Status	Conditioned Floor Area Served By The Indoor Unit (ft²)	Number of Air Filter Devices on Indoor Unit	Indoor Unit Required Minimum System Airflow Rate (cfm)	Status: Airflow Rate Verification from MCH-23	Is Field Verification of Default Non-Continuous Fan Operation Required?	Verification: Is Ducted Low Static Indoor Unit Certified to CEC?
Notes:								

For information and data collection only. Not valid until registered with a HERS provider

Registration Number: Registration Date/Time: HERS Provider:

CA Building Energy Efficiency Standards - 2022 Low-Rise Multifamily Compliance January 2022





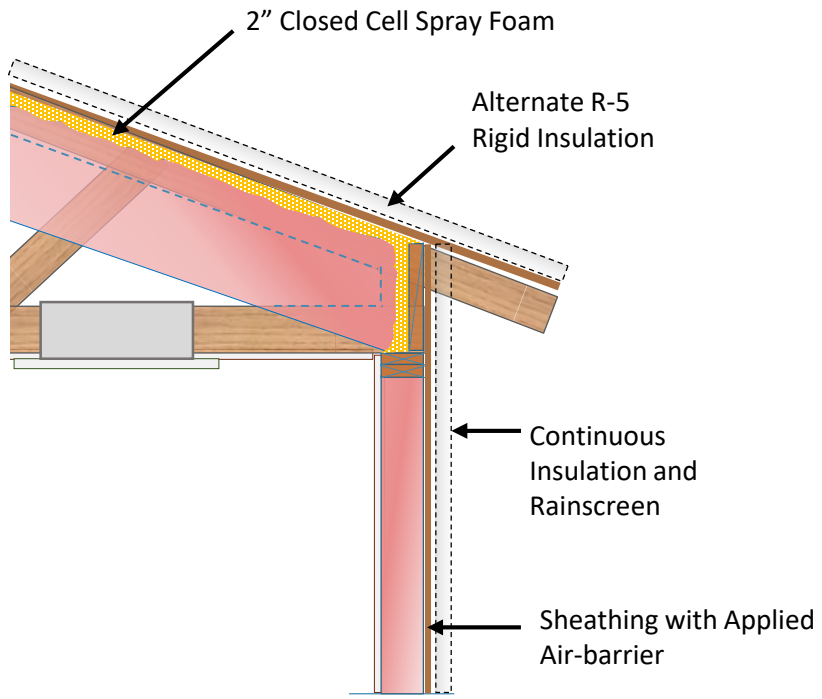
Ductless Indoor Unit within the Air and Thermal Boundary

HERS Work Flow:

- Triggered on CF1R
- Framing Stage - Construction Site Meeting
- Triggers MCH-25-H Refrigerant Charge
- Verification at both Install and Final

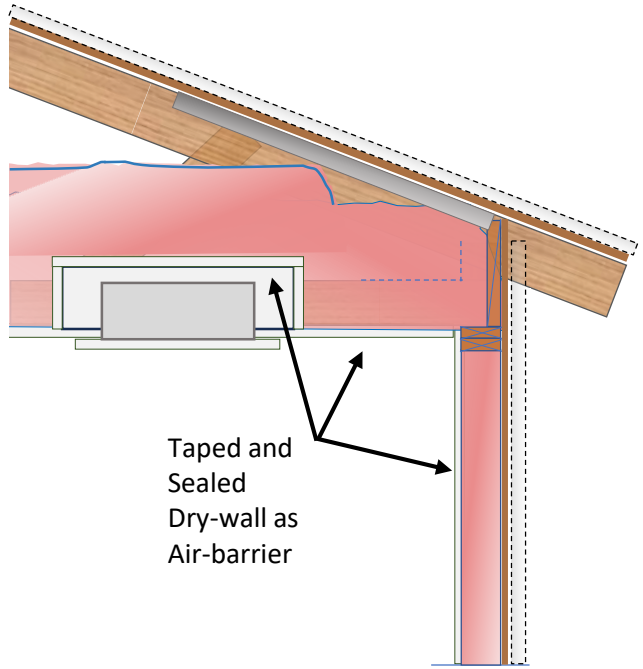
Reminder: VCHP Compliance Option –Ceiling Recessed Units Impacts Envelope Enclosure

Indoor units shall be installed within the air and thermal boundaries



Unvented Attic with a Continuous Air and Thermal Boundary

Ductless Recessed-Ceiling



Vented Attic with a Continuous Air and Thermal Boundary

ERV & HRV –see Table 170.2-K Mech Component Package

3 stories or less in CZ 4-10:

- **If heat pump** space conditioning system is installed to meet requirements, a balanced ventilation system without an ERV or HRV shall have a **fan efficacy ≤0.4 W/cfm**

4+ stories in CZ 1-2, 11-16:

- Balanced ventilation systems using ERV or HRV for **individual dwelling** units shall have a min sensible **recover efficiency ≥67% rated at 32ºF and fan efficacy ≤0.6 W/cfm**
- Balanced ventilation systems using ERV or HRV **serving multiple units** shall have a min sensible **recover efficiency ≥67%** rated at 32ºF; **Fan efficacy per 170.2(c)4a** (common area fans); and Recover bypass or control to directly **economize** with ventilation air based on outdoor air temperature limits per **Table 170.2-G**

HRV –Heat Recovery Ventilator
ERV –Energy Recovery Ventilator

Domestic Hot Water

Individual Dwelling Units

- 240-volt HPWH (plus prescriptive by cz)
- NEEA-rated Tier 3 HPWH (plus prescriptive by cz)
- Gas or propane instantaneous water heater

HPWH Multiple Units (>8 units)

- HW return to recirc tank
- Recirc WH - electric
- Single pass plumbed in series & parallel for multipass
- Primary storage tank temp setpoint ≥135ºF and recirc loop ≤ 10ºF than primary
- Minimum HPWH compressor cut-off temp ≤ 40ºF

