Round 2

Welcome to the California Statewide Codes and Standards Enhancement (CASE) Team's Stakeholder Meeting on

Multifamily Chapter Restructuring

We will begin shortly.

In the meantime, please fill out the polls below.

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Pacific Gas and Electric Company

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

SDGE
A Sempra Energy utility

LA DWP Los Angeles Department of Water & Power

SMUD

Welcome: Connect Your Audio

Audio – there are **three** options for connecting to the meeting audio: **Options 1 & 2** *recommended for those who wish to provide oral comments.*

To view options, click on the  icon on the top ribbon, then select *Connect My Audio.*

1. **Dial-out:** receive a call from the meeting. *Please note this feature* ***requires a direct line.***
2. **Dial-in:** dial-in to the conference via phone. Conference phone number and room number code provided. *Please then* ***identify your line*** *by entering your unique user ID on your phone.*
3. Use the **microphone** from your computer/device.

Above*: audio conference settings pop-up box*

2022 TITLE 24 CODE CYCLE, PART 6

Second Utility-Sponsored Stakeholder Meeting

Multifamily Chapter Restructuring

Statewide CASE Team

May 7, 2020

CALIFORNIA ENERGY CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

Meeting Guidelines – Computer/Device Users

Part 1a of 4 – Muting & Unmuting

Muting Guidelines:

To keep meetings running smoothly, all participants will be **muted upon entry**.

Participants will be **manually unmuted** by the Meeting Hosts.

Unmuting Guidelines:

If you are using your computer's microphone, in order to speak when prompted, you must first connect your audio by hovering over the  icon, then clicking *Connect My Audio > Using Microphone (Computer/Device).*

Meeting Guidelines – Dial-out/Dial-in Phone Users

Part 1b of 4 – Muting & Unmuting

Muting Guidelines:

To keep meetings running smoothly, all participants will be **muted upon entry**.

Participants will be **manually unmuted** by the Meeting Hosts.

Unmuting Guidelines:

1. If you are dialed in to the meeting, Meeting Hosts will unmute your specific line when it is your turn to speak. Your line is then active.
2. If you have **locally** muted your device, please also make sure to unmute before speaking.

Meeting Guidelines – Dial-in Phone Users

Part 2 of 4 - Pairing

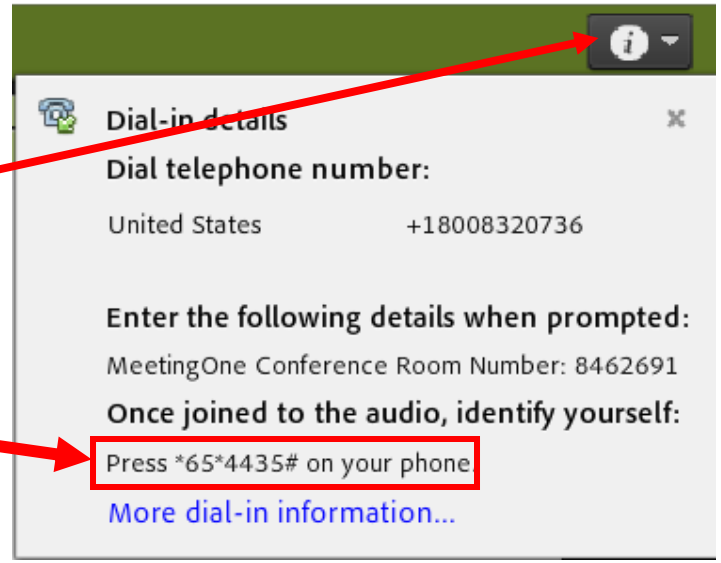
Pairing Guidelines:

If you **dialed in by phone** to join meeting audio, please **pair your line**. Dial-out users will be paired automatically.

- Navigate to the (i) button in the top right of your screen.
- Click the pull-down menu and ***identify your line*** *by entering your unique user ID on your phone.*

Steps to Pair Line:

1. **Select (i) button** pull-down on the top right of Adobe Connect window;
2. **Identify** your line using your unique code.

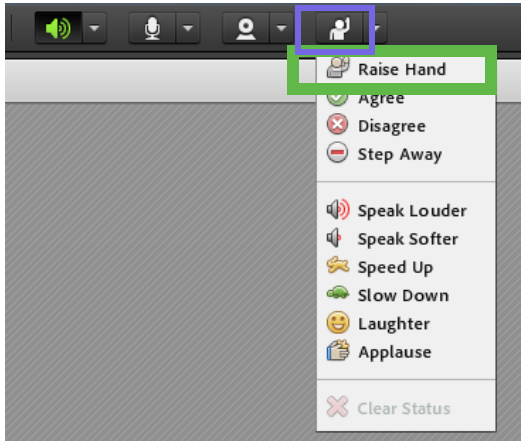


Meeting Guidelines – All Users

Part 3 of 4 - Participation

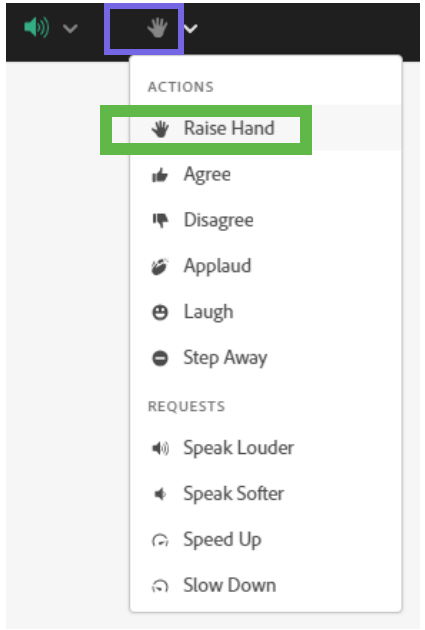
Participation Guidelines:

- **Questions & Comments**
  - Click ***"Raise Hand"*** if you would like to speak. Those with a hand raised will be called on by the speaker.
    - Meeting Hosts will then unmute your line, enabling others to hear your audio.
  - All questions and comments are also welcome via the chat window.
- **Other Meeting Feedback**
  - Provide live meeting feedback from the **top toolbar drop-down**.



***Above**: feedback view for Adobe Connect app users.*

***Below**: feedback view for HTML users.*



Meeting Guidelines – All Users

Part 4 of 4 – Discussion Ground Rules

- **We want to hear your thoughts.**
  - Supporting and opposing viewpoints are welcome.
- **When making comments, please:**
  1. Raise your hand; you will be unmuted and called on;
     - Computer/device users have the *additional* step to *Connect My Audio*
  2. Clearly state your name and affiliation prior to speaking
- Meeting Hosts will **place you back on mute** when done speaking.
- **Calls are recorded** for note development, recordings will not be publicized.
- Notes and presentation material will be posted on Title24Stakeholders.com/events.

Agenda

1	**Meeting Guidelines**	*8:30 am*
2	**Opening Remarks** from the California Energy Commission	*8:35 am*
3	**Overview & Welcome** from the Statewide Utility Team	*8:40 am*
4	**Presentation I:** Multifamily Chapter Restructuring	*8:45 am*
6	Wrap Up & Closing	*11:45 am*

Opening Remarks:
California Energy Commission

Policy Drivers: Building Standards

The following policy documents establish the goal for new building standards:

- **2008 CPUC/CEC Energy Action Plan** – ZNE for residential buildings by 2020 and nonresidential buildings by 2030
- **SB 100** – Clean electricity by 2045
- **B-55-18** – Governor Jerry Brown's Executive Order to achieve carbon neutrality
- **AB 3232** – Assess the potential for the state to reduce the emissions of greenhouse gases from the state's residential and commercial building stock by at least 40 percent below 1990 levels by January 1, 2030

2022 Updated Standards Schedule

Estimated Date	ACTIVITY OR MILESTONE
November 2018 – November 2019	Updated Weather Data Files
November 2018 – December 2019	Metric Development
November 2018 - July 2019	Measures Identified and Approved
April 24, 2019	Present the Efficiency Measure Proposal Template for public to submit measures
October 17, 2019	Compliance Metrics and Climate Data Workshop
August 2019 – November 2019	First Round of Utility-Sponsored Stakeholder Workshops
January 2020	Research Version of CBECC Available with new weather data files and updated metric
March 2020 – April 2020	Second Round of Utility-Sponsored Stakeholder Workshops
March 10, 2020	Staff Workshop on the proposed changes for the ATTCP program
March 26, 2020	Staff Workshop on the EDR1
March 2020 – May 2020	All Initial CASE/PUBLIC Reports Submitted to Commission
July 2020 – August 2020	All Final CASE/PUBLIC Reports Submitted to the Commission
August 2020 – October 2020	Commission-Sponsored Staff Workshops
September 2020 – November 2020	Express Terms Developed (including New Multifamily Section)
February 2021	45-Day Language posted and sent to list serve, Start of 45-Day review/comment period
March 2021	Lead Commissioner Hearing
July 2021	Adoption of 2022 Standards at Business Meeting
September 2021	Final Statement of Reasons Drafted and Approved
July 2021	Adoption of CALGreen (energy provisions) - Business Meeting
December 2021	Approval of the Manuals
October 2021	Final Rulemaking Package delivered to CBSC
December 2021	CBSC Approval Hearing
January 2021	Software, Compliance Manuals, Electronic Documents Available to Industry
January 1, 2023	Effective Date

