We will be starting soon!

Thanks for joining us

2022 Energy Code for Multi Family Projects

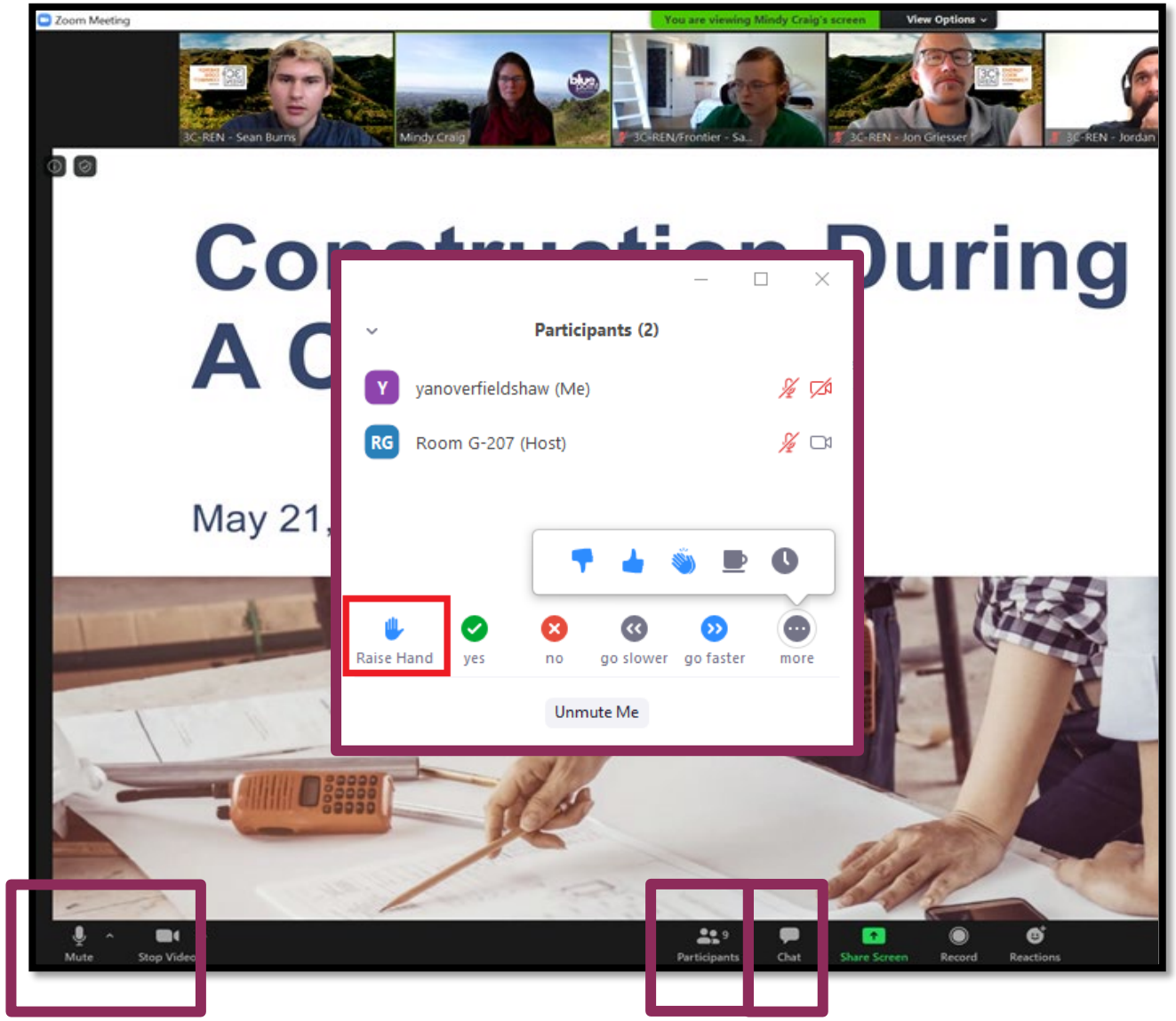
Jennifer Rennick – In Balance Green Consulting

Grant Murphy – In Balance Green Consulting

April 6, 2023

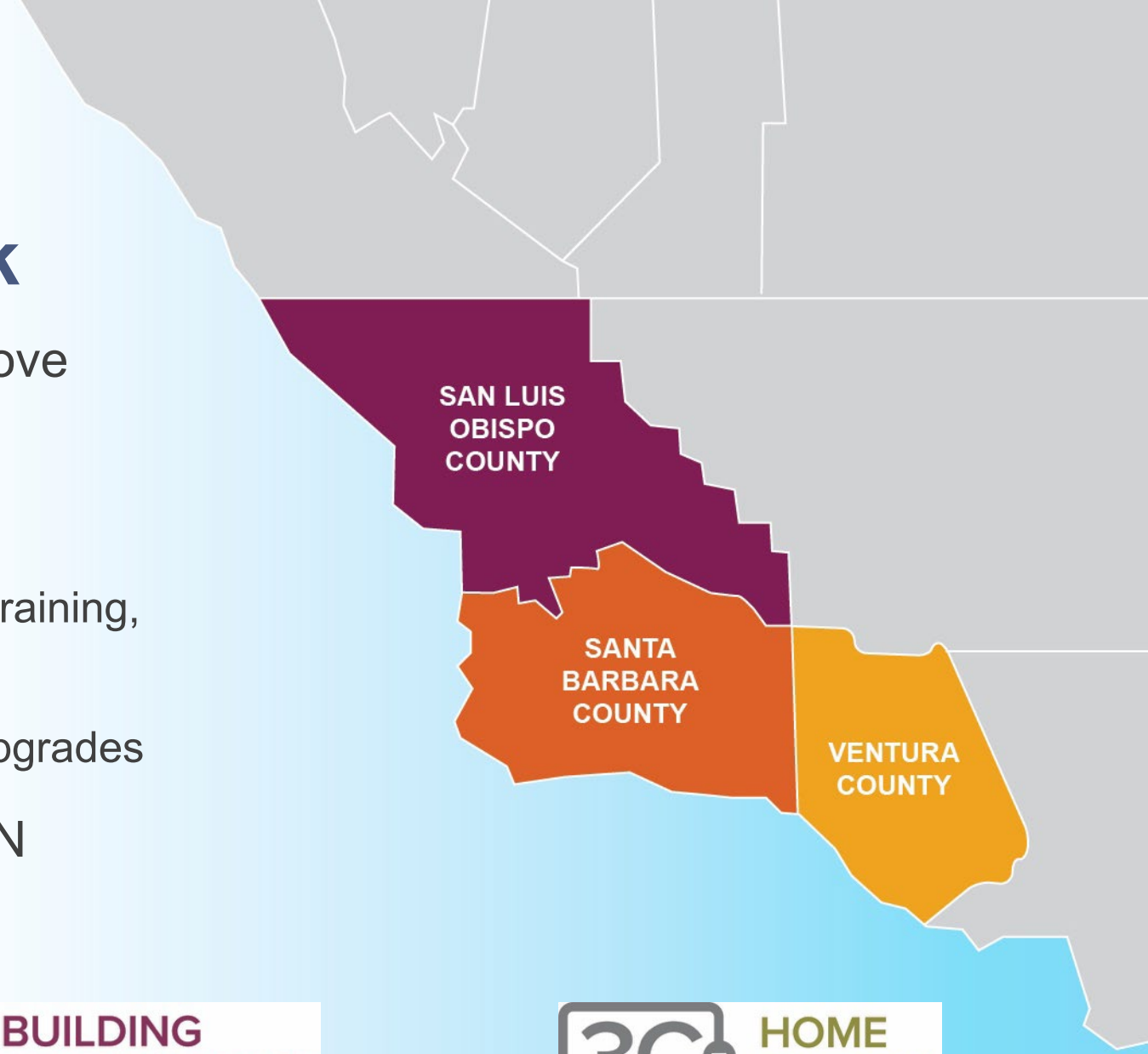
Zoom Orientation

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



3C-REN: Tri-County Regional Energy Network

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



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
805.781.4784

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

3C-REN
Staff Online

Today's Learning Objectives

- Learn how the 2022 Energy Code has been reorganized
- Review high level changes that have been made to the 2022 Energy Code impacting multifamily residences
- Learn some of the specific changes have been made to the 2022 Energy Code for multifamily residences:
  - Mandatory Measures
  - Performance and Prescriptive
  - Additions and Alterations

2022 Energy Code and CAL Green Training Series

JAN 12 - 2022 ENERGY CODE: SINGLE FAMILY

FEB 7 - 2022 ENERGY CODE: EXISTING BUILDINGS, ADDITIONS, AND ALTERATIONS (SINGLE FAMILY)

MAR 8 - 2022 ENERGY CODE: ACCESSORY DWELLING UNITS (ADUS)