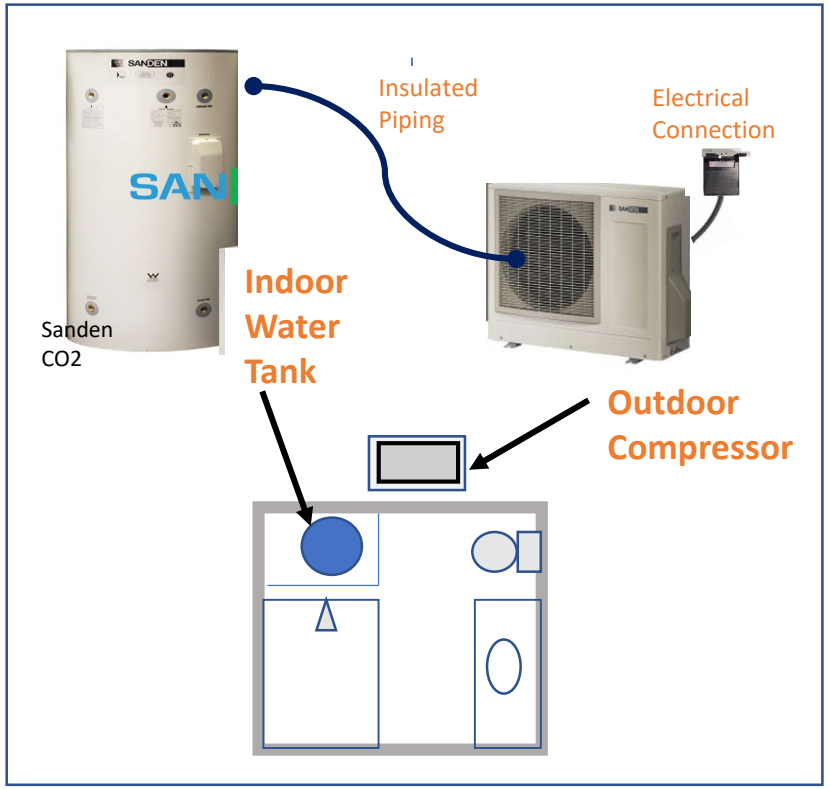
Gas/Propane Multiple Units

- CZ 1-9: Total input rating ≥1,000,000 Btu/hr & min. 90% thermal efficiency
- Solar WH system w/ min. solar savings fraction of:
  - CZ 1-9: 0.20
  - CA 10-16: 0.35
  - 5% reduction w/ DWHR
- Recirc loop (<8 units exempt from dual loop)

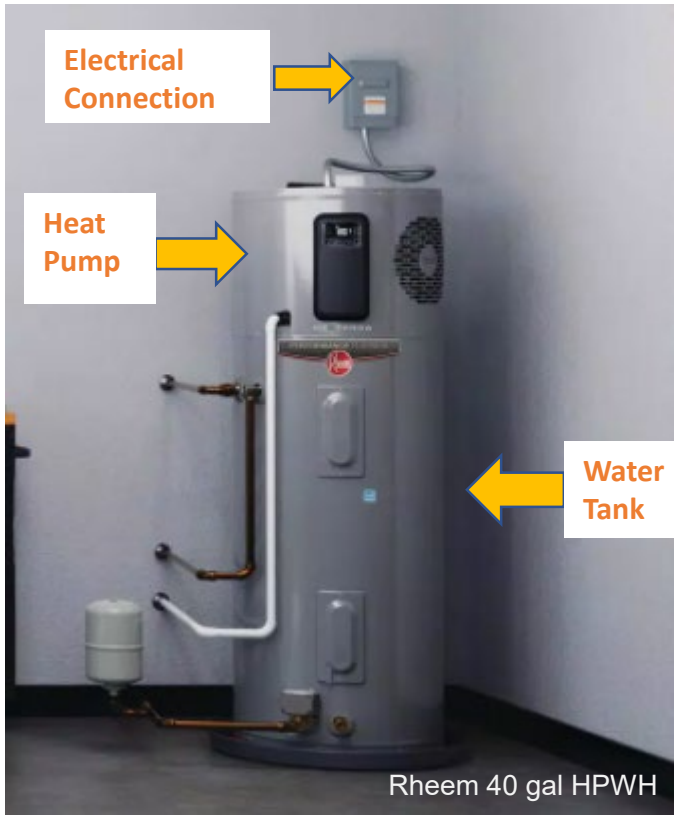
Prescriptive –Individual Dwelling Units

170.2(d)1

Split-System Heat Pump



Integrated Heat Pump



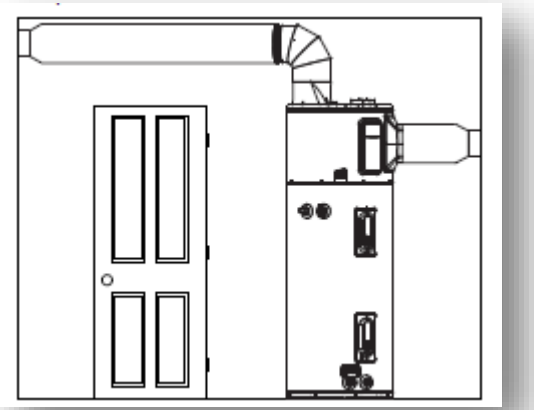
Gas On-Demand

Reminder: Confirm with your jurisdiction –it maybe incentivizing all-electric or limiting new gas infrastructure in new construction.

- 240V heat pump water heater HPWH NEEA Tier 3 or higher
- A gas or propane on-demand tankless with input of 200 kBtu/h or smaller

Design Considerations – Integrated HPWH

- 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



Central Domestic Hot Water (>8 units)

Gas or propane system is allowed with the following:

- A recirculation system (does not have to be dual loop)
- CZ 1-9: Total input rating ≥1,000,000 Btu/hr with a minimum thermal efficiency of 90%
- Solar water heating system with a minimum solar savings fraction of:
  - CZ 1-9 require 0.20 SSF
  - CZ 10-16 require 0.35 SSF
  - Solar can be reduced by 5% with a drain water heat recovery system