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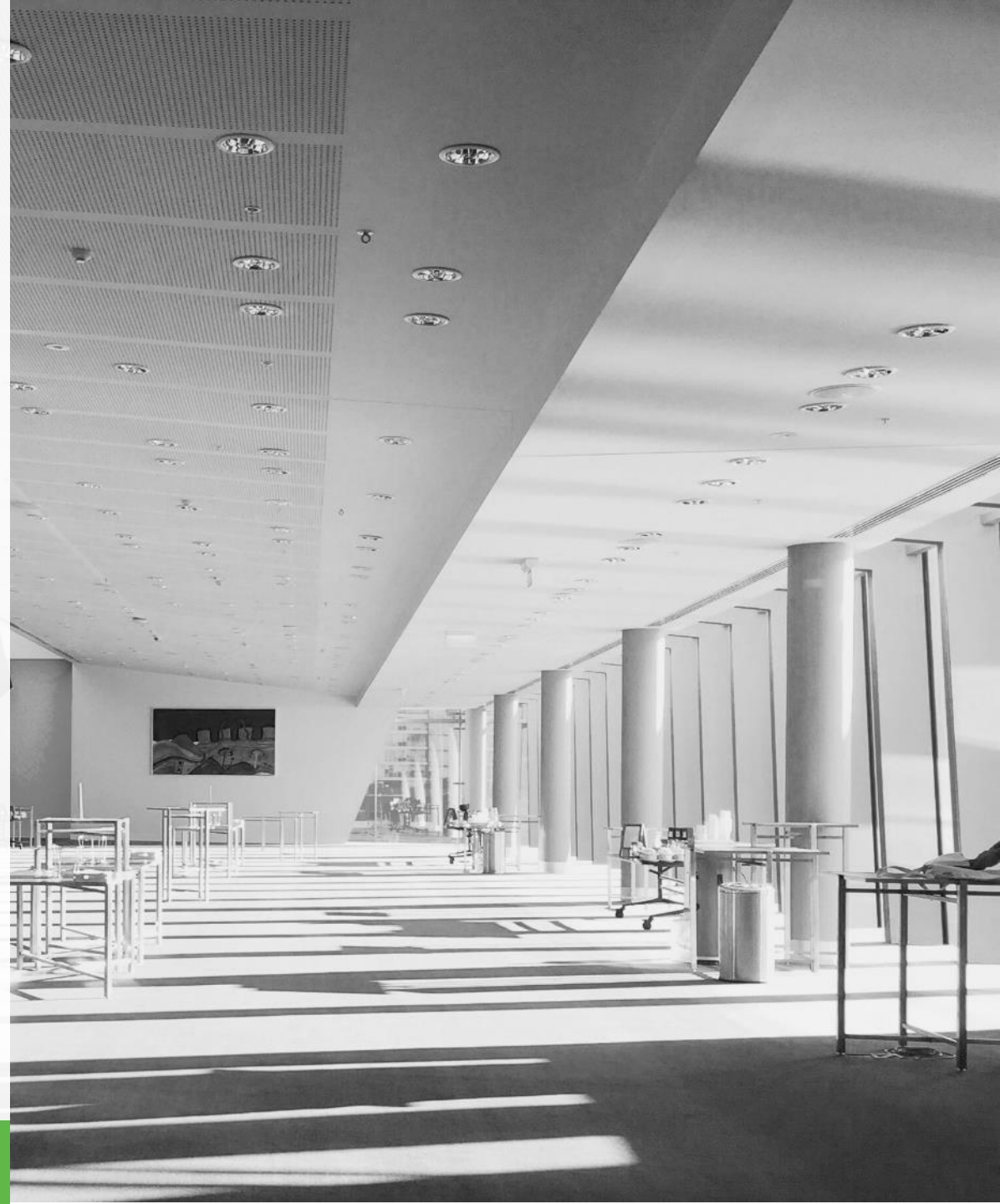
More information on pre-rulemaking for the 2022 Energy Code at:
https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

Title 24, Part 6 Overview

Kelly Cunningham
Codes and Standards
Pacific Gas & Electric



Statewide Utility Codes and Standards Team

Actively support the California Energy Commission in developing proposed changes to the Energy Code (Title 24, Part 6) to achieve significant statewide energy use reductions through the development of code change proposals for the 2022 cycle that are:

Feasible | Cost effective | Enforceable | Non-proprietary

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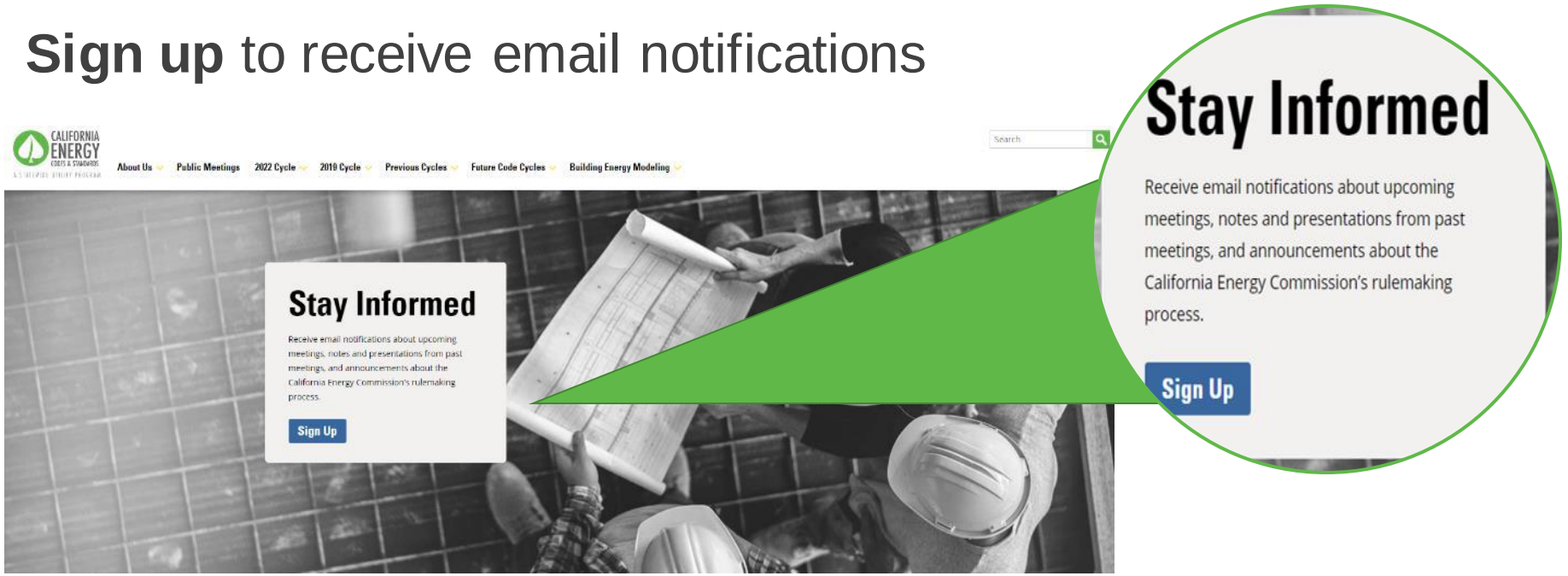
Utility-Sponsored Stakeholder Meetings

- All meetings can be attended **remotely**
- Check Title24Stakeholders.com/events for information about meetings and topic updates
- **Sign up** to receive email notifications

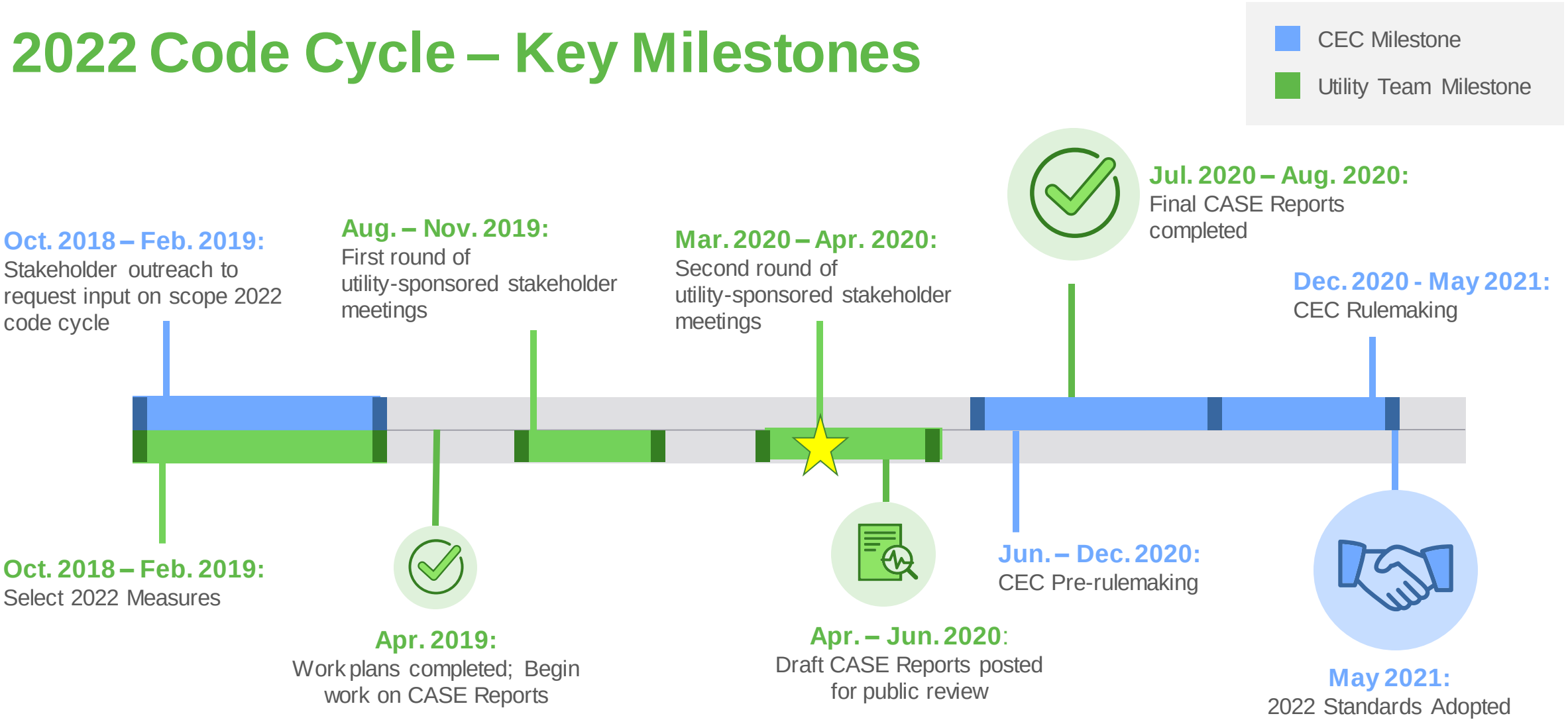


Second Round Utility-Sponsored Stakeholder Meetings

Meeting Topic	Building Type	Date
Lighting	NR/MF	Tuesday, March 3, 2020
Single Family Whole Building	SF	Thursday, March 5, 2020
Nonresidential and Single Family HVAC Part 1: Data Centers, Boilers, Air Distribution, Variable Capacity	NR/SF	Thursday, March 12, 2020
Water Heating and Multifamily All Electric Package	MF	Tuesday, March 17, 2020
Single Family Grid Integration	SF	Thursday, March 19, 2020
Multifamily HVAC and Envelope	MF	Wednesday, March 25, 2020
Covered Processes Part 1: Refrigeration System Opportunities	NR	Thursday, April 2, 2020
Nonresidential HVAC and Envelope Part 2: Reduced Infiltration, HVAC Controls (Air Efficiency, DOAS)	NR	Tuesday, April 14, 2020
Covered Processes Part 2: Controlled Environment Horticulture	NR	Thursday, April 16, 2020
Nonresidential Envelope: High Performance Envelope	NR	Thursday, April 23, 2020
Multifamily Restructuring	MF	Thursday, May 7, 2020