APR 6 - 2022 ENERGY CODE: MULTIFAMILY PROJECTS

MAY 4 - 2022 CAL GREEN: RES & NON-RES

MAY 17 - 2022 ENERGY CODE: NONRESIDENTIAL

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

Agenda

1. Energy Code Triennial Cycle
2. Energy Code Re-organization
3. Multifamily Residential –High Level Changes
4. Mandatory Measures Code Changes
5. Performance and Prescriptive Code Changes
6. Additions and Alterations Code Changes
7. Q&A

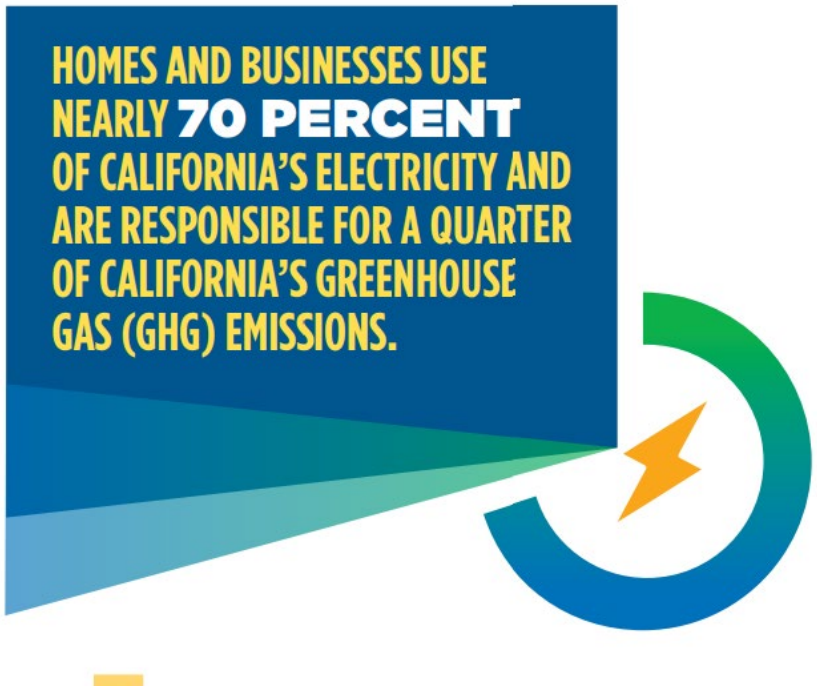
Energy Code Triennial Cycle

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

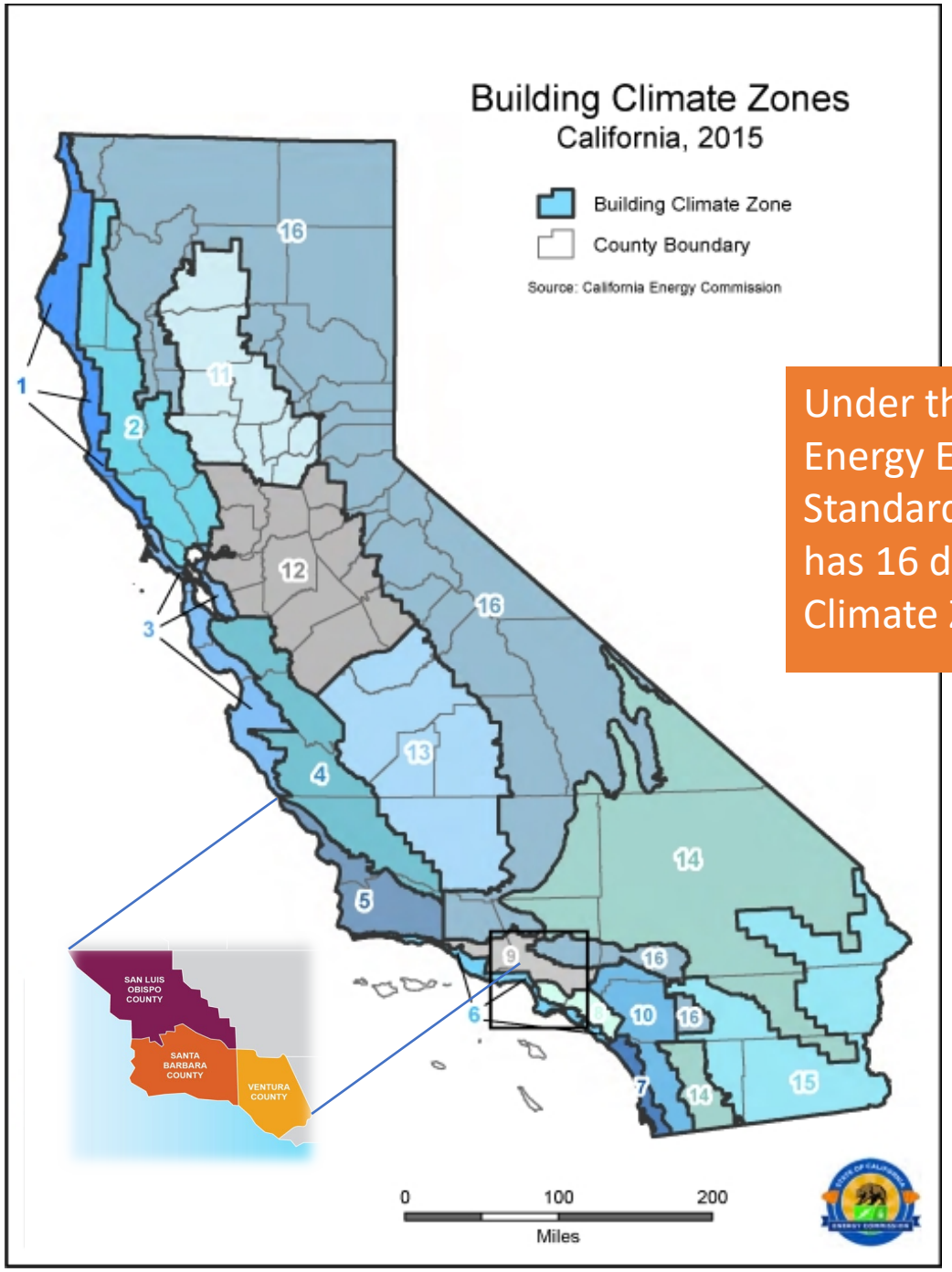


- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family and multifamily projects
- Expand PV systems and battery storage standards
- Strengthen ventilation standards

Focus on 3C-REN Tri-County Region

San Luis Obispo, Santa Barbara, and Ventura

CZ's: 4, 5, 6, 9, and 16



Under the Building Energy Efficiency Standards California has 16 defined Climate Zones (CZ)