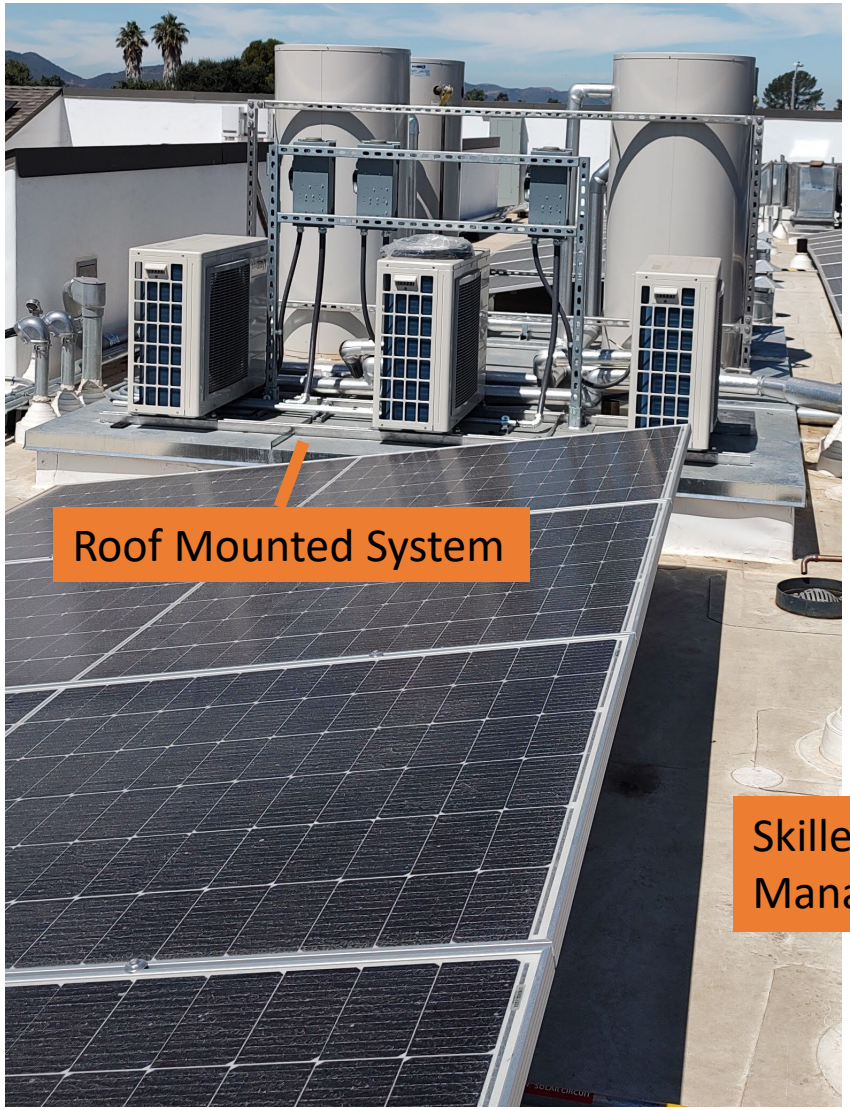
Performance Method is often used to avoid the solar thermal system requirement.

Central Domestic Hot Water (>8 units)

Heat Pump System with the following:

- *Hot water return* from recirculation loop shall *connect to a recirculation loop tank*
- Fuel source for the recirculation *loop tank* shall be *electricity* if auxiliary heating is needed
- For systems with *single pass primary heat pump* water heater, the primary thermal storage *tanks shall be plumbed in series* if multiple tanks are used
- Primary storage tank temp setpoint ≥135ºF
- Recirculation loop tank temp setpoint should be at least 10ºF lower than primary thermal storage tank
- Minimum HPWH compressor cut-off temp ≤ 40ºF

Central Heat Pump System – Distributed SanCO2 Systems



Project: Harry's House – Santa Barbara County

Solar Photovoltaic (PVs) and Battery Energy Storage Systems (BESS)

Low-Rise Multifamily (3 Stories or less)

- **Solar Ready (Mandatory Measure 110.10),** if PV is *not* triggered/installed
- **Solar PV** is required, exceptions apply.
- **BESS** is optional; *credit is available* under the Performance Method

Note: "Battery Ready" is only for Single Family Occupancy types.

High-Rise Multifamily (4 Stories or more)

- **Solar Ready (Mandatory Measure 110.10),** if PV is *not* triggered/installed, *up to 10 story building*.
- **Solar PV** is required, exceptions apply.
- **BESS** is required when Solar PV is triggered, exceptions apply.

Solar Photovoltaic (PV)

PV System Size (kW dc)

Prescriptive sizing equation is determined by the number of stories, i.e. low-rise (3 stories or less) or high-rise (4 stories or more)

SARA –Solar Access Roof Area

Area of a buildings' roof space capable of supporting PV system

- Including covered parking areas, and carports and other newly constructed structures onsite that are compatible with supporting a PV system per CBC 1511.2
- Exceptions: Any roof area that has <70% annual solar access

PV System for ≤3 stories

$$kW_{PV} = \frac{CFA \times A}{1000} + (N_{DU} \times B)$$

EQUATION 170.2-C

CFA: Conditioned Floor Area

N_{DU}: Number of Dwelling Units

A: Climate Zone Factor

B: Dwelling Adjustment Factor

No PV required if:

- PV size < 1.8 kWdc;
- SARA < 80 sq ft contiguous
- Snow loading parameters

Bonus: Size reduction of 25% if installed with battery

Pismo Terrace Apartments, Pismo Beach, CA

CFA = 16,032 SF Climate Zone 5

N_{DU} = 27

kW_{PV} = [(16,032 x 0.585)/1000]+(27 x 1.06)

kW_{PV} = 9.378 + 28.62

kW_{PV} = 37.99 = 38 kW system

The new exceptions were based on CEC cost effectiveness studies

Table for Adjustment Factors

Table 170.2-T: CFA (A) & Dwelling Unit (B) Adjustment Factors					
Zone	A	B	**Zone**	A	B
1	0.793	1.27	**9**	0.613	1.36
2	0.621	1.22	**10**	0.627	1.41
3	0.628	1.12	**11**	0.836	1.44
4	0.586	1.21	**12**	0.613	1.40
5	0.585	1.06	**13**	0.894	1.51
6	0.594	1.23	**14**	0.741	1.26
7	0.572	1.15	**15**	1.56	1.47
8	0.586	1.37	**16**	0.59	1.22

PV System for >4 stories

$$kW_{PV} = \frac{CFA \times A}{1000}$$

EQUATION 170.2-D

CFA: Conditioned Floor Area

A: Climate Zone Factor

No PV required if:

- PV size < 4 kWdc;
- SARA < 80 sq ft contiguous or < 3% of the CFA
- Snow loading parameters

OR

PV size = 14 W/sq ft x SARA

VTA Housing Ohlone Station, San Jose, CA

HIGHRISE (6 Stories, 73 units)	HIGHRISE (12 Stories, 190 units)
CFA = 56,168 SF	CFA = 174,483 SF
Climate Zone 4	Climate Zone 4
kW_{PV} = 56,168 x 2.21/1000	kW_{PV} = 174,483 x 2.21/1000
kW_{PV} = 124,131.28/1000	kW_{PV} = 385,607.43/1000
kW_{PV} = 124.13 = 125 kWdc	**kW_{PV} = 385.61 = 386 kWdc**

The new exceptions were based on CEC cost effectiveness studies

Table for Adjustment Factors: It's A Different Table!