Sign up for all meetings at title24stakeholders.com/events/

2022 Code Cycle – Key Milestones



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to help you decode Title 24, Part 6 and Title 20

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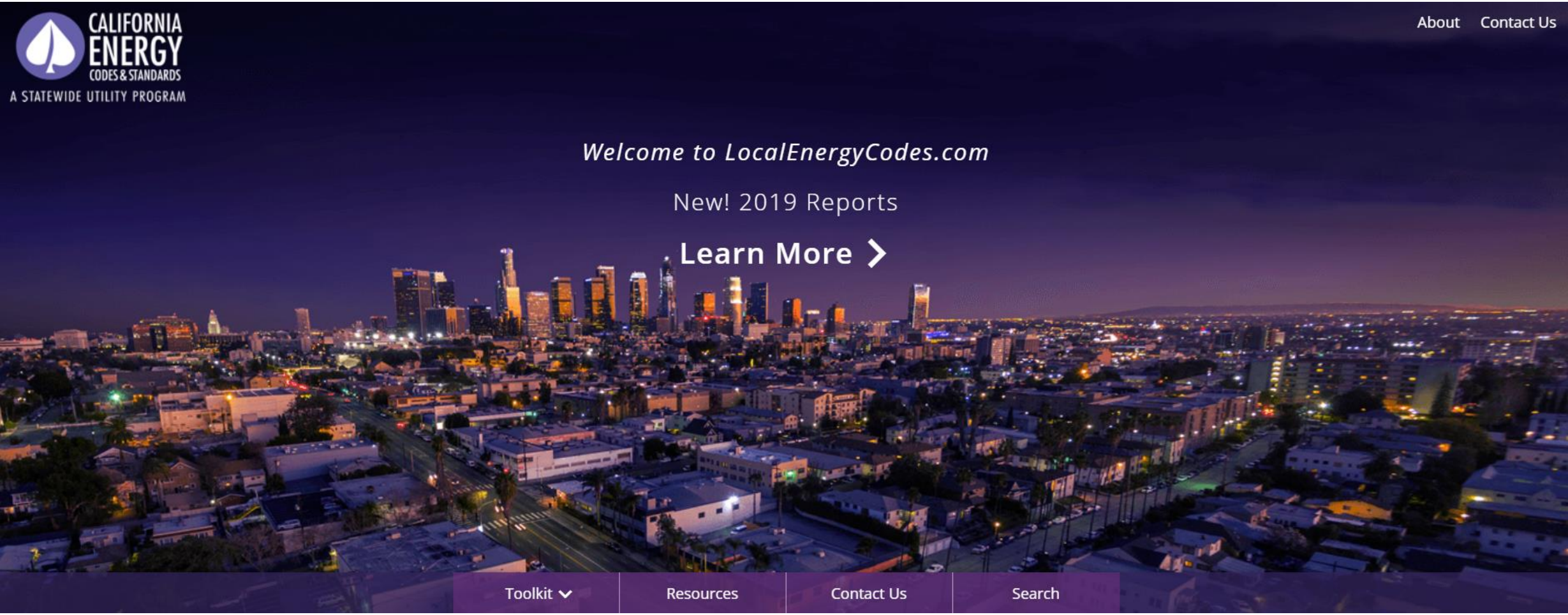
This program is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), Southern California Edison Company (SCE), and Southern California Gas Company (SoCalGas®) under the auspices of the California Public Utilities Commission.



The **Codes and Standards Reach Codes Program** provides technical support to local jurisdictions considering adopting a local energy and efficiency ordinance

www.LocalEnergyCodes.com

This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission.

Thank You

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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

2022 CALIFORNIA ENERGY CODE (TITLE 24, PART 6)

Multifamily Chapter Restructuring

Codes and Standards Enhancement (CASE) Proposal
Multifamily | Multifamily Chapter Restructuring

Elizabeth McCollum, TRC
May 7, 2020

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Agenda

1. Today's Objectives
2. Proposal Background
3. Proposed Code Language
4. Methodology for Energy Impacts Analysis
5. **Envelope** Submeasures
6. **HVAC** Submeasures
7. Questions and Next Steps

Today's Objectives

The focus of today's meeting includes:

1. **Revisit** background and intent of multifamily restructuring
2. **Introduce** proposed multifamily chapter language
3. **Present** proposed reapplication of 2019 low-rise and high-rise residential requirements

Code Change Proposal: Additional Resources

First-Utility Sponsored Meeting

The Statewide CASE Team held its first utility-sponsored stakeholder meetings for this topic on **February 8 and 25, 2019.**

Resources on Title24stakeholders.com

Presentation slides and **Submeasure summary** documents available that cover the following:

- ✓ Measure Background
- ✓ Market Overview & Analysis
- ✓ Technical Feasibility
- ✓ Compliance & Enforcement
- ✓ Draft Code Language

Also available in the **resources tab in today's presentation.**

Proposal Background

Context and History

- Multifamily makes up **30 percent** of projected 2023 residential new construction by dwelling units
- Multifamily building requirements depend on the number of stories

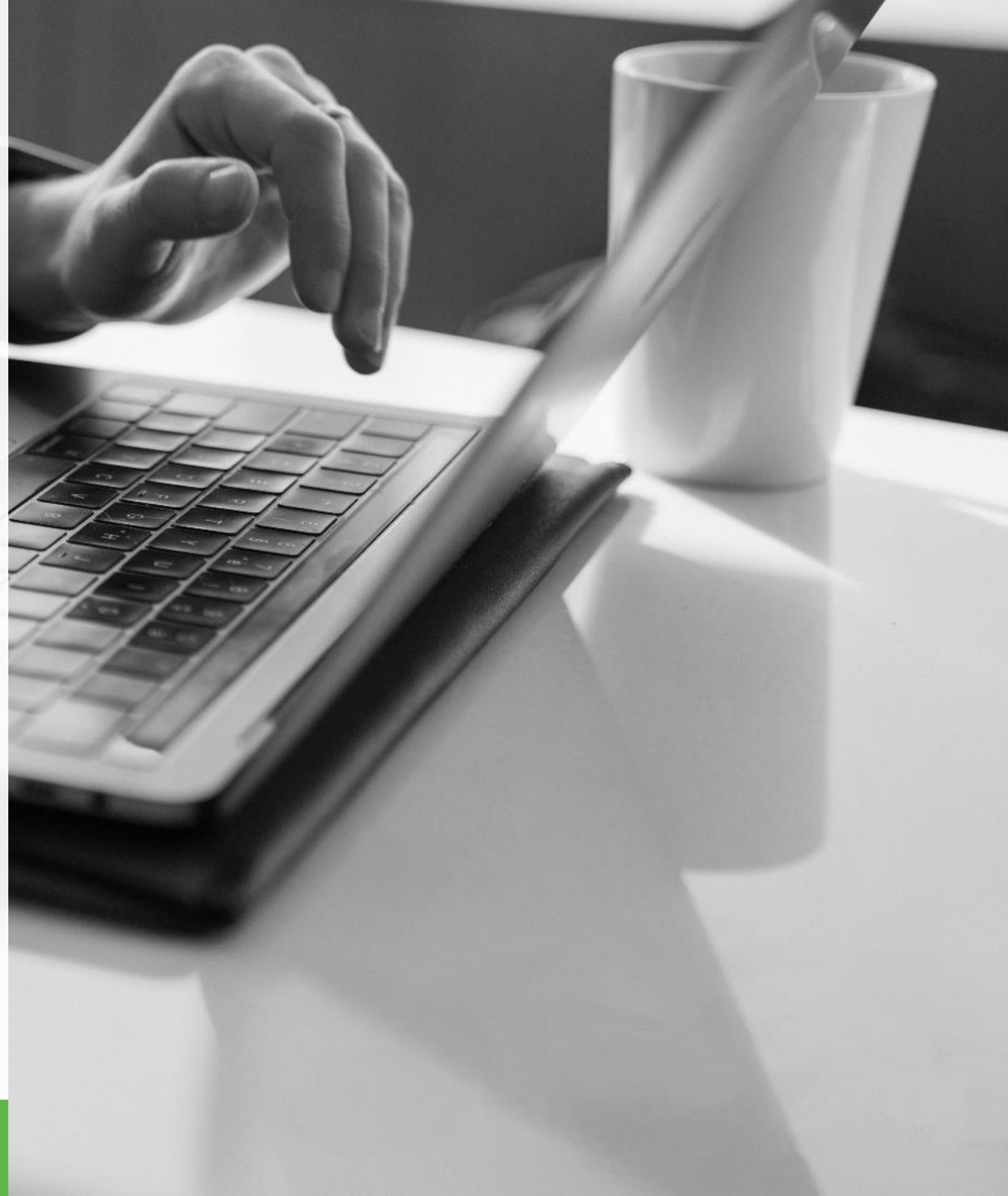
Low-Rise
Residential Code
3 or fewer stories

High-Rise
Nonresidential code
4 or more stories

Source: https://www.proudgreenbuilding.com/articles/icfs-featured-in-multifamily-housing-project/

Proposed Code Changes

- Definitions
- Reapplication of low-rise and high-rise residential requirements
- Chapter outlines



Proposed Definitions

- **Common Use Area** is a private use area, interior or exterior, within multifamily residential facilities where use is limited exclusively to owners, residents and their guests.
  - Consistent with Title 24, Part 2
- **Dwelling unit** is a single unit providing complete, independent living facilities for one or more persons including access permanent provisions for living, sleeping, eating, cooking and sanitation.
- **Nonresidential Building** is any building which is identified in the California Building Code Table; Description of Occupancy as Group A, B, E, F, H, I, M, or S; and is a U; as defined by Part 2 of Title 24 of the California Code or Regulation.
- ~~**High-Rise Residential**~~ **Multifamily Building** is a building, other than a hotel/motel, of Occupancy Group R-2 or R-4 ~~with four or more habitable stories~~.
- ~~**Low-Rise**~~ **Single Family Residential Building** is a building~~, other than a hotel/motel,~~ that is Occupancy Group:

  ~~R-2, multifamily, with three habitable stories or less; or~~
  R-3, single family; or
  U-building, located on a residential site.

Proposed Multifamily Chapters

The draft multifamily chapter language is available in the **resources tab.**

New section numbering: Simplified language from residential and nonresidential sections

- 160 Multifamily Buildings: Mandatory Features and Devices
- 170 Multifamily Buildings: Performance and Prescriptive Compliance Approaches
- 180 Multifamily Buildings: Additions and Alterations to Existing Buildings

Inclusive of dwelling units & common use areas.