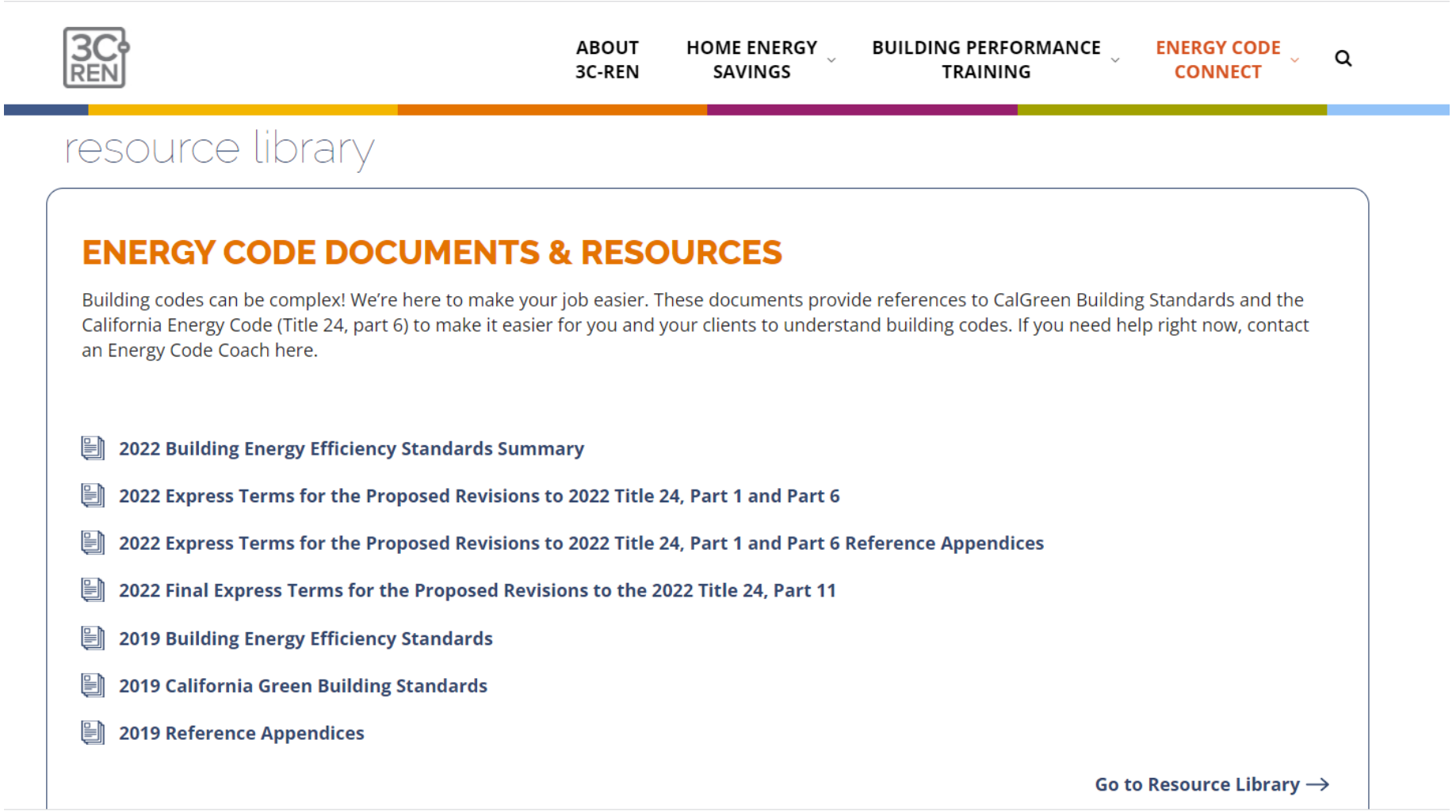
What You Need to Know

2022 Building Code went into affect January 1, 2023

- Project that **apply for permit** on or after January 1, 2023 will fall under the 2022 Code
- Documents available at: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

Key Documents at: 3C-REN Energy Code Connect – Resource Library

https://www.3c-ren.org/energy-code-connect



Energy Code Re-organization

Multifamily Subchapters Added
(Multifamily removed from Res and Non-Res Sections)

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)

T24 Part 6 Energy Code – Subchapter Organization

All [*regulated] Occupancies*

(A, B, E, F, H, I M, R, S, or U, except I-3 and I-4)

Subchapter 1 –All Occupancy –Scope, Definition

Subchapter 2 –All Occupancies – Mandatory Requirements

Sec 100.0-100.3 & Sec 110.0-110.12

Not Low-Rise Res

Subchapter 3 –Nonresidential, High-Rise Res, Hotel/Motel, Covered Process –Mandatory Requirements

[*HVAC and Ventilation*]

Sec 120.0-120.9

Subchapter 4 –Nonresidential, High-Rise Res, Hotel/Motel – Mandatory Requirements

[*Lighting and Power*]

Sec 130.0-130.5

Subchapter 5 –Performance and Prescriptive

[*New Construction*]

Sec 140.0-140.9

Subchapter 6 – Additions and Alterations

Sec 141.0-141.1

Low-Rise Res

Subchapter 7 –Low-Rise Residential Mandatory Measures

Sec 150.0

Subchapter 8 – Performance and Prescriptive

[*New Construction*]

Sec 150.1

Subchapter 9 – Additions and Alterations

Sec 150.2

T24 Part 6 Energy Code – Subchapter Organization

All [*regulated*] *Occupancies*

(A, B, E, F, H, I M, R, S, or U, except I-3 and I-4)

Subchapter 1 –All Occupancy –Scope, Definitions

Subchapter 2 –All Occupancies – Mandatory Requirements

Sec 100.0-100.3 & Sec 110.0-110.12

Not Residential

Subchapter 3 – Nonresidential, Hotel/Motel, Covered Process –Mandatory Requirements

[*HVAC and Ventilation*]

Sec 120.0-120.9

Subchapter 4 – Nonresidential, Hotel/Motel –Mandatory Requirements

[*Lighting and Power*]

Sec 130.0-130.5

Subchapter 5 –Performance and Prescriptive

[*New Construction*]

Sec 140.0-140.9

Subchapter 6 – Additions and Alterations

Sec 141.0-141.1

Single Family Res

Subchapter 7 –Single Family Residential Mandatory Measures

Sec 150.0

Subchapter 8 – Performance and Prescriptive

[*New Construction*]

Sec 150.1

Subchapter 9 – Additions and Alterations

Sec 150.2

Multifamily Res

Subchapter 10 – Multifamily Residential Mandatory Measures

Sec 160.0-160.9

Subchapter 11 – Performance and Prescriptive

[*New Construction]*

Sec 170.0-170.2

Subchapter 12 – Additions and Alterations

Sec 180.0-180.4

Multifamily Residence

Review High Level Changes
Highlight Key Changes under the Performance Method

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
- Lighting changes
- Electric ready
- Photovoltaics and Batteries

Many of the changes effecting energy efficiency have become part of the Mandatory requirements.

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

Performance Method (Computer Modeling)

Two Metric Types:

- **Source Energy Budget** is the efficiency of the energy used by the building (site energy) as well the energy used to produce, procure, and distribute it from a particular source. It serves as **proxy for carbon-based metric.**
- **TDV Energy Budget** is the efficiency of the building's source energy and brings in TDV multipliers based on when the energy is being used to reflect the actual cost, supply, and demand. It serves to **encourage better performance during peak hours.**

Key Take-aways for 2022

Source Energy
New proxy for carbon

Compliance software has changes to the **Standard Design** which now **varies by climate zone** and includes **heat pump space conditioning as Multifamily baseline.**

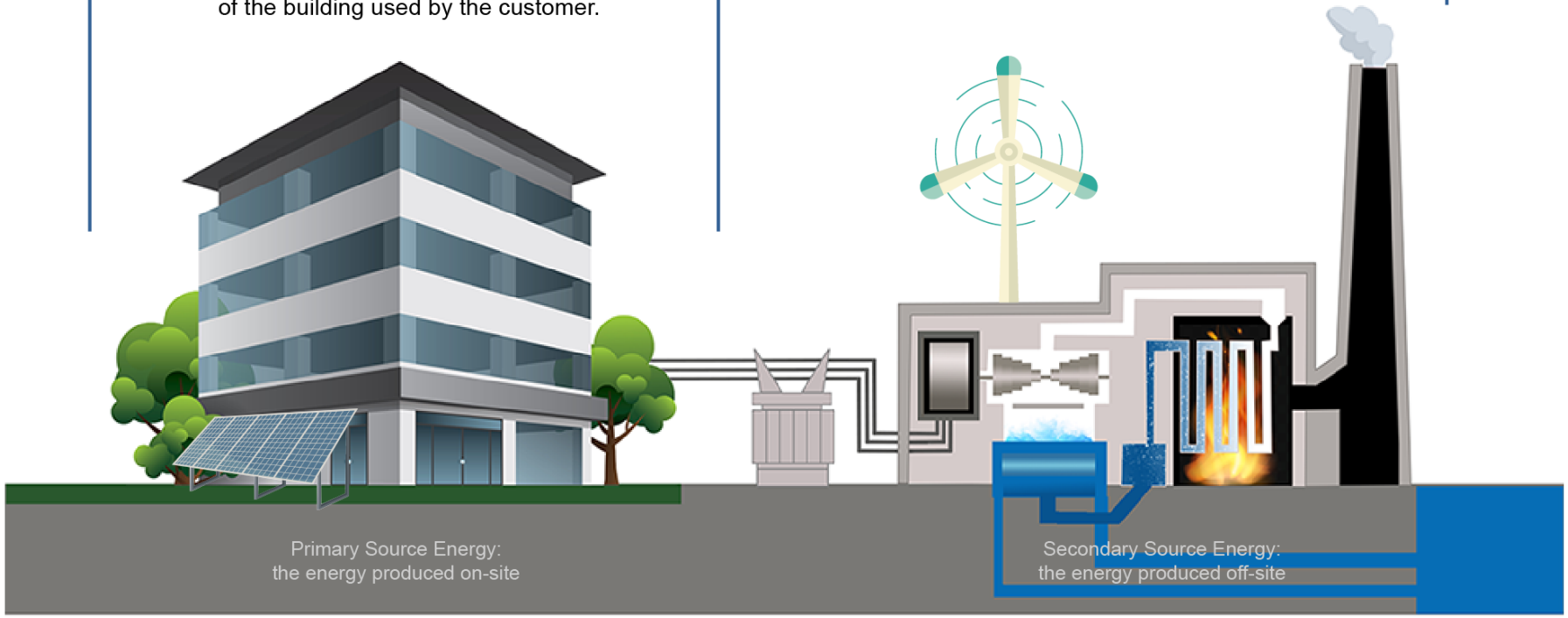
TDV ENERGY

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

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

Mandatory Measures

Section 110.0
Section 160.0
Minor changes to Water Heating and Lighting
Major changes to IAQ Ventilation, and Electric Ready

Change for All Occupancies

Updated equipment efficiencies in Section 110.0-110.12

Although it applies to all occupancies, the changes will most likely affect the common/non-res spaces, and dwellings with central systems.