Table 170.2-U: PV CAPACITY FACTORS			
Building Use	Zones 1, 3, 5, 16	Zones 2, 4, 6-14	Zone 15
Grocery	2.62	2.91	3.53
High-Rise Residential	1.82	2.21	2.77
Office	2.59	3.13	3.80
Retail	2.62	2.91	3.53
School	1.27	1.63	2.46
Warehouse	0.39	0.44	0.58
Auditorium, Hotel, Library, Restaurant, Theatre	0.39	0.44	0.58

Battery Energy Storage – Applies to high-rise (4 stories or more) when PV systems are required

Energy Capacity (kWh)

- $kWh_{batt} = kW_{PVdc} \times B/D^{0.5}$

Power Capacity (kW)

- $kW_{batt} = kW_{PVdc} \times C$

where, PV Size = kW_{PVdc} from Equation 170.2-D, and

D = Rated single charge-discharge cycle AC to AC (round-trip) efficiency of the battery storage system.

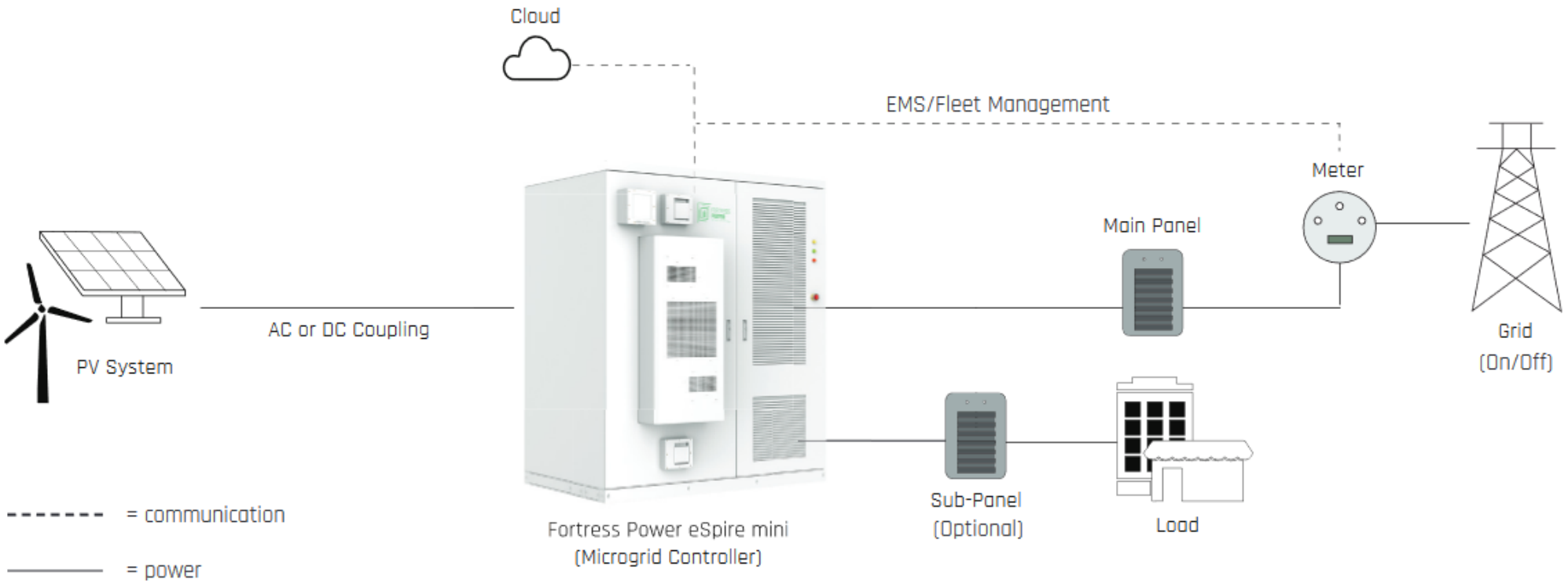
Table 170.2-V – Battery Storage Capacity Factors

Storage-to-PV Ratio	Factor B – Energy Capacity Wh/W	Factor C – Power Capacity W/W
Grocery	1.03	0.26
High-Rise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space	1.68	0.42
Retail	1.03	0.26
School	1.87	0.46
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

Battery Exemptions:

- If installed PV system size is less than 15% of the size determined by Equation 170.2-D
- If less than 10 kWh rated energy capacity
- Single tenant buildings <5,000 sq.ft CFA