Minimal reference to outside chapters.

- Section 110 for mandatory measures
- Sections 120, 130, 140, and 141 for nonresidential spaces within mixed use buildings

Impact of Combined Multifamily Chapters

	Residential	Nonresidential
Envelope	Combined by assembly type, with preference for more stringent	
HVAC	Systems serving individual dwelling units	Systems serving multiple dwelling units and/or common use areas
DHW	Dwelling unit and common use area systems	
Lighting	Indoor and outdoor lighting controlled from dwelling unit	Indoor and outdoor common use areas
Electric power distribution		Common use areas
Covered processes	Residential pools	Elevators and parking garages

SUBCHAPTER 10: MULTIFAMILY BUILDINGS MANDATORY REQUIREMENTS

New Section	Subsections	Content From	Change in Application
160.1 **BUILDING ENVELOPES**	(a) Ceiling and Roof Insulation (b) Wall Insulation (c) Floor and Soffit Insulation (d) Vapor Retarder (e) Fenestration Products (f) Installation of Fireplaces	150.0(a,b) 120.7(a) 150.0(c), 120.7(b) 150.0(d), 120.7(c) 150.0(g) 150.0(q), 150.0(e)	**Y**
160.2 VENTILATION AND INDOOR AIR QUALITY	(a) General (b) Dwelling Units (c) Common Use Areas (d) Parking Garages	New 150(m)12 120.1 Reference to 120.6(c)	N
160.3 **SPACE CONDITIONING SYSTEMS**	(a) Controls (a) Individual Dwelling Units (b) Central Systems and Common Use Areas	150.0(i,m) 150.0(h) 120.2 through 120.5	**Y**

SUBCHAPTER 10: MULTIFAMILY BUILDINGS MANDATORY REQUIREMENTS (cont.)

New Section	Subsections	Content From	Change in Application
160.4 WATER HEATING SYSTEMS	(a) Individual Gas Systems (b) Recirculation Loops (c) Solar Water Heating (d) Instantaneous Water Heating (e) Commercial Boilers (f) Insulation for Piping and Tanks	150.0(n)1 150.0(n)2 150.0(n)3 150.0(n)4 120.4 150.0(j), 120.3(b)	N
160.5 INDOOR AND OUTDOOR LIGHTING	(a) Dwelling Unit (b) Common Use Area (c) Outdoor Lighting and Controls (d) Sign Lighting Controls (e) Lighting Control Acceptance	150.0(k) 130.0, 130.1 130.2 130.3 130.4	N
160.6 ELECTRIC POWER DISTRIBUTION SYSTEMS	(a) Service Electrical Metering (b) Separation of Electrical Circuits (c) Voltage Drop (d) Circuit Controls (e) Demand Responsive Controls	130.5(a) 130.5(b) 130.5(c) 130.5(d) 130.5(e)	N
160.7 COVERED PROCESSES	(a) Elevators (b) Residential pools	Reference to 120.6(f) Reference to 110.4	N
160.8 SOLAR READY	(a) Solar ready buildings	Reference to 110.10	N

SUBCHAPTER 11: MULTIFAMILY BUILDINGS PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

New Section	Subsections		Content From	Change in application
170.0 GENERAL			150.0(a)	N
170.1 PERFORMANCE APPROACH			150.0(b)	N
170.2 PRESCRIPTIVE APPROACH	**(a) Building Envelope**	1. Roof/Ceiling 2. Wall Insulation 3. Fenestration 4. Doors 5. Raised Floors 6. Quality Insulation Installation	150.1(c)1, 140.3 (a) 150.1(c)2 150.1(c)3 150.1(c)5 150.1(c)4 150.1(c)11	**Y**
	(b) Space Conditioning Systems	**1. Sizing and Equipment** **2. Calculations** **3. Dwelling Unit** **4. Common Area**	140.4 (a) 140.4 (b) 150.1 (c)6, 7, 9, 10, 13 140.4(c) through (o)	**Y**
	(c) Daylighting	(for common areas)	140.3(c)	
	(d) Water Heating		150.0(c)8	N
	(e) Lighting		140.6, 140.7	N
	(f) Photovoltaic		150.0(c)14	N

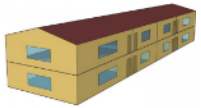
SUBCHAPTER 12: MULTIFAMILY BUILDINGS ADDITIONS, ALTERATIONS, AND REPAIRS

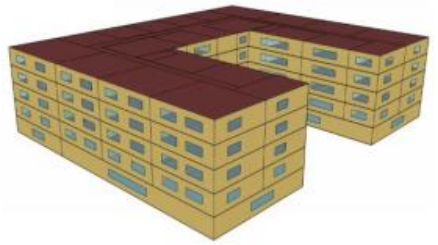
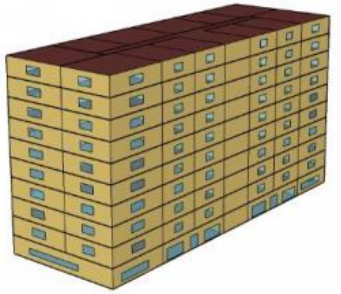
New Section	Subsections		Content From	Change in application
180.1 ADDITIONS	(a) Prescriptive Approach	**1. Envelope** 2. Ventilation and Indoor Air Quality 3. Water Heater	**150.2(a)1**	**Y** N N
	(b) Performance Approach		150.2(a)2	N
180.2 ALTERATIONS	(a) Mandatory	**1. Roof/Ceiling Insulation** **2. Wall Insulation** 3. Floor Insulation	**150.0**	**Y** **Y** N
	(b) Prescriptive	**1. Envelope** **2. Space Conditioning** 3. Lighting	**150.2**	**Y** **Y** N
	(c) Performance Approach		150.2	N
180.3 REPAIRS			150.2	N
180.4 WHOLE BUILDING			150.2	N

Methodology for Energy Impacts Analysis

- Prototype Overview
- Analysis Methodology

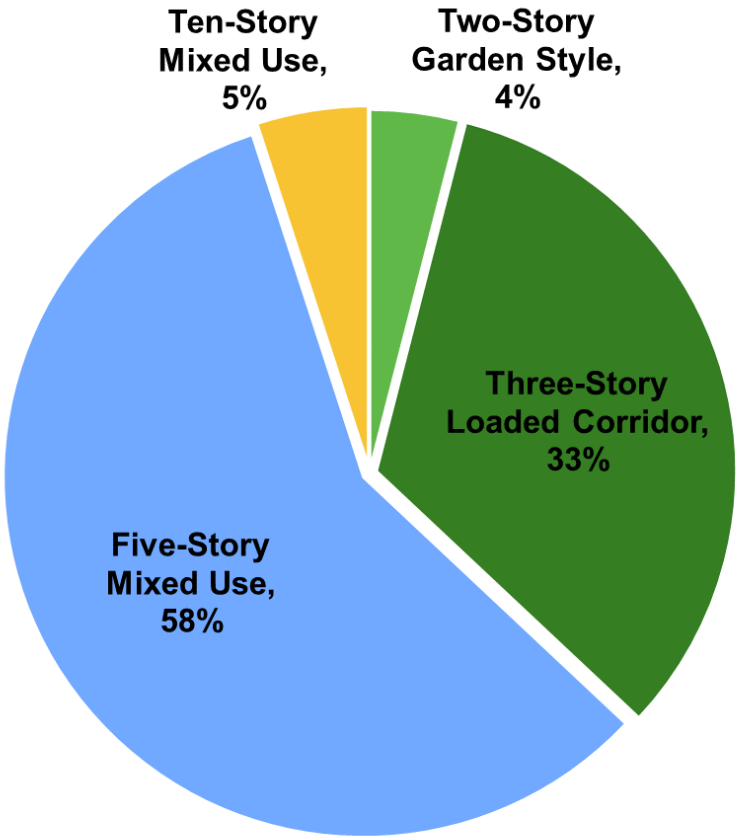
Prototype Overview



	Two-Story Garden Style	Three-Story Loaded Corridor	Five-Story Mixed-Use	Ten-Story Mixed-Use
Stories	2	3	5 (1 commercial, 4 residential)	10 (1 commercial, 9 residential)
No. dwelling units	8	36	88	117
Conditioned floor area	7,320	39,372	113,700	125,400
Wall assembly	Wood frame	Wood frame	Wood frame over concrete podium	Steel frame
Roof assembly	Low-sloped attic roof	Flat roof	Flat roof	Flat roof
Window-to-wall ratio	15%	25%	25% (residential), Ground floor 10%	40% (residential) Ground floor 10%
Space heating and cooling	Individual split heat pump AND Individual gas furnace, split A/C	Individual split heat pump AND Individual gas furnace, split A/C	Individual gas furnace, split A/C	Individual gas furnace, split A/C
Ventilation	Exhaust only	Exhaust only	Central supply ventilation ducted to corridors and units	Central supply ventilation ducted to corridors and units

Multifamily Construction by Prototype



- Energy Commission's construction forecast projects nearly **52,000** new construction multifamily dwelling units in 2023
- The Statewide CASE Team further created the composition of each prototype, as a percentage of the multifamily construction population

https://ww2.energy.ca.gov/title24/documents/2022_Energy_Code_Data_for_Measure_Proposals.xlsx

Methodology for Energy Impacts Analysis: All Submeasures

Tools Used	CBECC-Com 2022 RV for 5-story and 10-story (unless otherwise noted) CBECC-Res 2022 RV for 2-story garden and 3-story loaded corridor
Building Prototypes Used	1. 2-story Garden: 2 story; 7,680 SF; 8 units 2. 3-story Loaded Corridor: 3 story, 40,000 SF; 36 units 3. 5-story Mixed-Use: 5 story; 113,100 SF; 88 units 4. 10-story Mixed-Use: 10 story; 125,400 SF; 117 units
Climate Zones Modeled	All climate zones where applicable
Analysis Period	30 years for all prototypes
Energy Impact Results	2022 Interim TDV; results per dwelling unit

ACM Changes/Assumptions Impacting High-Rise Analysis

1. **Baseline HVAC system** for buildings 8 stories and greater: individual furnace and split A/C per dwelling unit
2. **Ventilation schedule**: 100%, rather than 25% default for nonresidential
3. **Internal heat gain algorithms**: From residential rather than nonresidential
4. Items 2 and 3 require a combination of Energy Plus and CBECC-Com modeling.