Mixed Occupancies- Section 110.0(f)

- When a building is designed and constructed for **more than one type of occupancy (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**.

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:

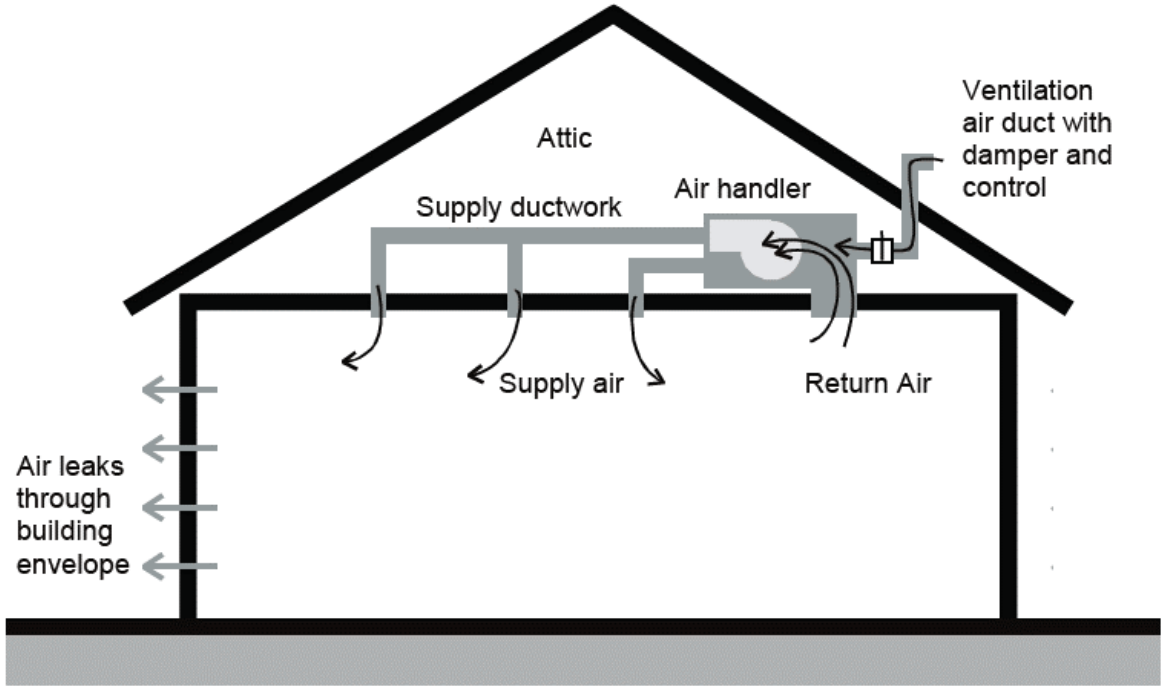
- Central Fan Integrated (CFI) Ventilation Systems
- Kitchen and Bathroom Exhaust
- Prescriptive Ventilation Duct Sizing
- Balanced Ventilation with Heat/Energy Recovery
- Required Testing of Ventilation System Air Flow

Central Fan Integrated (CFI) Ventilation Systems

New language to clarify when and how CFI systems can be used and operated:

- Outdoor Air Dampers Required
- Damper Controls –Clarified Operation
- Variable Ventilation – Clarified Controls and Operation

Main premise did not change: Continuous fan operation not permissible way of meeting indoor air quality ventilation

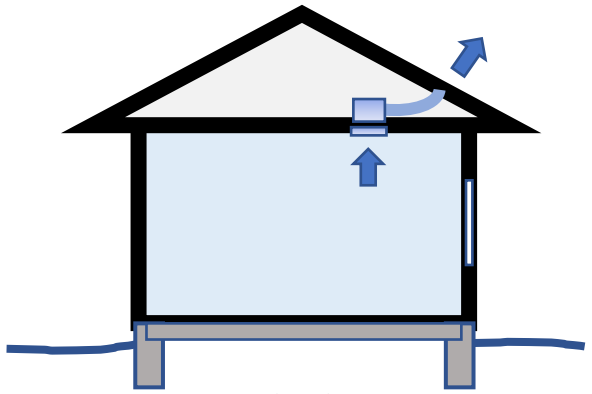


Source: California Energy Commission

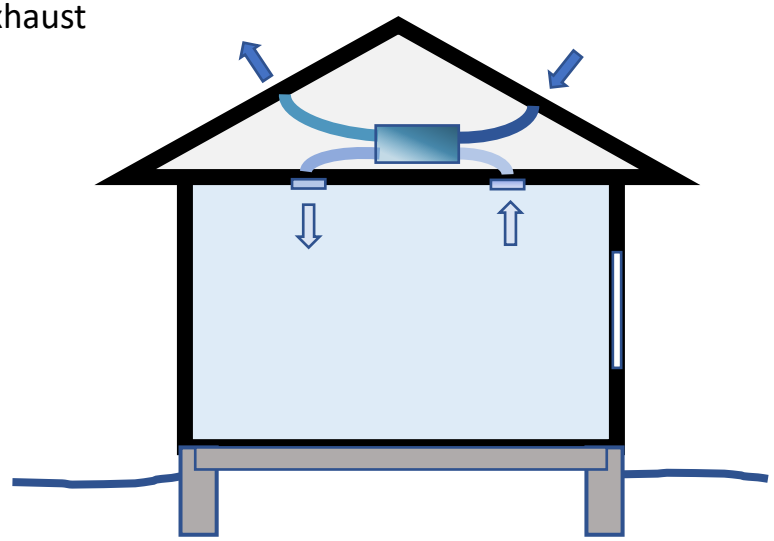
Mechanical Exhaust –Kitchens and Bathrooms

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

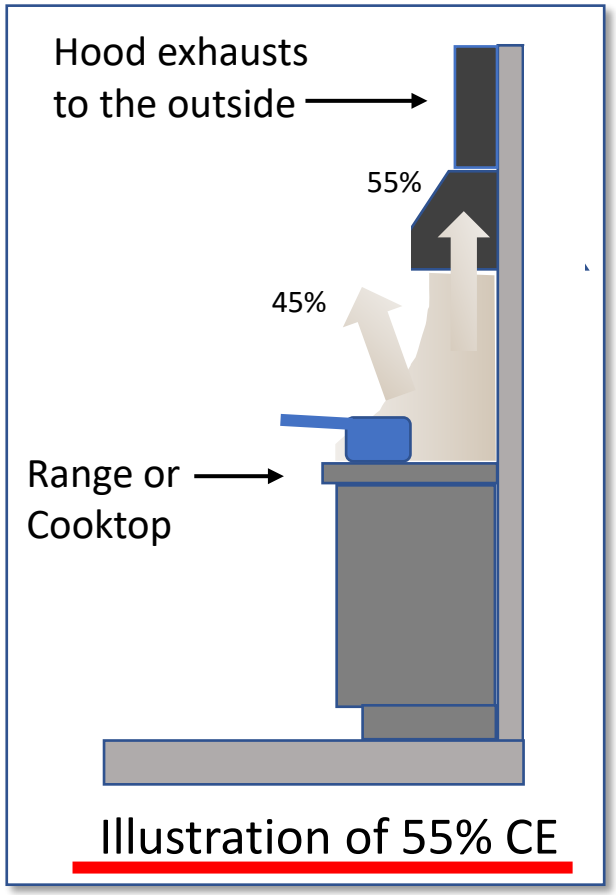


Illustration of 55% CE

- 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

Lighting

(a) Dwelling Unit Lighting:
Table 160.5-A CLASSIFICATION OF HIGH LUMINOUS EFFICACY LIGHT SOURCES
–**Removed some of the LED light sources** that did not need to meet JA8

Minor Updates:

- **Joint Appendix JA8** which provides the qualification requirements for high luminous efficacy light sources
- **Recessed Luminaires** must meet the clearance and installation requirements of **California Electrical Code Section 410.116**
- **Blank Electrical Boxes**. The number of electrical boxes that are more than 5 feet above the finished floor and do not contain a luminaire or other device shall be **no greater than the number of bedrooms**. These electrical boxes must be **served by a dimmer, vacancy sensor control, low voltage wiring or fan speed control**.

(b) Common Services Areas Lighting:

- ***All* non-dwelling/common-living spaces, parking garage areas, outdoor lighting, and associated controls** follow nearly the same mandatory requirements as under the non-res (section 130) lighting standards.
- Minor changes from 2019 to 2022 Standards, and
- **Secondary daylit zones** have been included in the **daylighting controls** requirements under the 2022 standards.

Electric Power Distribution Systems

Clarify:

Multifamily buildings shall comply with the applicable requirements of Sections 160.6(a) through 160.6(e).