Example of Multifamily / Small Commercial Battery Energy Storage System



eSpireMini_022224

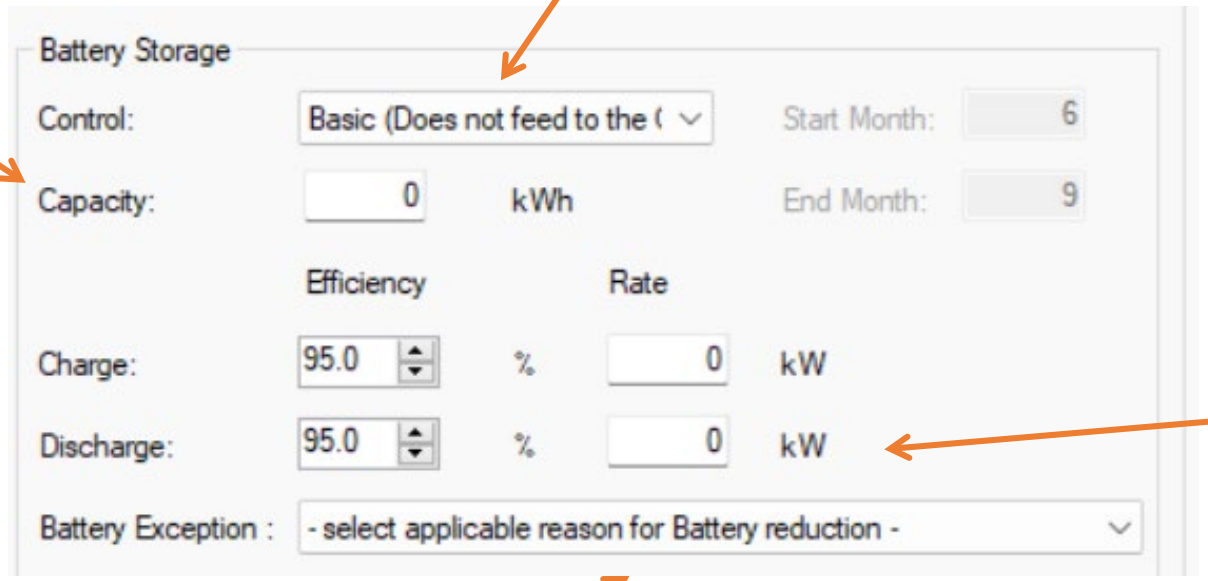
Self Utilization Credit Available for Low-Rise Multi-Family

EnergyPro v9 Input Example
Performance Method

Control Options:

- **Basic** (Does not feed to the Grid)
- **Time of Use** [*need 'Start Month' and 'End Month'*]
- **Advances DR Controls** [i.e., *Advanced Demand Response Controls / JA12 Advanced Demand Flexibility Control*]

Energy Capacity (kWh) is obtained from manufacture.



Battery Charge and Discharge Efficiency is a 95% default. [*Equivalent to 90% round trip efficiency]*

Rate of Charge and Discharge is obtained from manufacture.

Note: Battery Exceptions apply to Non-Res occupancies and Multi-Family high-rise buildings (greater than 3 stories).

Additions and Alterations

Section 180.0
Minor changes to Additions
Some significant changes to Alterations: New sections for Ceilings, IAQ Ventilation, and Exterior Doors

Additions and Alterations

- Additions and Alterations can be shown to comply with the Energy Code via Performance (computer modeling) or Prescriptively (checklist).
- Additions –Requirements match single-family requirements
- Alterations –Requirements are a mix from single-family and nonresidential

- 180.0 General
- 180.1 Additions
  - (b) Prescriptive
  - (c) Performance
- 180.2 Alterations
  - (a) Mandatory
  - (b) Prescriptive
  - (c) Performance
- 180.3 Repairs
- 180.4 Whole Building

The Challenge of Existing Buildings

In addition to new buildings, the standards apply to substantial upgrades to existing homes and businesses.

At least 50 percent of single-family homes and nearly 60 percent of California's apartment complexes (about 14 million total residences) were built before the state's first energy standards.

Updating older buildings is critical to achieving the state's climate and clean energy goals.

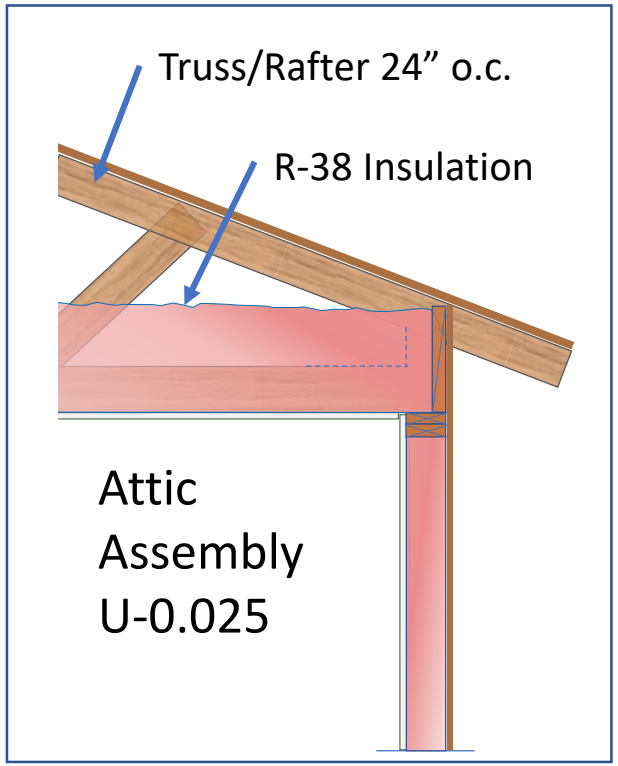
Additions –Roof and Ceiling

Additions that are **700 square feet or less** shall meet the requirements of Section 170.2(a) [i.e. Prescriptive Components], with the following modifications:

Roof and ceiling insulation in a ventilated attic shall meet one of the following requirements:

a. In **Climate Zones 1, 2, 4, and 8 - 16**, achieve an overall assembly U-factor not exceeding 0.025. In wood framed assemblies, **R-38** or greater.

b. In **Climate Zones 3, 5, 6, and 7**, achieve an overall assembly U-factor not exceeding 0.031. In wood framed assemblies, **R-30** or greater.



Change from 2019 Code: CZ’s 2, 4, 8, 9 and 10 got “upgraded” to R-38

Additions –Ventilation for Indoor Air Quality (IAQ)

The following shall **not be required** to comply with the **mechanical IAQ ventilation** airflow specified in Sections 160.2(b)2Aiv (whole-dwelling unit IAQ ventilation) or 160.2(b)2Av (multifamily central IAQ ventilation)

1. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by less than or equal to **1000 square feet**.
2. **Junior Accessory Dwelling Units** (JADU) that are additions to an existing building.

Local Mechanical Exhaust . Additions to existing buildings shall comply with all applicable requirements specified in 160.2(b)2Avi and 160.2(b)2B, **i.e. mandatory measures for kitchen and bathroom exhaust**

Change from 2019 Code: Clarification that JADU's don't trigger IAQ whole-dwelling unit nor multifamily central ventilation calculations

Alterations –Roofs

Roof Replacements –This section is triggered when 50 % or 2,000 sf of the roof is being replaced or recovered.