Envelope

- Roof Products
- Roof/Ceiling Insulation
- Wall U-Factor
- Fenestration Properties
- Window Area Limits

Code Change Proposal Summary: Multifamily Envelope

Submeasure	Type of Change	Software Updates Required	Sections of Code Unified
Roof Products	Prescriptive	Standard Design	150.1 and 140.
Roof/Ceiling Insulation	Mandatory	N	150.0(a) and 120.7(a)
	Prescriptive	Standard Design	150.1 and 140
Wall U-Factor	Mandatory	N	150.0(b) and 120.7(b)
	Prescriptive	Standard Design	TABLE 150.1-B and TABLE 140.3-C
Fenestration Properties	Mandatory	N	150.0(q)
	Prescriptive	Standard Design	TABLE 150.1-B and TABLE 140.3-C
Window Area Limits	Prescriptive	Standard Design	TABLE 150.1-B and TABLE 140.3-C

Envelope

- Roof Products
- Roof/Ceiling Insulation
- Wall U-Factor
- Fenestration Properties
- Window Area Limits

Multifamily Unification – Roof Products

2019

Low-Rise Residential Code

Category	Prescriptive Roof Product Requirement
Low-sloped roofs	CZ 13 and 15 0.63 solar reflectance 0.75 thermal emittance
Steep-sloped roofs	CZ 10 -15 0.20 solar reflectance 0.75 thermal emittance

2019

High-Rise Non-Residential Code

Category	Prescriptive Assembly U-factor Range
Low-sloped roofs	CZ 9 -11, 13 -15 0.55 solar reflectance 0.75 thermal emittance
Steep-sloped roofs	CZ 2 -15 0.20 solar reflectance 0.75 thermal emittance

2022

Unified Multifamily Code

Category	Prescriptive Assembly U-factor Range
Low-sloped roofs	CZ 13 and 15 0.63 solar reflectance 0.75 thermal emittance CZ 9-11,14 0.55 solar reflectance 0.75 thermal emittance
Steep-sloped roofs	CZ 2-15 0.20 solar reflectance 0.75 thermal emittance

Impact at a glance

Change for low-rise

- Low-sloped in CZ 9-11,14
- Steep-sloped in CZ 2-9

Change for high-rise

- Low-sloped in CZ 13 and 15

Definition of Baseline and Proposed Conditions: Roof Products

Baseline Conditions

2-story garden and 3-story loaded corridor

- Low-sloped CZ 9-11,14: 0.10 solar reflectance
- Steep-sloped CZ 2-9: 0.10 solar reflectance

5-story and 10-story

- Low-sloped CZ 13,15: 0.55 solar reflectance

Proposed Conditions

2-story garden and 3-story loaded corridor

- Low-sloped CZ 9-11,14: 0.55 solar reflectance
- Steep-sloped CZ2-9: 0.20 solar reflectance

5-story and 10-story

- Low-sloped CZ 13,15: 0.63 solar reflectance

2023 Construction Forecast: New Construction Roof Products

Building Type	Total Statewide New Construction Permitted in 2023 (dwelling units)	Percent of Statewide New Construction Impacted by Proposal	Statewide New Construction Impacted by Proposal in 2023 (dwelling units)
Low-Rise Garden	2,079	52%	1,081
Low-Rise Loaded Corridor	17,149	52%	8,917
Mid-Rise	30,140	4.6%	1,386
High-Rise	2,598	4.6%	120
Total Multifamily	**51,966**	22%	11,505

Incremental Per Unit Cost: Roof Products

Over 30 Year Period of Analysis

Incremental First Cost		Incremental Maintenance Cost	
0.10 to 0.20 solar reflectance – steep slope			
Material	$0.189 /sqft	Material Replacement (yr 20)	$0.105 /sqft
Installation	-	Annual Maintenance	-
Total	**$0.189 /sqft**	**Total**	**$0.105 /sqft**
0.10 to 0.55 solar reflectance – low slope			
Material	$0.525 /sqft	Material Replacement (yr 15)	$0.337 /sqft
Installation	-	Annual Maintenance	-
Total	**$0.525 /sqft**	**Total**	**$0.337 /sqft**
0.55 to 0.63 solar reflectance – low slope			
Material	Negligible	Material Replacement	Negligible
Installation	-	Annual Maintenance	-

Envelope

- Roof Products
- Roof/Ceiling Insulation
- Wall U-Factor
- Fenestration Properties
- Window Area Limits

Multifamily Unification: Roof/Ceiling Insulation

2019

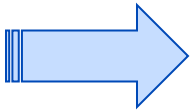
Low-Rise Residential Code

Category	Mandatory Assembly U-factor	Prescriptive Assembly U-factor or R-value
Attic Roof, Option B	0.043	CZ 1,2: R-38+0 CZ 3,5-7: R-30+0 CZ 4, 8-16: R-38+19
Attic Roof, Option C	0.043	CZ 1,11-16: R-38 CZ 2-10: R-30

2019

High-Rise Non-Residential Code

Category	Mandatory Assembly U-factor	Prescriptive Assembly U-factor
Metal Building	0.098	0.041
Wood Framed and Others	0.075	CZ 1,2,4,8-16: 0.028 CZ 3,5,6: 0.034 CZ 7: 0.039



2022

Unified Multifamily Code

Category	Mandatory Assembly U-factor	Prescriptive Assembly U-factor or R-value
Attic Roof (high performance attic applies)		
Option B	0.043	CZ 1,2: R-38+0 CZ 3,5-7: R-30+0 CZ 4, 8-16: R-38+19
Option C	0.043	CZ 1,11-16: R-38 CZ 2-10: R-30
Non Attic Roof		
Metal Buildings	0.098	0.041
Wood Framed and Others	0.075	TBD to match Opt.C flat roof equivalent CZ 1,11-16: ~0.024 CZ 2-10: ~0.030

Impact at a glance

All flat roofs are compared to a flat roof

High-rise wood framed/other will align with current low-rise performance levels

Definition of Baseline and Proposed Conditions: Roof/Ceiling Insulation

Baseline Conditions

3-story Mixed Use prototype

- Wood-framed flat roof
  - CZ 1,2,4,8-16: U=0.028
  - CZ 3,5,6: U=0.034
  - CZ 7: U=0.039

Proposed Conditions

3-story Mixed Use prototype

- Wood-framed flat roof designed to meet performance level of an Option C res-code attic
  - CZ 1,11-16: R-38 ceiling insulation with R-5 continuous insulation, U=0.024
  - CZ 2-10: R-30 ceiling insulation with R-7 continuous insulation. U=0.030

2023 New Construction Forecast: Roof/Ceiling Insulation

Building Type	Total Statewide New Construction Permitted in 2023 (dwelling units)	Percent of Statewide New Construction Impacted by Proposal	Statewide New Construction Impacted by Proposal in 2023 (dwelling units)
Low-Rise Garden	2,079	78%	1,622
Low-Rise Loaded Corridor	17,149	78%	13,376
Mid-Rise	30,140	0%	0
High-Rise	2,598	0%	0
Total Multifamily	**51,966**	**29%**	**14,998**

Poll

In which multifamily building types have you seen attics?

A. Quadplex or similar
B. Garden style up to 3 stories
C. Loaded corridor up to 3 stories
D. Mid-rise 4 to 7 stories
E. High-rise 8+ stories

Envelope

- Roof Products
- Roof/Ceiling Insulation
- Wall U-Factor
- Fenestration Properties
- Window Area Limits

Multifamily Unification: Wall U-factor*

**Information also shown in Submeasure Summary doc.*

2019

Low-Rise Residential Code

Category	Mandatory Assembly U-factor	Prescriptive Assembly U-factor Range	CZ 12 U-factor
Building Envelope	2x4 frame 0.102 2x6 frame 0.071 Non-framed 0.102	0.051 – 0.065	0.051
Mass Interior	Masonry walls to meet prescriptive requirements	0.059 – 0.077	0.077
Mass Exterior		0.077 – 0.125	0.125
Below Grade Interior	Masonry walls to meet prescriptive requirements	0.067 – 0.077	0.077
Below Grade Exterior		0.053 – 0.200	0.200

2019

High-Rise Non-Residential Code

Category	Mandatory Assembly U-factor	Prescriptive Assembly U-factor Range	CZ 12 U-factor
Metal Building	0.113	0.057 – 0.061	0.057
Curtain Wall	0.280		
Metal Framed	0.151	0.048 – 0.105	0.069
Wood Framed	0.110	0.042 – 0.059	0.059
Mass Heavy	0.690	0.160 – 0.690	0.253
Mass Light	0.440	0.170 – 0.227	0.170

2022

Unified Multifamily Code

Category	Mandatory Assembly U-factor	Assembly U-factor Range	CZ 12 U-factor
Metal Buildings	0.113	0.057 – 0.061	0.057
Spandrel Panels and Curtain Wall	0.280		
Metal Framed, > 1-hour	0.151	0.048 – 0.105	0.069
Wood Framed, > 1-hour	2x4 frame 0.102 2x6 frame 0.071 Non-framed 0.102	0.042 – 0.059	0.059
Framed (wood or metal) and other, ≤1-hour		0.051 – 0.065	0.051
Heavy Mass	0.690	0.160 – 0.690	0.253
Light Mass	0.440	0.059 – 0.077	0.077
Below Grade	Meet prescriptive requirement	0.067 – 0.077	0.077

Methodology and Assumptions for Energy Impacts Analysis: Wall U-factor

- CBECC-Com calculates wall assembly U-factor based on materials (and properties) specified
- Code categorized by wall construction and fire rating only
- Example wall assembly components, for wood-framed ≤ 1hr, CZ 12

Components	Base – U-factor 0.059	Proposed – U-factor 0.051
Continuous Insulation	EPS 3/4" (R 2.89)	EPS 1" (R 3.85)
Outer Finish	*1x* 5/8"gyp (R 0.56)	1x 5/8"gyp (R 0.56)
Framing	2 x 6 @16 (8')	2 x 6 @16 (8')
Cavity Insulation	R-21 cavity (batt)	R-21 cavity (batt)
Inner Finish	1x 5/8"gyp (R 0.56)	1x 5/8"gyp (R 0.56)

Definition of Baseline and Proposed Conditions – Wall U-factor, CZ 12 example

Baseline Conditions

1. Wood-framed ≤1hr: U-factor 0.059
2. Metal-framed ≤1hr : U-factor 0.069
3. Mass wall light: U-factor 0.170

Proposed Conditions

1. U-factor 0.051
2. U-factor 0.051
3. U-factor 0.077

Incremental Cost Information: Wall U-factor

- RS Means for material, labor, and O&P costs
  - Collected for each wall construction and associated components
  - Costs collected for select climate zones and adjusted to other climate zones using cost indices
- No difference in maintenance costs