(a) Service Electrical Metering

(b) Separation of Electrical Circuits for Electrical Energy Monitoring

EXCEPTION 2 to Section 160.6(b): Sub-metered electrical power distribution systems that provide power to **dwelling units**

(c) Voltage Drop

(d) Circuit Controls for 120-Volt Receptacles and Controlled Receptacles

EXCEPTION 2 to Section 160.6(d): Receptacles in **common use areas providing** shared provisions for living, eating, cooking, or sanitation **to dwelling units** that would otherwise lack these provisions.

Key Take Away:

- Minimal change.
- Code clarifies that the non-dwelling unit portions of multifamily buildings must comply and dwelling units are exempt.

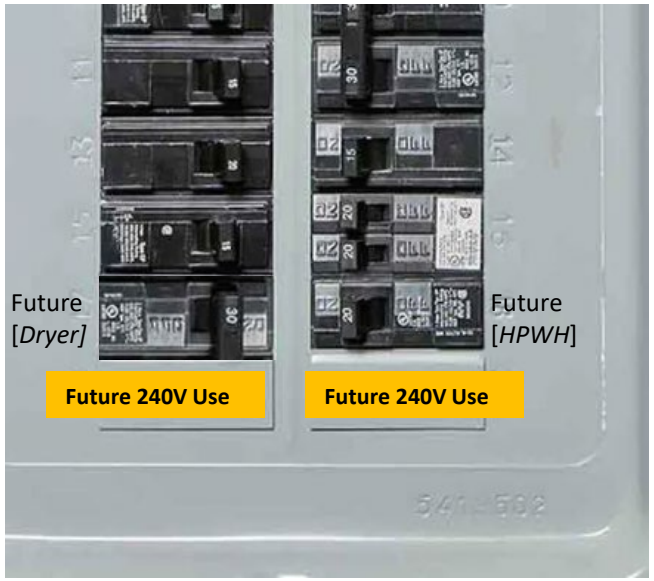
Water Heater 160.4 and Electric Ready Buildings 160.9

–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

New Construction Prescriptive and Performance

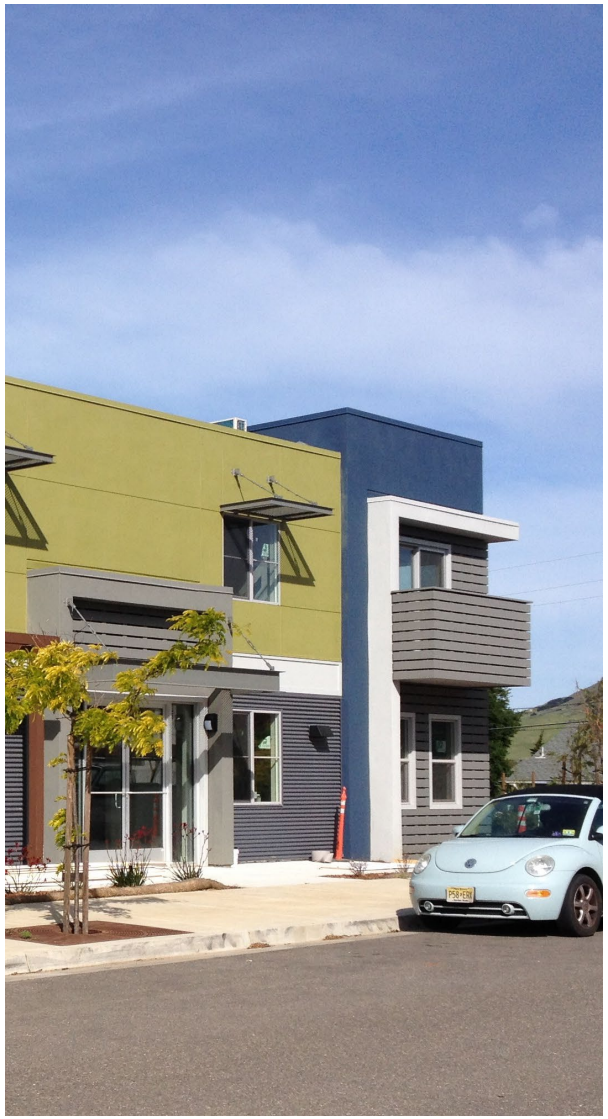
Section 170.0
Performance 170.1 and Prescriptive 170.2(a through (f)
Minor changes to Insulation and Envelope, Space Heating, Domestic Hot Water, IAQ Ventilation and Solar Electric

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

Fenestration

Fenestration performance requirements based on product type and # of floors

Fenestration area allowance based on window and floor area.

		Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fenestration	Curtain Wall/ Storefront	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
		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
		Minimum VT, four or more 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[5]	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.

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[e]	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

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

3 stories or less in CZ 4-10:

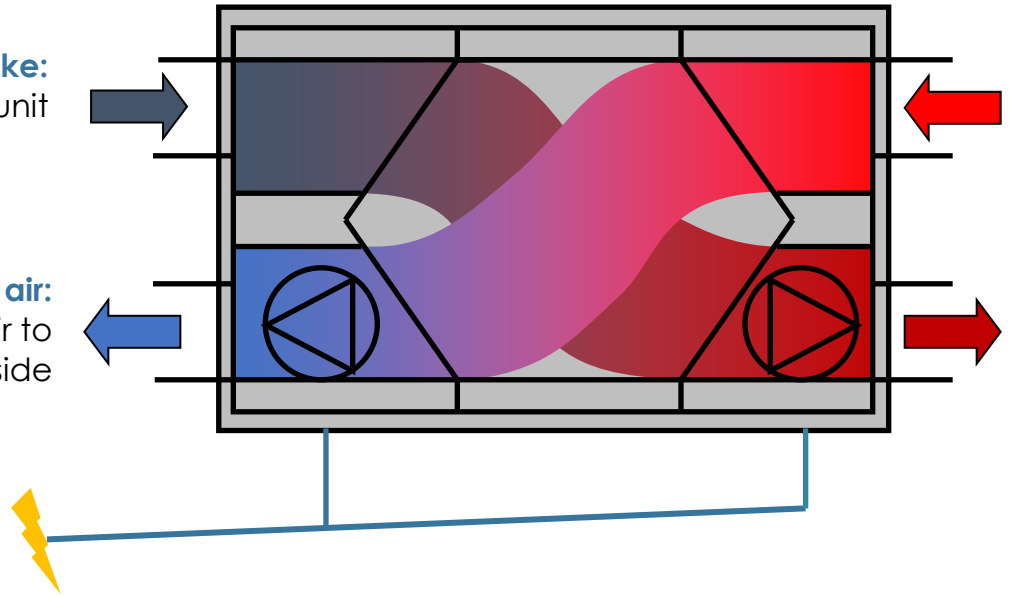
- **If heat pump** space conditioning system is installed to meet requirements, a balanced ventilation system without an ERV or HRV shall have a **fan efficacy ≤0.4 W/cfm**

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

Example:
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

Fan Systems- Common Area

- Table 170.2-B Supply Fan Power Allowances (watts/cfm)
- For common areas only with air handling units
- Limitations on fan power*
- Dedicated outdoor air systems*

	Multi-Zone VAV Systems ≤5,000 cfm	Multi-Zone VAV Systems >5,000 and ≤10,000 cfm	Multi-Zone VAV Systems >10,000 cfm	All Other Fan Systems ≤5,000 cfm	All Other Fan Systems >5,000 and ≤10,000 cfm	All Other Fan Systems >10,000 cfm
Supply System Base Allowance for AHU Serving Spaces < 6 Floors Away.	0.395	0.453	0.413	0.232	0.256	0.236
Supply System Base Allowance for AHU Serving Spaces > 6 Floors Away	0.508	0.548	0.501	0.349	0.356	0.325
MERV 13 to MERV 16 Filter Upstream of Thermal Conditioning Equipment (two times the clean filter pressure drop~~mid-life~~)[2]	0.136	0.114	0.105	0.139	0.120	0.107
MERV 13 to MERV 16 Final Filter Downstream of Thermal Conditioning Equipment. (two times the clean filter pressure drop~~mid-life~~)[2]	0.225	0.188	0.176	0.231	0.197	0.177

Credit to fan components that save energy

*Similar to non-residential requirements

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)

Domestic Hot Water

- The following are allowed for individual dwelling units:
  - 240 volt HPWH (CZ 1 and 16 allowed with compact hot water distribution or CZ 16 with drain water heat recovery system)