Updates:

- Steep-slope roofs in **CZ 4 and 8-15**:
  - Cool roof required with **0.20** aged solar reflectance and 0.75 thermal emittance
- Low-slope roofs **CZ 2, 4 and 6-15:**
  - Cool roof required with **0.63** aged solar reflectance and 0.75 thermal emittance
  - Can use aged solar reflectance insulation trade-off (**Table 180.2-A**);
- Low-sloped roofs **CZ 1, 2, 4, and 8-16** must install **R-14 continuous insulation (CI)** or U -0.039

Table 180.2-A Roof/Ceiling Insulation Tradeoff for Low-Sloped Aged Solar Reflectance

Minimum Aged Solar Reflectance	Roof Deck Continuous Insulation R-value (Climate Zones 6-7)	Roof Deck Continuous Insulation R-value (Climate Zones 2, 4, 8-15)
0.60	2	16
0.55	4	18
0.50	6	20
0.45	8	22
No requirement	10	24

Main Take-aways:
Climate Zones added to Roof replacement requirements
Tables 180.2-A have higher insulation levels
Significant updates to allowable exemptions

Alterations –Ceilings of Vented Attics

New Section

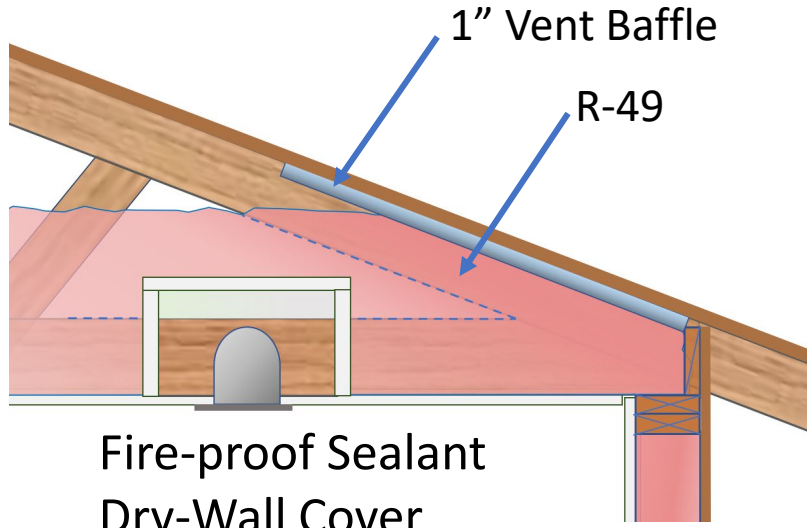
Altered ceilings shall be insulated to R-49 in CZ 1-4, 6, 8-16

[not CZ 5 and 7]

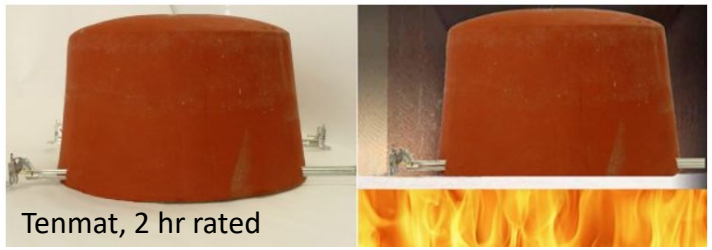
- Except for CZ 1, 3, and 6 with existing R-19 insulation

In CZ 1-4 and 8-16 *[not CZ 5,6,or 7]* **recessed downlights** in the ceiling **shall be covered with insulation** to the same depth as the rest of the ceiling. **Downlights not rated** for insulation contact must be **replaced or retrofitted** with a **fire-proof** cover that allows for insulation to be installed directly over the cover

- Except CZ 1 -4 and 8 -10, existing R-19 insulation *[not CZ 11-16]*



Fire-proof Sealant
Dry-Wall Cover



Manufactured Cover

Alterations –Ceilings of Vented Attics

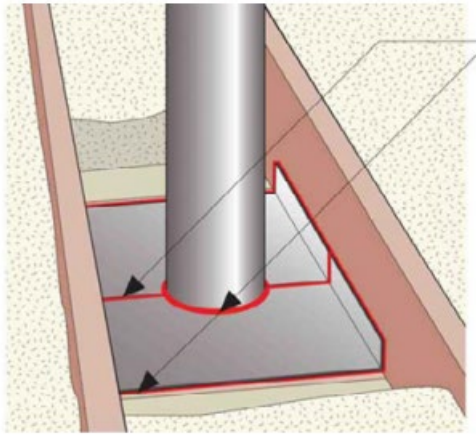
New Section

Altered ceilings must be air sealed in CZ 2, 4, 8-16 *[not CZ 1,3, 5-7]*

- Exception for existing R-19 insulation
- Except where combustion appliances are within the air boundary

Attic ventilation shall comply with the California Building Code requirements. Exception where

- existing R-38 existing insulation, asbestos, and knob and tube wiring
- the accessible spaces in the attic that are not large enough
- the attic space is shared with other dwellings that are not part of the alteration



U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

Drawings and instructions in the guide show contractors the proper way to air seal around typical breaks in the ceiling. Here, sheet metal and fire-rated caulk provide air sealing around a flue pipe.

3C REN

Alterations –Ducts

Updates if Entirely New or Complete Replacement:

- Ducts extended at least **25 ft** trigger this section (previously 40 ft)
- Duct leakage to test at **12%** or less (previously 15%)
- Duct leakage to the outside to test at **6%** or less (previously 10%)
- Duct Insulation increased to **R-8 for CZ 1, 2, 4, 8-10, 12, and 13** (previously R-6) Table 180.2-C

TABLE 180.2-C DUCT INSULATION R-VALUE

Climate Zone	3, 5-7	1, 2, 4, 8-16
Duct R-Value	R-6	R-8

R-8 Flex Duct

Duct Alteration "upgrades" have been shown to be cost effective.

Alterations or Replaced Space Heating

Main Take-away: Clarification on where electric resistance heating can be used

Altered Space-Conditioning Heating System. Altered or replacement space-conditioning heating systems **shall not use electric resistance** as the primary heat source

EXCEPTION 1 to Section 180.2(b)2Av: Non-ducted electric resistance space heating systems, if the existing space heating system is electric resistance.