Incremental Per Unit Cost: Wall U-factor

Over 30 Year Period of Analysis

Incremental First Cost		Incremental Maintenance Cost		Total Cost – 5-story prototype[a]	Total Cost – 10-story prototype[b]
Material	$0.07 /sqft	Material Replacement	-	$2,369	$2,867
Labor	$0.06 /sqft	Annual Maintenance	-	$2,030	$2,458
Total with O&P	**$0.19 /sqft**	**Total**	**$0**	**$6,430**	**$7,782**

[a] With 33,840 sqft total exterior wall area
[b] With 40,960 sqft total exterior wall area

- Cost difference between U-factor 0.059 (base) and 0.051 (proposed)
- Base and proposed cases for each assembly categories and U-factor level required different components and costs

Poll

Linking wall assembly energy requirements to the wall's fire rating is:

A. Functional and viable, it makes specification easier
B. Complicated or confusing, it makes specification harder
C. Other feedback *(please specify)*

Envelope

- Roof Products
- Roof/Ceiling Insulation
- Wall U-Factor
- Fenestration Properties
- Window Area Limits

Multifamily Unification: Fenestration Properties

2019

Low-Rise Residential Code

Category	U-factor | SHGC | VT
All Fenestration	0.30 | 0.23 (or NR*) | NR*

2019

High-Rise Non-Residential Code

Category	U-factor | SHGC | VT
Fixed Window	0.36 | 0.25 | 0.42
Operable Window	0.46 | 0.22 | 0.32
Curtainwall	0.41 | 0.26 | 0.46
Glazed Doors	0.45 | 0.23 | 0.17

2022

Unified Multifamily Code

Category	U-factor | SHGC | VT
Curtainwall	Align with 2022 Non-Res requirement
All others	0.30 | 0.23 (or NR*) | NR* Except Class AW products may follow 2019 Non-Res requirements

*NR = No Requirement

Impact at a glance

Punched windows in mid-rise and high-rise buildings now aligned with residential code requirements

Methodology and Assumptions for Energy Impacts Analysis: Fenestration Properties

- CBECC-Com accepts window schedules; window locations are evenly distributed between building exterior walls
- CBECC-Com allows user inputs on window performance characteristics
- Windows are assumed to be all fixed, all operable, or a mixture of both
  - Fixed windows are less costly options than operable ones
  - Existing requirements for fixed windows are more stringent
    – U-factor 0.36 for fixed vs. 0.46 for operable
  - Windows not used as secondary means of escape as multiple other means exist
    – based on National Fire Protection Association (NFPA) Section 24.2
- The same SHGC 0.25 and VT 0.42 for both base and proposed cases

Incremental Cost Information: Fenestration Properties

- Window costs and market insights from seven windows manufacturers and subject matter experts
- Window costs ($/sqft) for products with performance specifications

Performance Metric	U-factor	SHGC
Range	0.30 – 0.46	0.23-0.25
Market Prevalence	Low/Medium/High	

- Labor costs do not vary for window energy performance
- No difference in maintenance costs

Incremental Per Unit Cost: Fenestration Properties

Over 30 Year Period of Analysis

Incremental First Cost[a]		Incremental Maintenance Cost		Total Cost – MR prototype[b]	Total Cost – HR prototype[c]
Material	$5 per sqft	Material Replacement	-	$40,910	$91,840
Installation	-	Annual Maintenance	-	0	0
Total	**$5/ft²**	**Total**	**$0**	**$40,910**	**$91,840**

[a] For windows between 4 ft² and 20 ft²
[b] With 8,182 sqft total windows area
[c] With 18,368 sqft total window area

- Cost difference between U-factor 0.36 (proposed) and 0.30 (base) @ 0.25 SHGC
  - Double pane, argon infill, vinyl frame
  - Mostly represent operable windows
  - Aluminum (architectural) windows unlikely to achieve 0.30

Poll

What is the underlying challenge in specifying windows at the proposed performance characteristic (u=0.30, SHGC=0.23)?

A. None, these windows are available and appropriately priced for their value
B. They are unavailable in the market
C. They are available, but too expensive
D. My preferred window manufacturer/distributor doesn't have them readily available (though I know others do)
E. I don't have the range of aesthetic and functional options at my disposal at this window caliber
F. Other *(please specify)*

Poll

Which window property is more challenging to find at a functional price?

A. U-factor of 0.30 or lower
B. SHGC of 0.23 or lower
C. Both are equally challenging

Envelope

- Roof Products
- Roof/Ceiling Insulation
- Wall U-Factor
- Fenestration Properties
- Window Area Limits

Multifamily Unification: Window Area Limits

2019

Low-Rise Residential Code

Metric	Threshold
Max Total Area - % of conditioned floor area	20%
Max West Facing Area	5%

2019

High-Rise Non-Residential Code

Metric	Threshold
Max Window-to-Wall (WWR) ratio	40%

2022

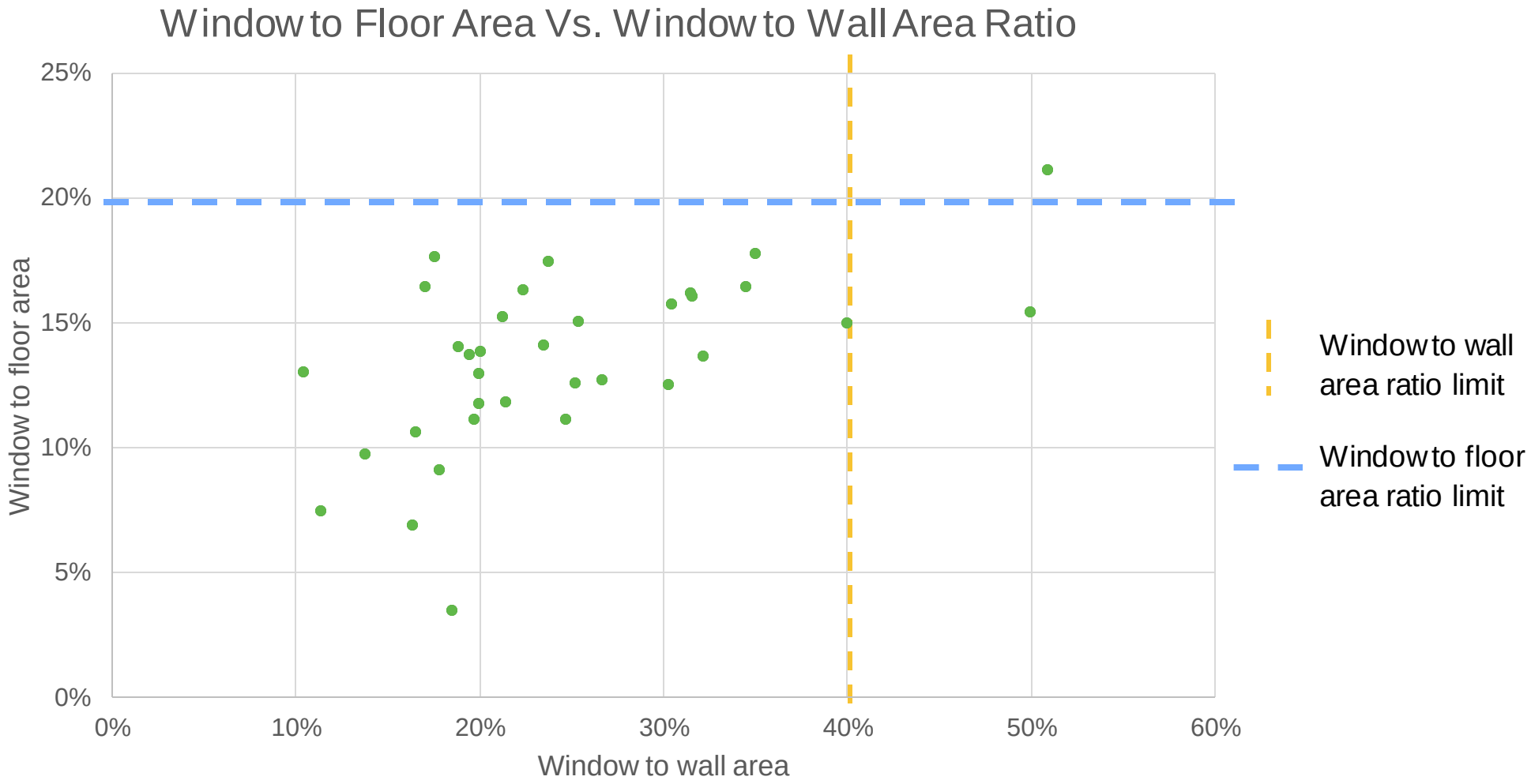
Unified Multifamily Code

Metric	Threshold
Max Total Area - % of conditioned floor area	20%
Max Window-to-Wall (WWR) ratio	40%

Impact at a glance

Little impact anticipated. Impact not isolated to low-rise or high-rise.

Window Area Norms: California Multifamily New Homes Program Data*



*California Multifamily New Homes (CMFNH) Program Data – 2013 and 2016 Code. 34 High Rise Buildings.

HVAC

- Duct Insulation R-Values
- Duct Leakage Testing
- Space Conditioning Airflow Rate and Fan Efficacy
- Refrigerant Charge Verification or Fault Indicator Display

Code Change Proposal Summary: Multifamily HVAC

Submeasure	Type of Change	Software Updates Required	Field Verification Required	Sections of Code Unified
Duct Insulation R-Values	Mandatory	Update Standard Design (CBECC-Res). Add ability to model duct systems in CBECC-Com.	N	150.0(m)1B and 120.4(a)
	Prescriptive		N	150.1(c)9 and 140.4*(no requirement)*
Duct Leakage Testing	Mandatory	Add ability to model duct systems in CBECC-Com	Y	150.0(m)11C, 120.4(a), and 140.4(l) *(only prescriptive requirement)*
Space Conditioning Airflow Rate and Fan Efficacy	Mandatory	Add option in CBECC-Com. Update Standard Design.	Y	150.0(m)13B&C and 140.4*(no requirement)*
Refrigerant Charge Verification or Fault Indicator Display	Prescriptive	Add option in CBECC-Com. Update Standard Design.	Y	150.1(c)7A and 140.4*(no requirement)*

Field verifications could be completed be either a HERS Rater or ATT. HERS Rater on multifamily projects for mechanical ventilation testing.

Poll

Who should conduct the proposed field verifications for multifamily buildings 4-stories and greater?