  OR

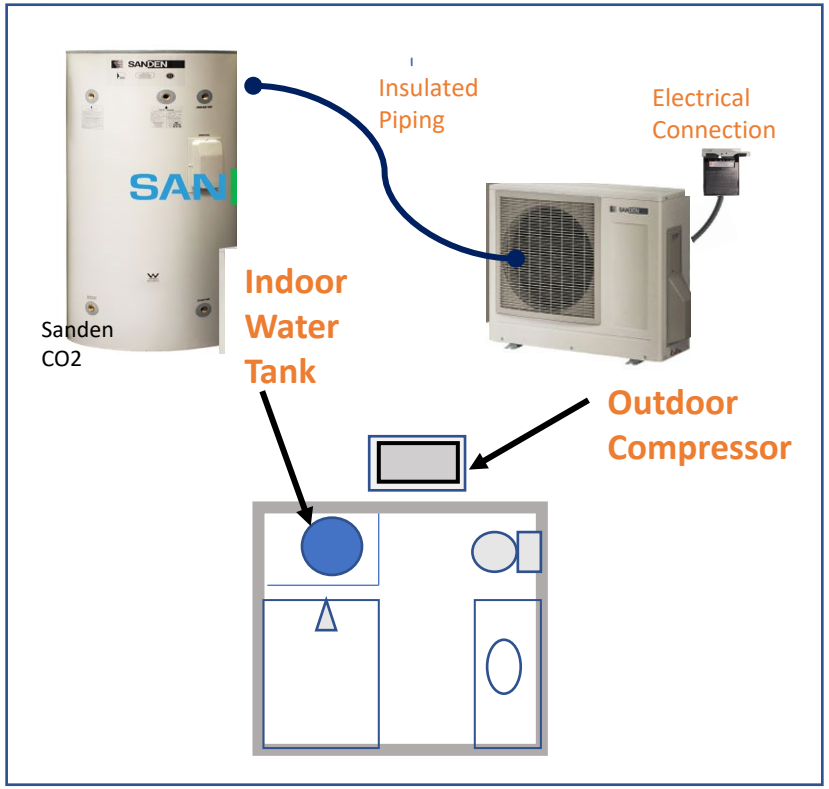
  - NEEA-rated Tier 3 HPWH (CZ 16 allowed with drain water heat recovery system)

  OR

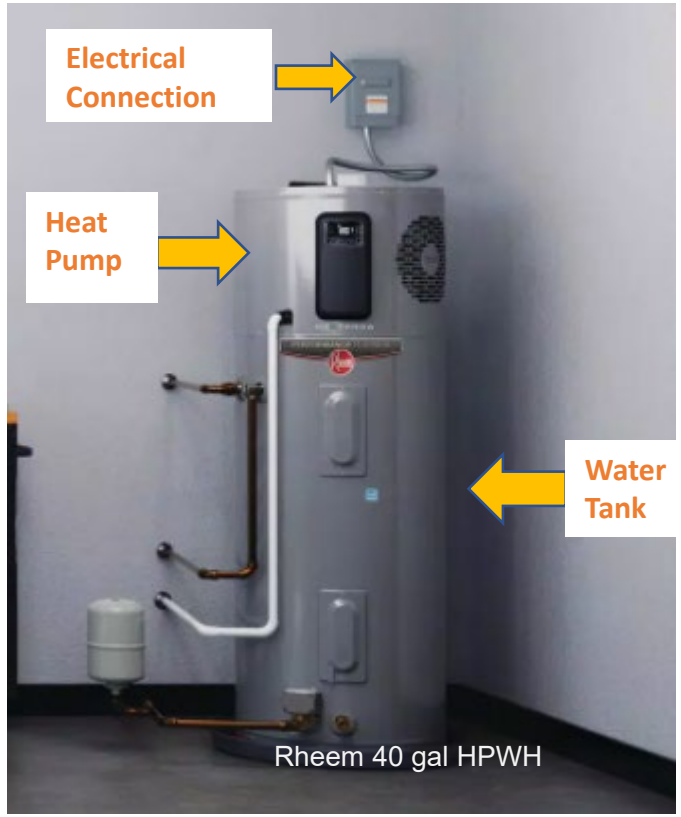
  - Gas or propane instantaneous water heater with an input of 200,000 Btu/hr or less

Prescriptive Change

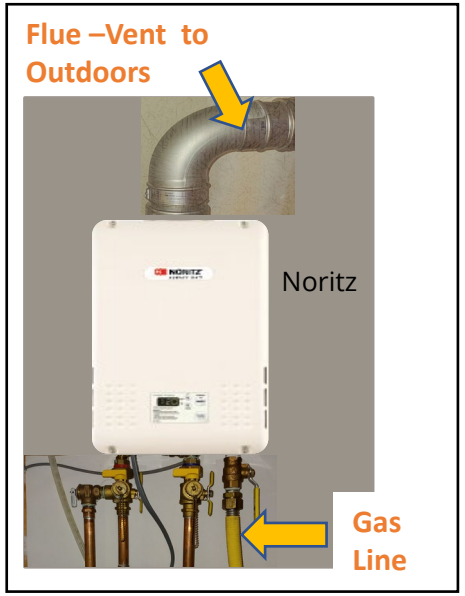
Split-System Heat Pump



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

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

Requirements for clustered HPWH have been clarified.

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: 0.20
    - CA 10-16: 0.35
    - Solar can be reduced by 5% with a drain water heat recovery system

Eliminated the requirement for 2 or more recirculation loops

Lighting

- Dwelling unit requirements match single-family changes
- Common area requirements mostly match nonresidential changes
- Outdoor lighting has calculation changes
- Sign lighting has minimal changes

Minor changes.

Area Category Allowances for Common Areas

Primary Function Area	Allowed Lighting Power Density for General Lighting (W/ft²)	Additional Lighting Power Qualified Lighting Systems	Additional Lighting Power Additional Allowance (W/ft², unless noted otherwise)
Storage	0.45	-	-
Conference, Multipurpose and Meeting Area	0.75	Display/Decorative	0.30
Copy Room	0.50	-	-
Corridor Area	0.40	Decorative/Display	0.25
Dining Area Bar/Lounge and Fine Dining	0.45	Display/Decorative	0.35
Dining Area Cafeteria/Fast Food	0.45	Display/Decorative	0.~~35~~25
Dining Area Family and Leisure	0.40	Display/Decorative	0.25
Health Care / Assisted Living Nurse's Station	0.75	Tunable white or dim-to-warm[8]	0.10
Health Care / Assisted Living Physical Therapy Room	0.85	Tunable white or dim-to-warm[8]	0.10
Kitchen/Food Preparation Area	0.95	-	-
Electrical, Mechanical, Telephone Rooms	0.40	Detailed Task Work[1]	0.20
Exercise/Fitness Center and Gymnasium Area	0.50	-	-
Lobby, Main Entry	0.70	Display/Decorative	0.25
Locker Room	0.45	-	-
Lounge, Breakroom, or Waiting Area	0.55	Display/Decorative	0.25
Concourse and Atria Area	0.60	Display/Decorative	0.25

*Partial table, see 170.2-M for full table

- Table 170.2-M for Lighting Power Density Values (watts/ft^2)
- Increased stringency
- Based on LEDs

Bring common spaces into MF. Clarification on calculation of allowed indoor lighting power

Prescriptive Changes

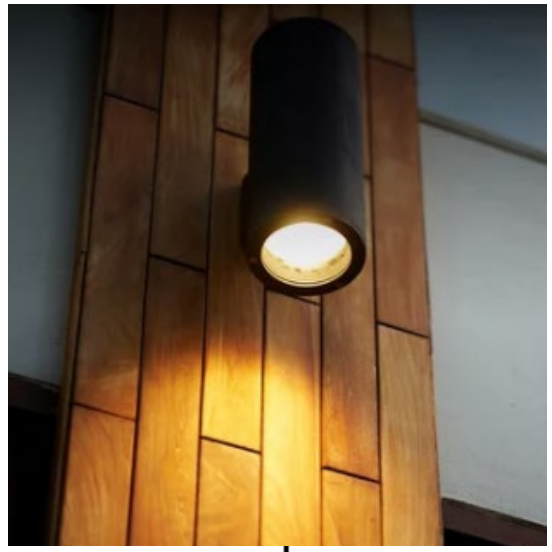
Office Area	> 250 square feet	0.60	Decorative/Display and Portable lighting for office areas[5]	0.20
Office Area	≤ 250 square feet	0.65	Decorative/Display and Portable lighting for office areas[5]	0.20
Parking Garage Area	Parking Zone and Ramps	0.10	First ATM or Ticket Machine	100 W
Parking Garage Area	Parking Zone and Ramps	0.10	Additional ATM or Ticket machine	50 W each
Parking Garage Area	Daylight Adaptation Zones[3]	1.00	-	-
Laundry Area		0.45	-	-
Restrooms		0.65	Decorative/ Display	0.35
Stairwell		0.60	Decorative/ Display	0.35
All other		0.40	-	-
Aging Eye/Low-vision[6]	Lobby, Main Entry	0.85	Display/Decorative	0.30
Aging Eye/Low-vision[6]	Lobby, Main Entry	0.85	Transition Lighting OFF at night[7]	0.95
Aging Eye/Low-vision[6]	Stairwell	0.80	Display/Decorative	0.30
Aging Eye/Low-vision[6]	Corridor Area	0.70	Display/Decorative	0.30
Aging Eye/Low-vision[6]	Lounge/Waiting Area	0.80	Display/Decorative	0.30
Aging Eye/Low-vision[6]	Multipurpose Room	0.85	Display/Decorative	0.30
Aging Eye/Low-vision[6]	Dining	0.80	Display/Decorative	0.30
Aging Eye/Low-vision[6]	Restroom	1.00	Display/Decorative	0.20

*Partial table, see 170.2-M for full table

- Area Category Allowances for common areas
  - Lighting Power Density Values (watts/ft^2)Table 170.2-M

Outdoor Lighting

- Residential outdoor lighting controls apply to luminaires controlled from the dwelling unit
- Outdoor lighting zone applications have changed in Section 10-114
- Urban (moderately high); Urban Clusters (Moderate)



LZ2	Moderate	~~Rural areas~~Urban clusters, as defined by the 2010 U.S. Census. The following building types may occur here: multifamily housing, mixed use residential neighborhoods, religious facilities, schools, and light commercial business districts or industrial zoning districts.
LZ3	Moderately High	Urban areas, as defined by the 2010 U.S. Census. The following building types may occur here: high intensity commercial corridors, entertainment centers, and heavy industrial or manufacturing zone districts.