EXCEPTION 2 to Section 180.2(b)2Av: Ducted electric resistance space heating systems, if the existing space heating system is electric resistance and a ducted space cooling system is not being replaced or installed

EXCEPTION 3 to Section 180.2(b)2Av: Electric resistance space heating systems, if the existing space heating system is electric resistance and located in Climate Zones 6, 7, 8, or 15.

Typically not allowed...

Ductless Electric Wall Heater

Alterations –Ventilation IAQ for Dwelling Units

Mechanical Ventilation for Indoor Air Quality (IAQ)- Entirely New or Complete Replacement Ventilation Systems. Considered a complete replacement if 75% of duct and associated materials are replaced. Duct system to comply with the **Mandatory Measures** 160.2(b)2 Ventilation and Indoor Air Quality.

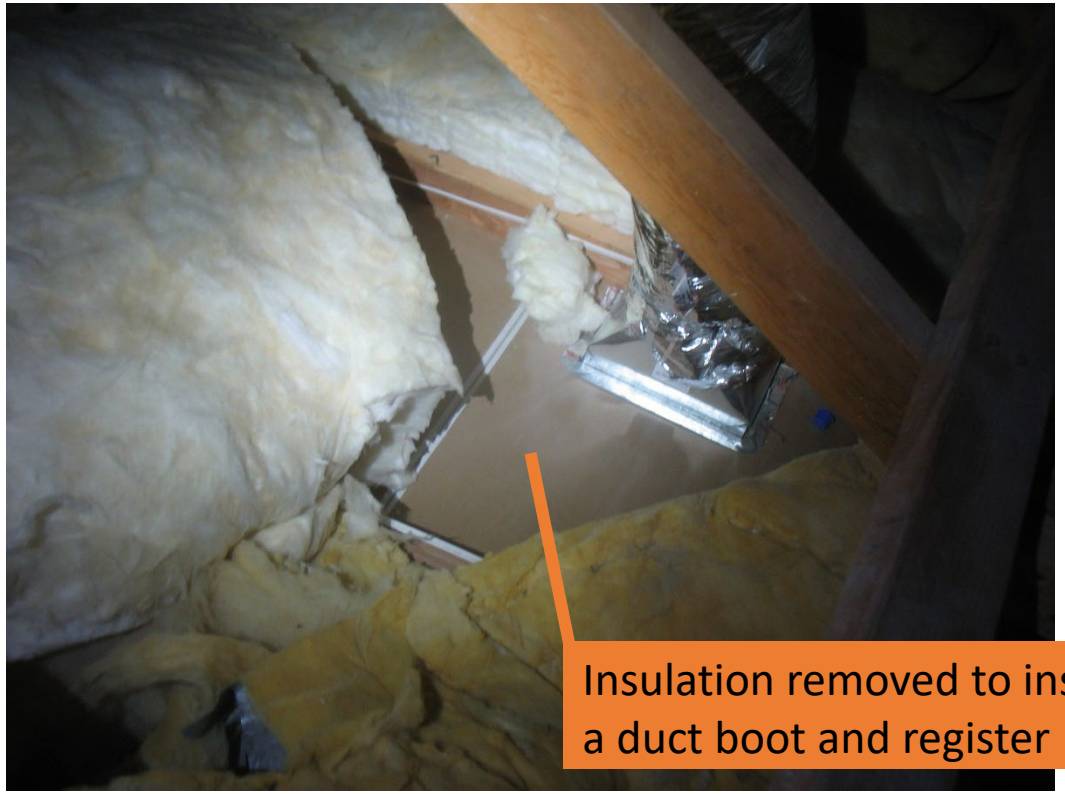
Mechanical Ventilation for Indoor Air Quality - Altered Ventilation Systems. Altered ventilation system components or newly installed ventilation equipment serving the alteration shall comply with **Mandatory Measures** 160.2(b)2Aiv or 160.2(b)2Av Ventilation and Indoor Air Quality with qualifications... And HERS per RA3.7 or NA2.2

- Fan Replacement
- Fan Alteration
- Air Filters
- Kitchen Exhaust
- Bathroom Exhaust
- Exhaust Fan Replacement

New IAQ Ventilation Sections

Dedicated Balanced IAQ Ventilation with Heat Recovery

‘Design – Construction – Verification’ is a Team Sport



Insulation removed to install a duct to a duct boot and register

- Well executed job site work flow makes HERS Duct Leakage Testing, QII, and Envelope Air Leakage Sealing go smoothly and easily.
- Follow up with each trade to ensure one trades person is not undermining the other trades person’s work.