A. HERS Rater
B. Mechanical Acceptance Test Technician (ATT)
C. Either HERS Rater or ATT
D. Don’t know

HVAC

- Duct Insulation R-Values
- Duct Leakage Testing
- Space Conditioning Airflow Rate and Fan Efficacy
- Refrigerant Charge Verification or Fault Indicator Display

Multifamily Unification: Duct Insulation R-value

2019

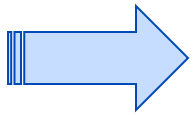
Low-Rise Residential Code

Category	Mandatory	Prescriptive
Ducts in conditioned space (verified low leakage ducts)	R-4.2	R-6.0
Ducts in all other locations	R-6.0	CZ 3,5-7: R-6 CZ 1-2,4,8-16: R-8

2019

High-Rise Non-Residential Code

Category	Mandatory	Prescriptive
Ducts in conditioned space	R-4.2	N/A
Ducts in unconditioned space	R-8.0	N/A



2022

Unified Multifamily Code

Category	Mandatory	Prescriptive
Dwelling Unit with Individual Ducts		
Ducts in conditioned space (verified low leakage ducts)	R-4.2	N/A
Ducts in conditioned space (visual inspection)	R-6.0	N/A
Ducts in unconditioned space	R-8.0	N/A
Common Use Areas / Central System Ducts		
Ducts in conditioned space	R-4.2	N/A
Ducts in unconditioned space	R-8.0	N/A

Impact at a glance

CZ 3, 5-7 - Low-rise ducts in unconditioned space changes to R-8.0 from R-6.0

High-rise dwelling unit ducts align to current residential requirements

Definition of Baseline and Proposed Conditions: Duct Insulation

Baseline Conditions

2-story garden style – top floor ducts in attic

- CZ 3,5-7: R-6

5-story/10-story mixed use (CBECC-Res) – ducts in indirectly conditioned space

- R-4.2

Proposed Conditions

2-story garden style – top floor ducts in attic

- CZ 3,5-7: R-8

5-story/10-story mixed use (CBECC-Res) – ducts in indirectly conditioned space

- R-6

2023 New Construction Forecast: Duct Insulation

Building Type	Total Statewide New Construction Permitted in 2023 (dwelling units)	Percent of Statewide New Construction Impacted by Proposal	Statewide New Construction Impacted by Proposal in 2023 (dwelling units)
Two-Story Garden Style	2,079	11%	221
Three-Story Loaded Corridor	17,149	11%	1,821
Five-Story Mixed-Use	30,140	84%	25,190
Ten-Story Mixed-Use	2,598	77%	1,998
Total Multifamily	**51,966**	**52%**	**29,230**

- 2-story/3-story percentage impacted based on CalCERTS data for projects with ducts in unconditioned space for CZ3,5-7.
- 5-story/10-story percentage impacted based on portion of consultant project data with ducted systems serving individual units.

Incremental Per Unit Cost: Duct Insulation

Over 30 Year Period of Analysis

- Costs collected from online product research
- Costs assume:
  - No incremental labor cost
  - Average costs for 4in, 6in, & 8in duct

Sample pricing for 8in 25ft flexible duct

R-4.2: $42.00

R-6: $52.30

R-8: $71.00

Incremental First Cost (per linear foot of duct)	
R-4.2 to R-6	
Material only	$0.33
Total	**$0.33**
R-6.0 to R-8.0	
Material only	$0.71
Total	**$0.71**

Do you find these costs to be reasonable?

Poll

What type of ductwork is typically installed in apartment units with individual HVAC systems in multifamily buildings 4-stories and greater?

A. Vinyl flex duct
B. Rigid sheet metal
C. Duct board
D. Other

Poll

What level of duct insulation is typically installed in apartment units with individual HVAC systems in multifamily buildings 4-stories and greater?

A. Uninsulated
B. R-4.2
C. R-6.0
D. R-8.0

HVAC

- Duct Insulation R-Values
- Duct Sealing/Leakage Testing
- Space Conditioning Airflow Rate and Fan Efficacy
- Refrigerant Charge Verification or Fault Indicator Display

Multifamily Unification – Duct Sealing/Leakage Testing

2019

Low-Rise Residential Code

Category	Mandatory Requirement	Prescriptive Requirement
All ducted systems	12% total or 6% to outside (of nominal airflow)	N/A

2019

High-Rise Non-Residential Code

Category	Mandatory Requirement	Prescriptive Requirement
Systems serving single zones <5,000 ft^2 with >25% of ducts in unconditioned space	N/A	6% total (of nominal airflow)

2022

Unified Multifamily Code

Category	Mandatory Requirement	Prescriptive Requirement
Dwelling unit individual ducting	12% total or 6% to outside (of nominal airflow)	N/A
Common use areas with single zone systems serving <5,000 ft^2 with >25% ducts in unconditioned space	N/A	6% total (of nominal airflow)
Central multi-zone systems	N/A	N/A

Impact at a glance

New mandatory testing of all ductwork for mid-rise and high-rise buildings, but at 12% versus current prescriptive requirement of 6%.

Definition of Baseline and Proposed Conditions: Duct Sealing/Leakage Testing

Baseline Conditions

5-Story & 10-Story Mixed Use (in CBECC-Res)

- Ducts in conditioned space
- No duct testing (duct leakage rate TBD)

Proposed Conditions

5-Story & 10-Story Mixed Use (in CBECC-Res)

- Ducts in conditioned space
- Duct testing to 6% leakage to outside

2023 New Construction Forecast:
Duct Leakage Testing

Building Type	Total Statewide New Construction Permitted in 2023 (dwelling units)	Percent of Statewide New Construction Impacted by Proposal	Statewide New Construction Impacted by Proposal in 2023 (dwelling units)
Two-Story Garden Style	2,079	0%	0
Three-Story Loaded Corridor	17,149	0%	0
Five-Story Mixed-Use	30,140	84%	25,190
Ten-Story Mixed-Use	2,598	77%	1,998
Total Multifamily	**51,966**	**52%**	**27,188**

Percentage impacted based on portion of consultant project data with ducted systems serving individual units.

Incremental Per Unit Cost: Duct Leakage Testing

Over 30 Year Period of Analysis

- Costs dependent on basecase condition
- Costs assume:
  - HERS verification cost only
  - $0 material/labor cost assuming that basecase condition is not too much higher than 12% leakage – *research will validate*

Incremental First Cost	
Material	$0
Installation	$0
HERS Verification	$150
Total	**$150**

Sampling will be allowed and taken into account in the cost analysis.

Do you find these costs to be reasonable?

Poll

What is the challenge with requiring duct testing in apartment units with individual duct systems in multifamily buildings 4-stories and greater?

A. Ductwork is difficult to access and to properly seal
B. Air handling equipment typically used is leaky
C. The process is too complicated or time consuming
D. All of the above
E. None
F. Other *(please specify)*

HVAC

- Duct Insulation R-Values
- Duct Leakage Testing
- Space Conditioning Airflow Rate and Fan Efficacy
- Refrigerant Charge Verification or Fault Indicator Display

Multifamily Unification – Space Conditioning Airflow Rate and Fan Efficacy

2019

Low-Rise Residential Code

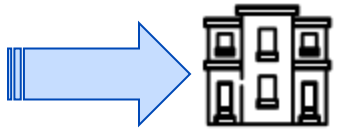
Category	Mandatory Requirement
Fan Efficacy Verification	0.45 W/cfm gas furnace 0.58 W/cfm other air handlers
Airflow Rate Verification	≥ 350 cfm/ton

2019

High-Rise Non-Residential Code

No equivalent requirement

2022



Unified Multifamily Code

Category	Mandatory Requirement
Systems serving individual dwelling units with ducted cooling	
Fan Efficacy Verification	0.45 W/cfm gas furnace 0.58 W/cfm other air handlers
Airflow Rate Verification	≥ 350 cfm/ton
Central systems and common area spaces	
No requirement	

Impact at a glance

New mandatory testing for mid-rise and high-rise buildings with individual HVAC systems and ducted cooling.

Definition of Baseline and Proposed Conditions: Space Conditioning Airflow Rate and Fan Efficacy

Baseline Conditions

5-Story & 10-Story Mixed Use

- ***tbd*** W/cfm (gas furnace)
- ***tbd*** cfm/ton

Proposed Conditions

5-Story & 10-Story Mixed Use

- 0.45 W/cfm (gas furnace)
- 350 cfm/ton

Poll

Individual dwelling unit HVAC systems installed in multifamily buildings 4-stories and greater typically meet what range of fan efficacy?

A. <0.35 W/cfm
B. 0.35 – 0.45 W/cfm
C. 0.46 – 0.58 W/cfm
D. 0.59 – 0.75 W/cfm
E. > 0.75 W/cfm
F. Don’t know

Poll

Individual dwelling unit HVAC systems installed in multifamily buildings 4-stories and greater typically meet what range of airflow?

A. <250 cfm/ton
B. 250 – 350 cfm/ton
C. 351 – 450 cfm/ton
D. > 450 cfm/ton
E. Don’t know

2023 Construction Forecast: New Construction: Space Conditioning Airflow Rate and Fan Efficacy

Building Type	Total Statewide New Construction Permitted in 2023 (dwelling units)	Percent of Statewide New Construction Impacted by Proposal	Statewide New Construction Impacted by Proposal in 2023 (dwelling units)
Two-Story Garden Style	2,079	0%	0
Three-Story Loaded Corridor	17,149	0%	0
Five-Story Mixed-Use	30,140	84%	25,190
Ten-Story Mixed-Use	2,598	77%	1,998
Total Multifamily	**51,966**	**52%**	**27,188**

Percentage impacted based on portion of consultant project data with ducted systems serving individual units.

Incremental Per Unit Cost: Space Conditioning Airflow Rate and Fan Efficacy

Over 30 Year Period of Analysis

- Costs collected from prior projects and research
- Costs assume:
  - No or minimal incremental material/labor cost

Incremental First Cost	
Material	$0
Installation	$0
HERS Verification	$100
Total	**$100**

Sampling will be allowed and taken into account in the cost analysis.

Do you find these costs to be reasonable?