General Hardscape Allowances

Table 170.2-R

Linear Wattage Allowance - removed

TABLE 170.2-R GENERAL HARDSCAPE MULTIFAMILY LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 0[2]	Lighting Zone 1[2]	Lighting Zone 2[2]	Lighting Zone 3[2]	Lighting Zone 4[2]
Area Wattage Allowance (AWA)	No allowance[1]	0.026 W/ft²	0.030 W/ft²	0.038 W/ft²	0.055 W/ft²
Initial Wattage Allowance (IWA)	No allowance[1]	300 W	350 W	400 W	450 W

Change from 2019: Change in methodology

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

Change from 2019: Slight modifications to definitions, and new formula for high-rise residential

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

Cox Cottages, Santa Maria, CA

CFA = 1,141 SF Climate Zone 5

N_{DU} = 2

kW_{PV} = [(1,141 x 0.585)/1000]+(2 x 1.06)

kW_{PV} = 0.667 + 2.12

kW_{PV} = 2.78 = 3 kW system

The new exceptions were based on CEC cost effectiveness studies

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 the 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 Storage for 4+ Stories

Applies to **high-rise (4 stories or more)** when PV systems are required

Two metrics: energy capacity (kWh) and power capacity (kW)

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

No battery storage system required:

- 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

Change from 2019: New Requirement

Estimating Panel System

Given a PV System Size (kW)

- Take the PV System Size (kW) calculated from EQ 170.2-C/D and multiply by 1000 to convert to Watts.
- Look at different PV Panel products and look for wattage/power (efficiency in Watts) and dimensions.
- Divide PV System Size (in watts) by wattage to determine an estimated number of units.
- Multiply number of units by dimensions of panels to determine area of solar array.

SolarWorld Sunmodule SW340 XL Mono 340W Solar Panel

Electrical Data	
Nominal Maximum Power (Pmax):	340 Watts
Open Circuit Voltage (Voc):	47.60 Volts
Maximum Power Point Voltage (Vmpp):	38.0 Volts

Example PV System Size = 4.21 kW*1000 = 4210 W

~# of Units = PV System Size/Wattage

~# of Units = 4210W/340W

~#of Units = 12.38

ESTIMATED # of UNITS = 13

Mechanical Data	
Technology:	Monocrystalline (Mono)
Dimensions:	78.46 x 37.80 x 1.30 inches = 20.6 SF
Weight:	47.60 lbs

Array Area = # of Units x Dimension of Panel

Array Area = 13 x 20.6 SF

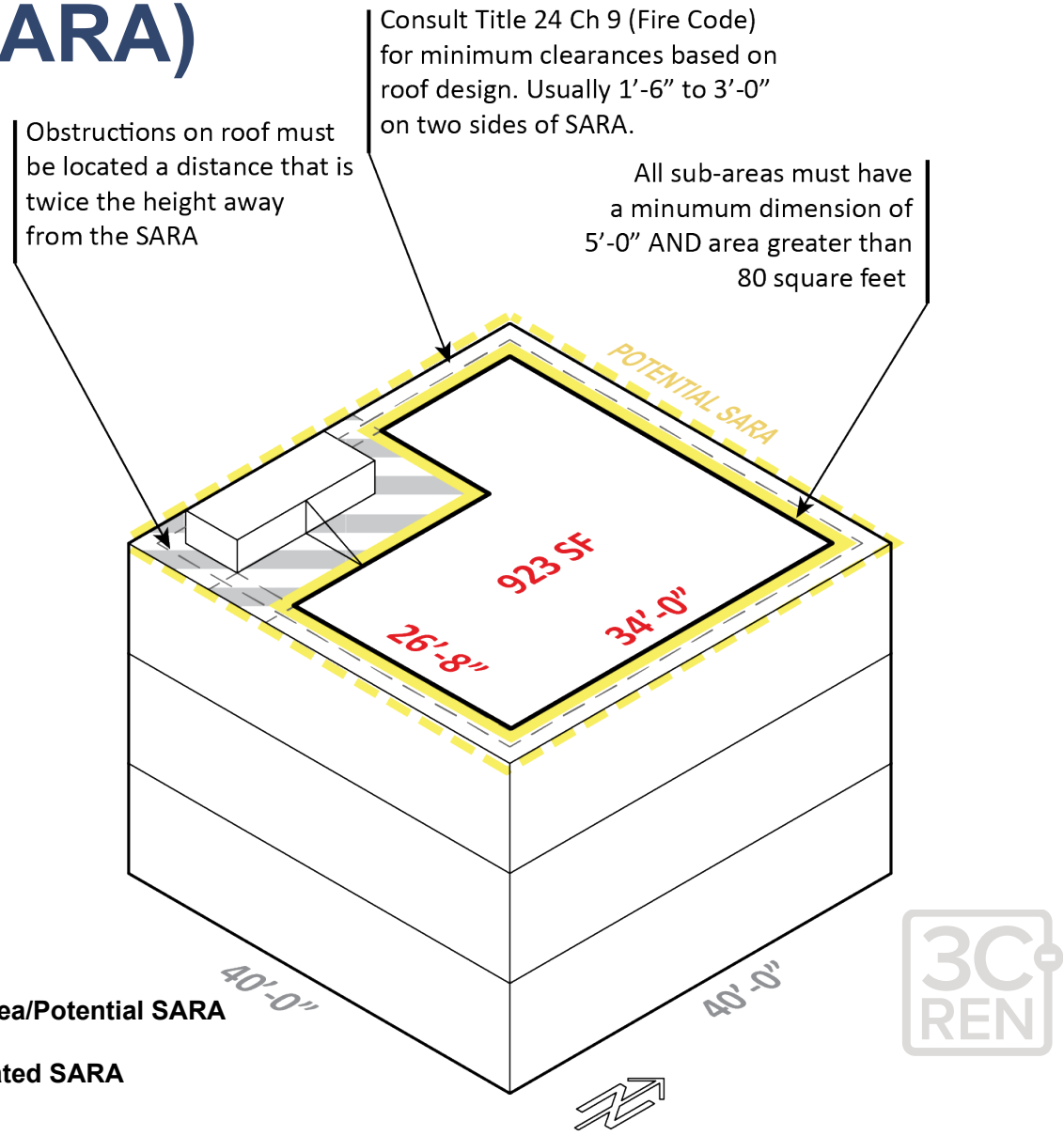
Array Area ≈ 267.8 SF

Solar Accessible Roof Area (SARA)

Determining SARA

Area of a buildings' roof space capable of supporting PV system that meets the following:

- Potential SARA is roof area that has more 70% annual solar access. If steep-slope, roof pitch must be oriented within 90 to 300 degrees of true north.
- **For Multi-Family**, total Designated SARA no less than 15% of total roof area, excluding skylights.
- If this cannot be met, Designated SARA should be 50% of Potential SARA
- **For Multi-Family**, Designated SARA is compliant because 923/1600 = 57% > 15%



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.