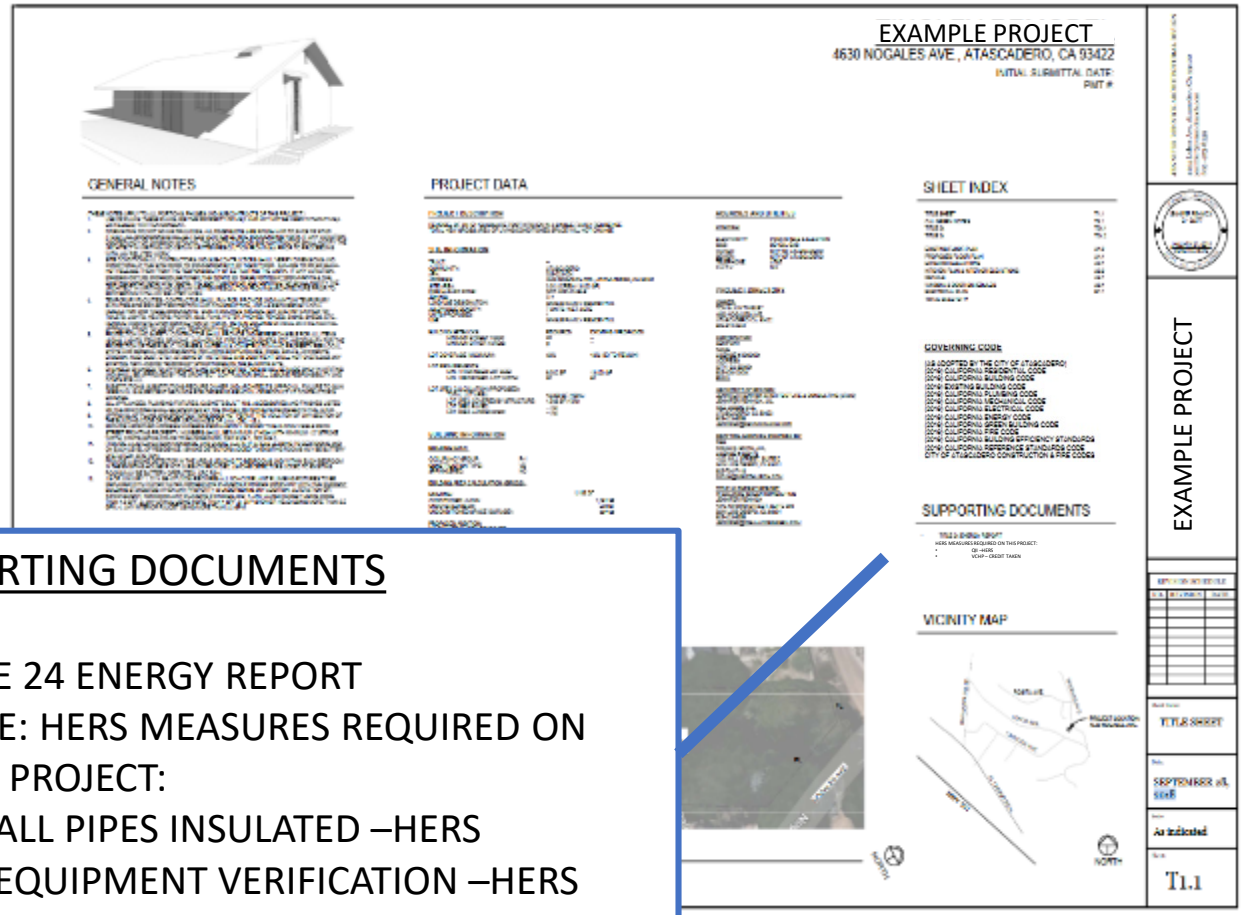
Happy HERS Rater

“I've found that certain trades can affect thermal performance... In a bad way....!” --P.D., HERS Rater

Consider Including Key HERS 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’

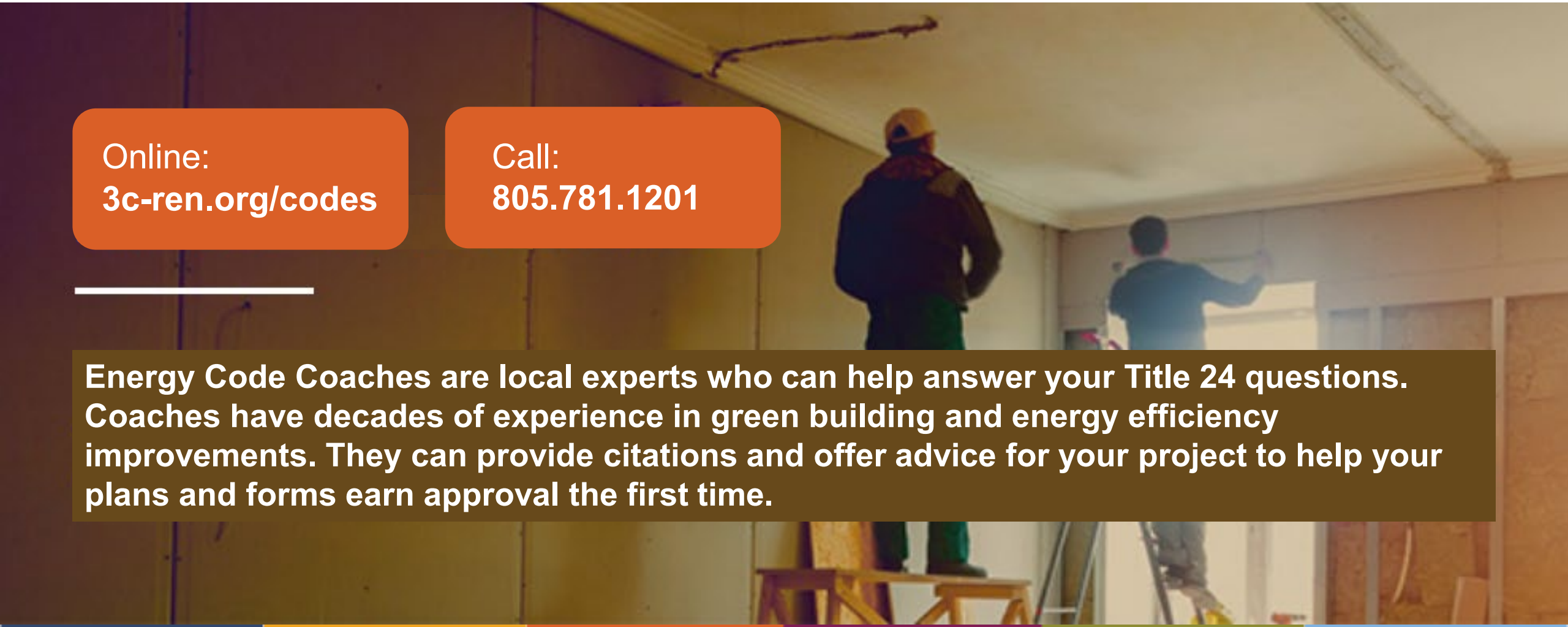


SUPPORTING DOCUMENTS

- TITLE 24 ENERGY REPORT
- NOTE: HERS MEASURES REQUIRED ON THIS PROJECT:
  - ALL PIPES INSULATED –HERS
  - EQUIPMENT VERIFICATION –HERS
  - VCHP – CREDIT

Questions about Title 24?

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



Online:
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 for AIA and ICC LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - June 17th - Working with Rebate and Incentive Programs for REALTORS
  - July 8th - 2022 CalGreen Codes for Residential and Non-Residential
  - July 15th - Increasing Referrals for REALTORS
  - July 18th - Carbon Reduction through Building Electrification- Part 1: All Electric Design and Construction Series
  - July 18th – October 3rd - Certified Passive House Designer/Consultant (CPHD) Pacific Summer Hybrid Cohort
- Visit www.3c-ren.org/events for our full catalog of trainings.

Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org

TRI-COUNTY REGIONAL ENERGY NETWORK

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