HVAC

- Duct Insulation R-Values
- Duct Leakage Testing
- Space Conditioning Airflow Rate and Fan Efficacy
- Refrigerant Charge Verification or Fault Indicator Display

Multifamily Unification – Refrigerant Charge/Fault Indicator Display

2019

Low-Rise Residential Code

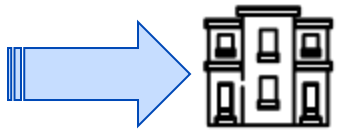
Category	CZs Required (Prescriptive)
Refrigerant charge verification	2, 8-15

2019

High-Rise Non-Residential Code

No equivalent requirement

2022



Unified Multifamily Code

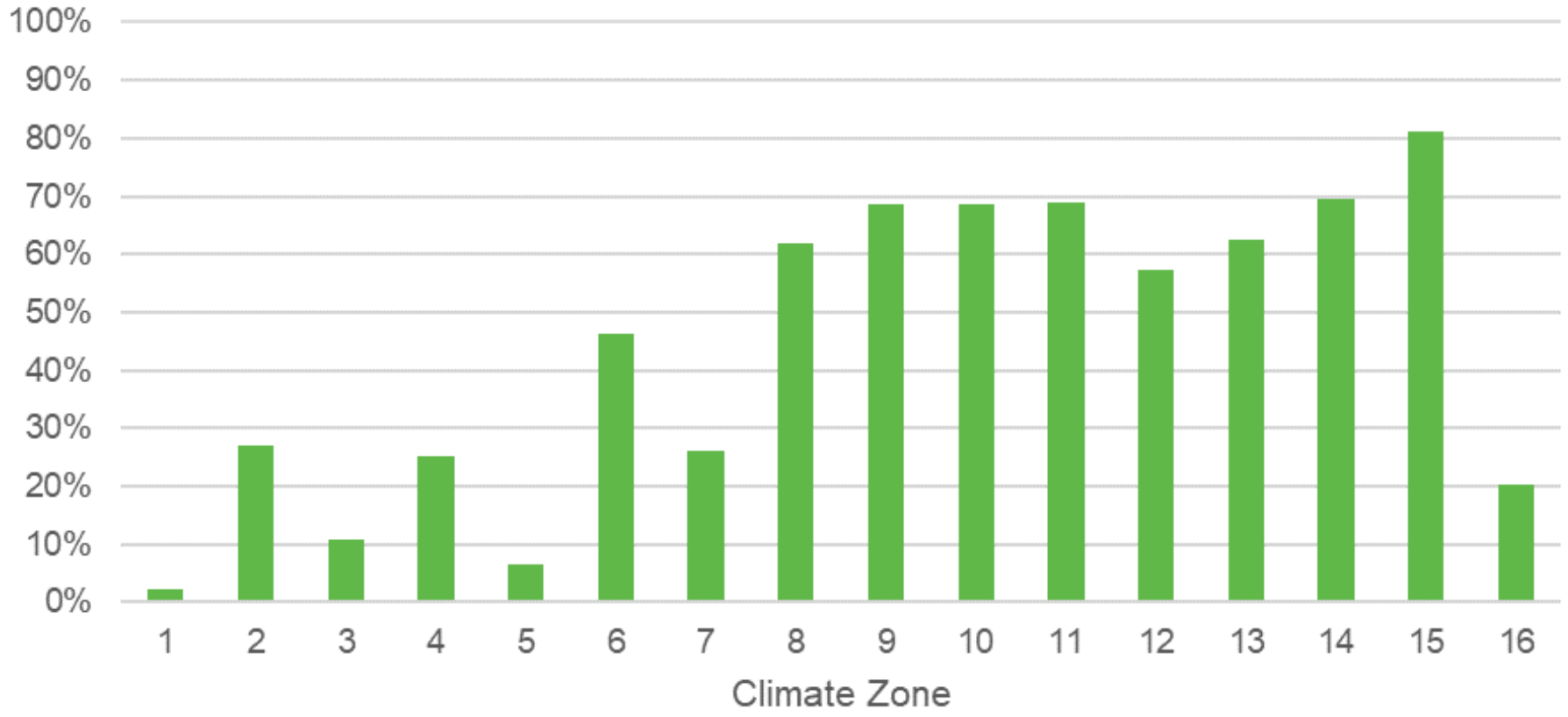
Category	Requirement
Systems serving individual dwelling units	
Refrigerant charge verification	Prescriptive in CZ 2, 8-15
Central systems and common area spaces	
No requirement	

Impact at a glance

New prescriptive requirement in CZ 2, 8-15 for mid-rise and high-rise buildings with air conditioning or heat pump systems serving individual dwelling units.

CalCERTS Data - Refrigerant Charge Verification

Percent of new construction low-rise multifamily units in CalCERTS with refrigerant charge verification.



Definition of Baseline and Proposed Conditions: Refrigerant Charge Verification

Baseline Conditions

5-Story & 10-Story Mixed Use

- No refrigerant charge verification (adjust EER by 0.90 factor)

Proposed Conditions

5-Story & 10-Story Mixed Use

- Refrigerant charge verification (adjust EER by 0.96 factor)

2023 New Construction Forecast: Refrigerant Charge Verification

Building Type	Total Statewide New Construction Permitted in 2023 (dwelling units)	Percent of Statewide New Construction Impacted by Proposal	Statewide New Construction Impacted by Proposal in 2023 (dwelling units)
Two-Story Garden Style	2,079	0%	0
Three-Story Loaded Corridor	17,149	0%	0
Five-Story Mixed-Use	30,140	50%	15,061
Ten-Story Mixed-Use	2,598	52%	1,346
Total Multifamily	**51,966**	**32%**	**16,407**

- Percentage impacted based on portion of consultant project data with air conditioning or heat pump systems serving individual units and applied to portion of dwelling units in applicable climate zones. CZ 2, 8-15 only.

Incremental Per Unit Cost: Refrigerant Charge Verification

Over 30 Year Period of Analysis

- Costs collected from prior projects and research
- Costs assume:
  - No or minimal incremental material/labor cost

Incremental First Cost	
Material	$0
Installation	$0
HERS Verification	$100
Total	**$100**

Sampling will be allowed and taken into account in the cost analysis.

Do you find these costs to be reasonable?

Thank You

Questions?

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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

We want to hear from you!

+ Stakeholder meeting feedback informs utility-sponsored CASE Reports.
+ Draft CASE Reports for today's topics will be published in **September 2020.**

*Comments will be considered as they are received. Stakeholders are invited to submit feedback on today's presentation, and the Draft CASE Report to help shape the **Final** CASE Report submitted to the Energy Commission.*

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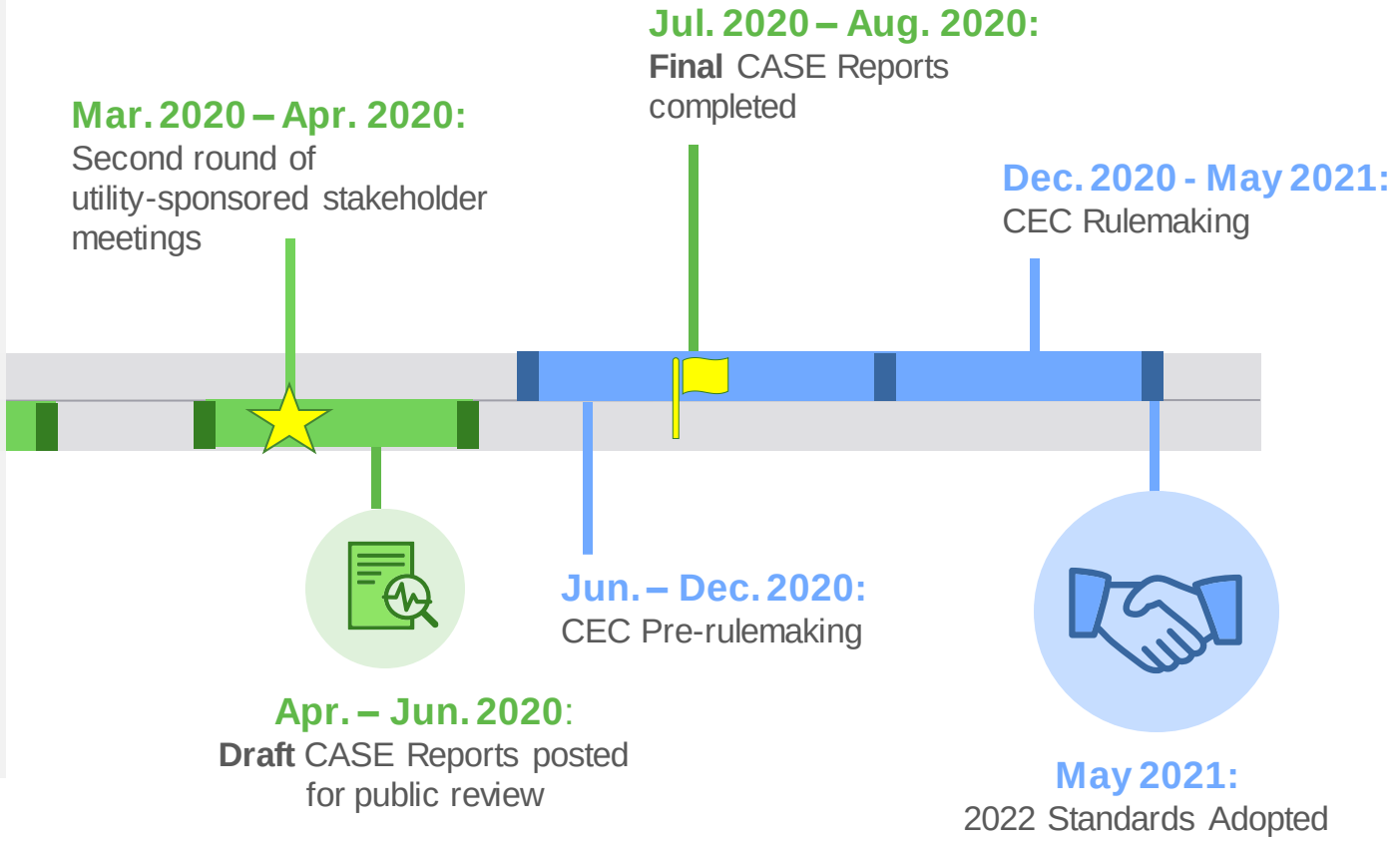

Upcoming Meetings

Meeting Topic	Building Type	Date
Lighting	NR/MF	Tuesday, March 3, 2020
Single Family Whole Building	SF	Thursday, March 5, 2020
Nonresidential and Single Family HVAC Part 1: Data Centers, Boilers, Air Distribution, Variable Capacity	NR/SF	Thursday, March 12, 2020
Water Heating and Multifamily All Electric Package	MF	Tuesday, March 17, 2020
Single Family Grid Integration	SF	Thursday, March 19, 2020
Multifamily HVAC and Envelope	MF	Wednesday, March 25 2020
Covered Processes Part 1: Refrigeration System Opportunities	NR	Thursday, April 2, 2020
Nonresidential HVAC and Envelope Part 2: Reduced Infiltration, HVAC Controls (Air Efficiency, DOAS)	NR	Tuesday, April 14, 2020
Covered Processes Part 2: Controlled Environment Horticulture	NR	Thursday, April 16, 2020
Nonresidential Envelope: High Performance Envelope	NR	Thursday, April 23, 2020
Multifamily Restructuring	MF	Thursday, May 7, 2020

Thank you for your participation today

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Please complete the closing polls below