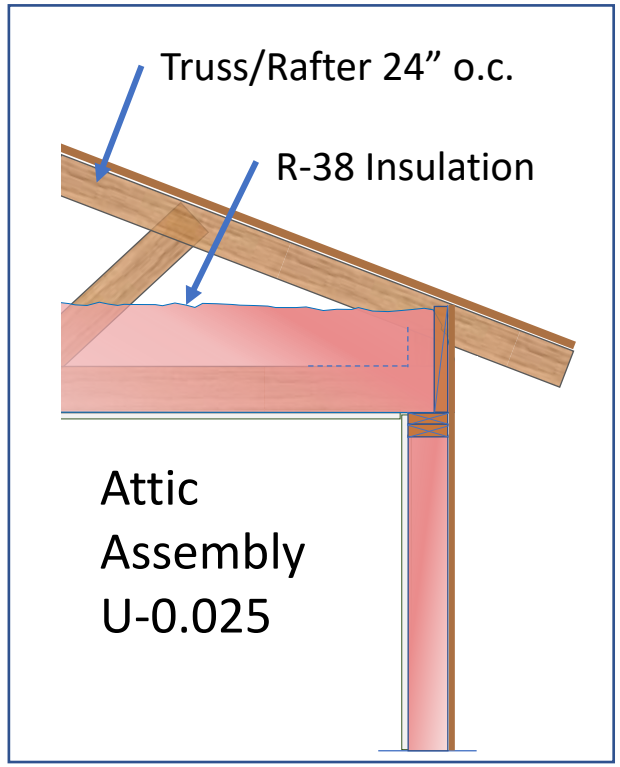
Additions –Roof and Ceiling

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

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

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

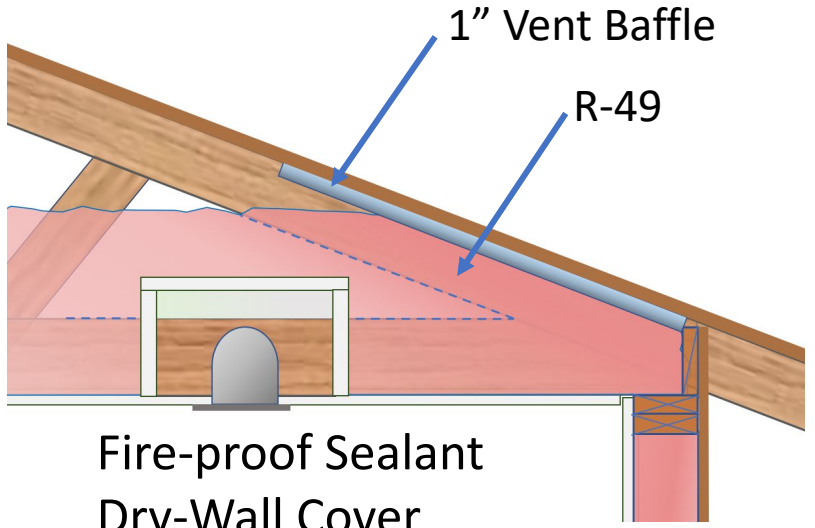
Altered ceilings shall be insulated to R-49 in CZ 1-4, 6, 8-16

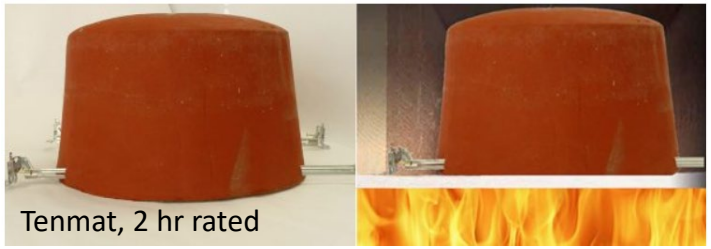
[not CZ 5 and 7]

- 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]*





Manufactured Cover

Alterations –Ceilings of Vented Attics

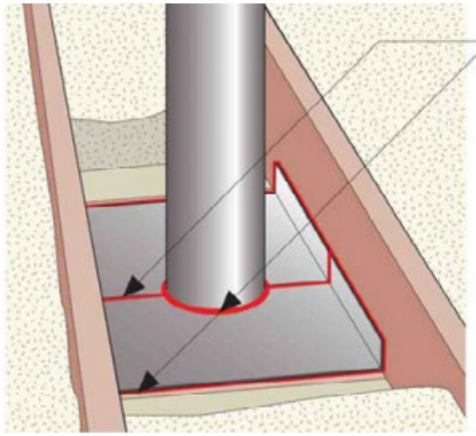
New Section

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



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.

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

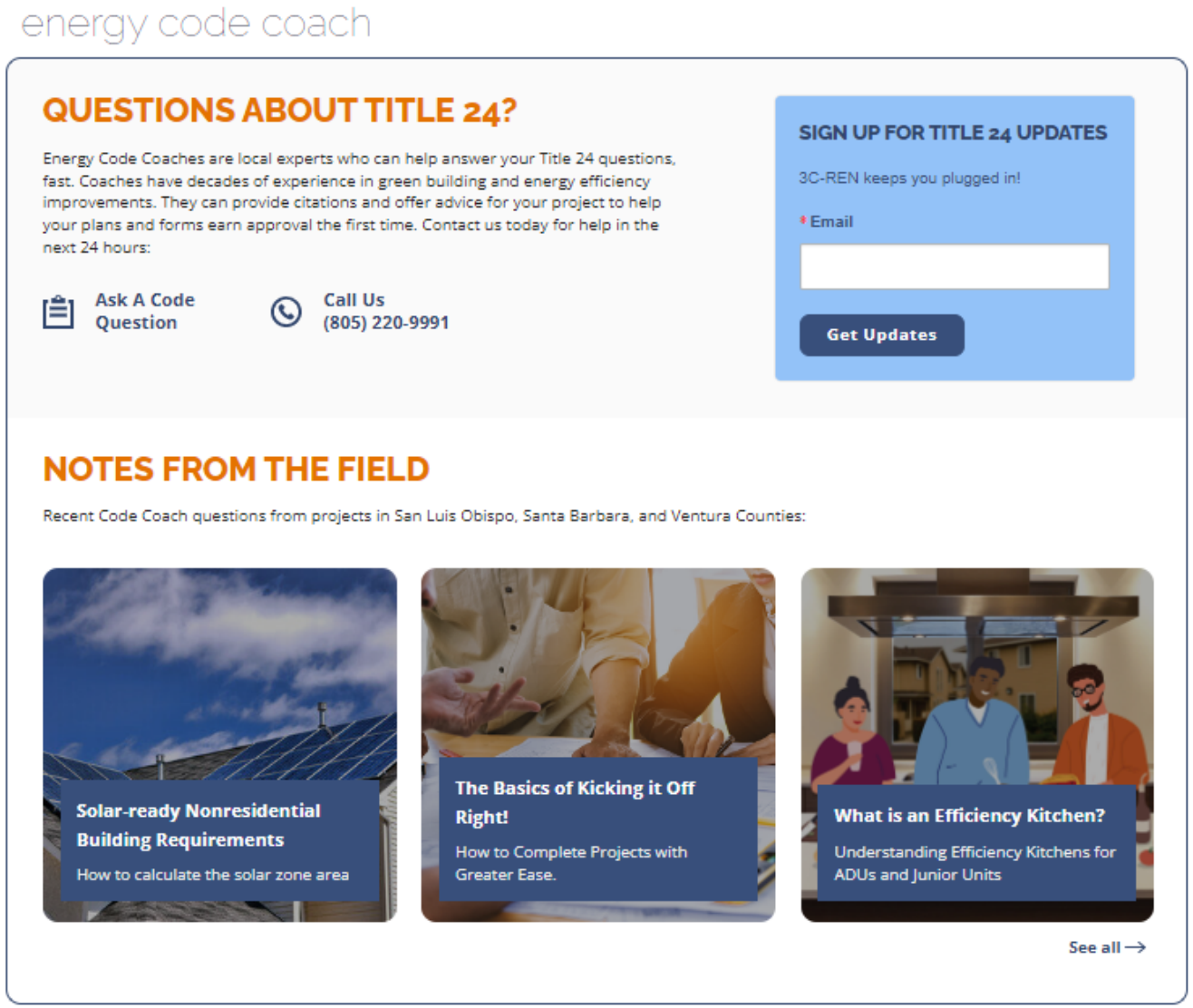
- Fan Replacement
- Fan Alteration
- Air Filters
- Kitchen Exhaust
- Bathroom Exhaust
- Exhaust Fan Replacement

New IAQ Ventilation Sections

Dedicated Balanced IAQ Ventilation with Heat Recovery

Have Questions? Contact your local CODE COACH

https://www.3c-ren.org/energy-code-connect



Closing

- Continuing Education Units Available
  - Contact shuskey@co.slo.ca.us for AIA and ICC LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - April 6th - High Performance Buildings & Careers – Class 1: High Performance Fundamentals Series
  - April 11th – Heat Recovery Ventilation in Existing Multifamily Buildings
  - April 18th – Electrification Products for the Central Coast Climate
  - April 20th - Using Building Science to Design and Build High Performance Homes – Class 2: HPF Series
  - April 25th - Intro to Residential HVAC Design (ACAA) Part 1
  - April 27th - Intro to Residential HVAC Design (ACAA) Part 2
  - Become a HERS Rater – Complete Interest Form at 3C-REN.org
  - Passive House Designer/ Consultant Certification – Complete Interest Form at 3C-REN.org

Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org

3C REN

TRI-COUNTY REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA