Introba

2022 California Code

What's new in "Title 24"?

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Introba Global Presence

31
Offices

1,000+
Staff

Canada

- **6 OFFICES**
  Toronto, Calgary, Edmonton, Vancouver, Victoria, Kelowna
- 300+ people

USA

- **19 OFFICES**
  Atlanta, Austin, Chicago, Dallas, Denver, Houston, Indianapolis, Kansas City, Los Angeles, Miami, New Haven, New York, Oakland, San Diego, Seattle, St. Louis, Washington
- 440+ people

EMEA

UK

- **2 OFFICES**
  London, Oxford
- 100+ people

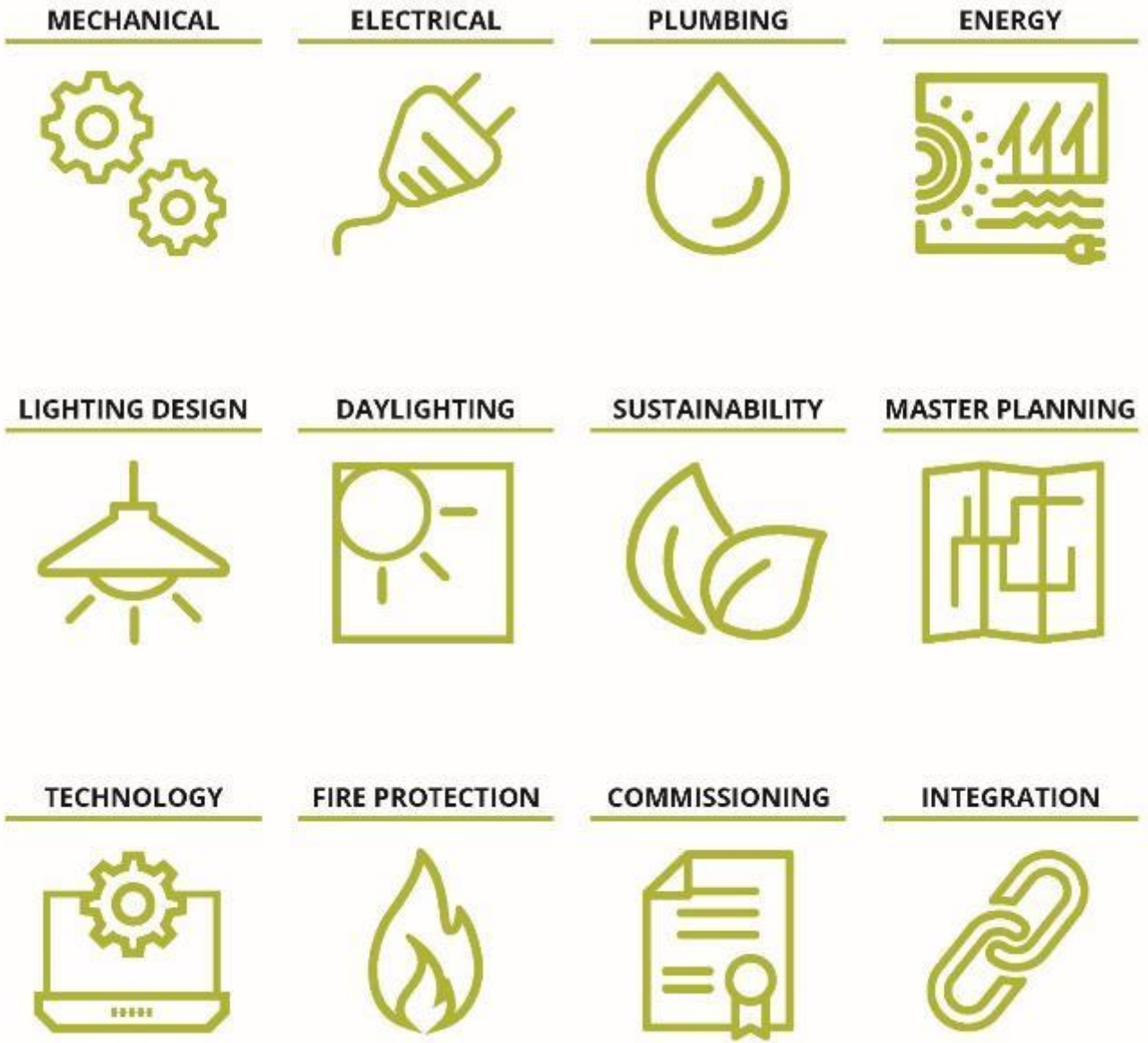
SERBIA

- **1 OFFICE**
  Belgrade
- 60+ people

Australia

- **3 OFFICES**
  Brisbane, Melbourne, Sydney
- 110+ people

Comprehensive Services



Learning Objectives

1. Understand the format and organizational structure of California Code of Regulations (C.C.R), Title 24, and specifically the Part 6 Energy Code, including the difference between “mandatory” and “prescriptive requirements”

2. Understand the general trends and intention behind the recent, current and anticipated future Energy Code Changes

3. Understand the new mandatory requirements of the Title 24 Energy Code that went into effect on January 1, 2023

4. Understand the new prescriptive requirements of the Title 24 Energy Code that went into effect on January 1, 2023

California Code of Regulations (C.C.R), Title 24

Part 1 - Administrative Code
- Prime/Architect

Part 2 - Building Code
- Vol. 1 – Architect
- Vol. 2 – Structural

Part 2.5 - Residential Code

Part 3 - Electrical Code
- Electrical

Part 4 - Mechanical Code
- Mechanical

Part 5 - Plumbing Code
- Mechanical/Plumbing

Part 6 - Energy Code
- "Title 24"
- All designers, contractors, & owner (often Mechanical)

Part 7 – *vacant*

Part 8 – Historical Building Code
- Printed in Part 1

Part 9 – Fire Code

Part 10 – Existing Building Code

Part 11 - California Green Building Standards Code, CALGreen
- All designers & contractor (often Mechanical)

Went into effect on January 1, 2023

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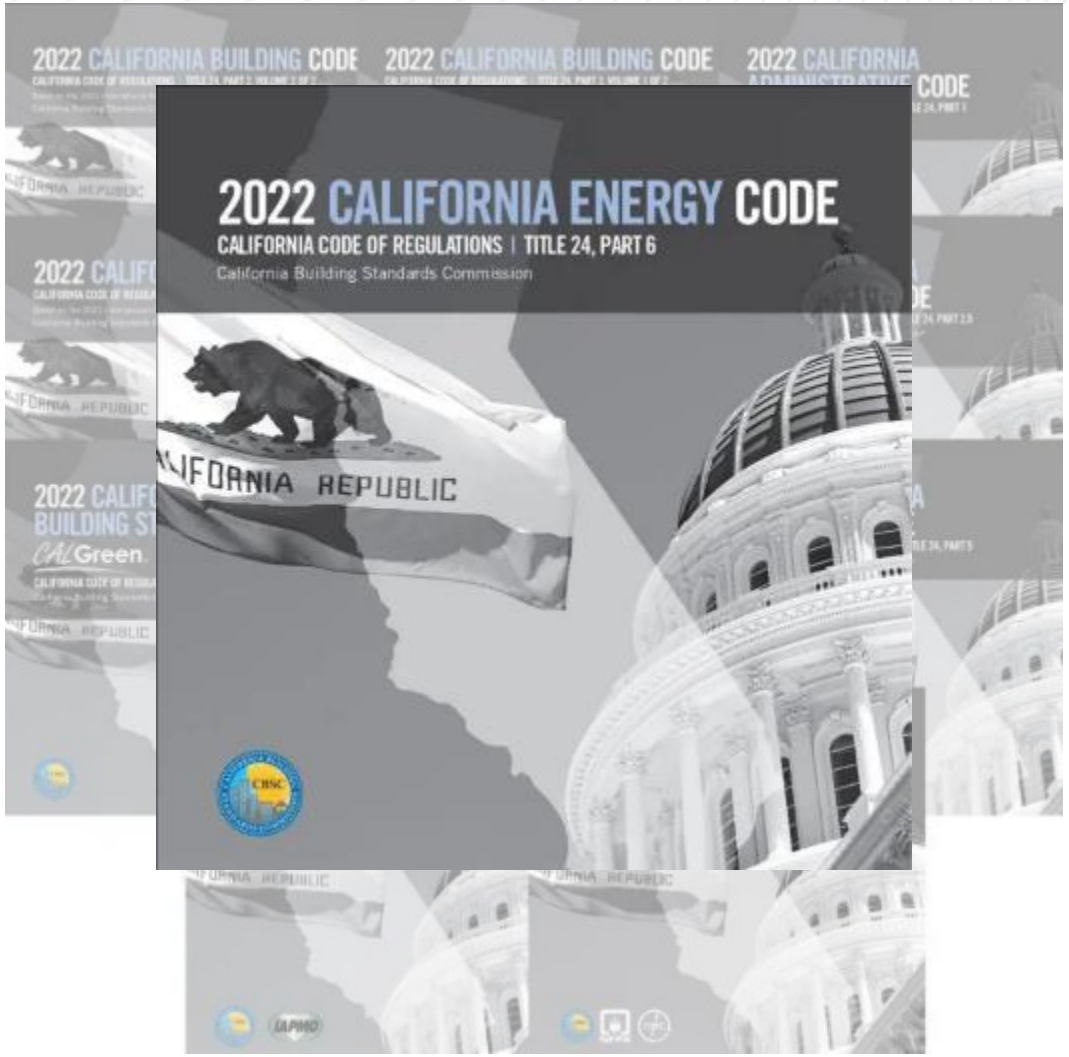

Part 6 - Energy Code
- **"Title 24"**
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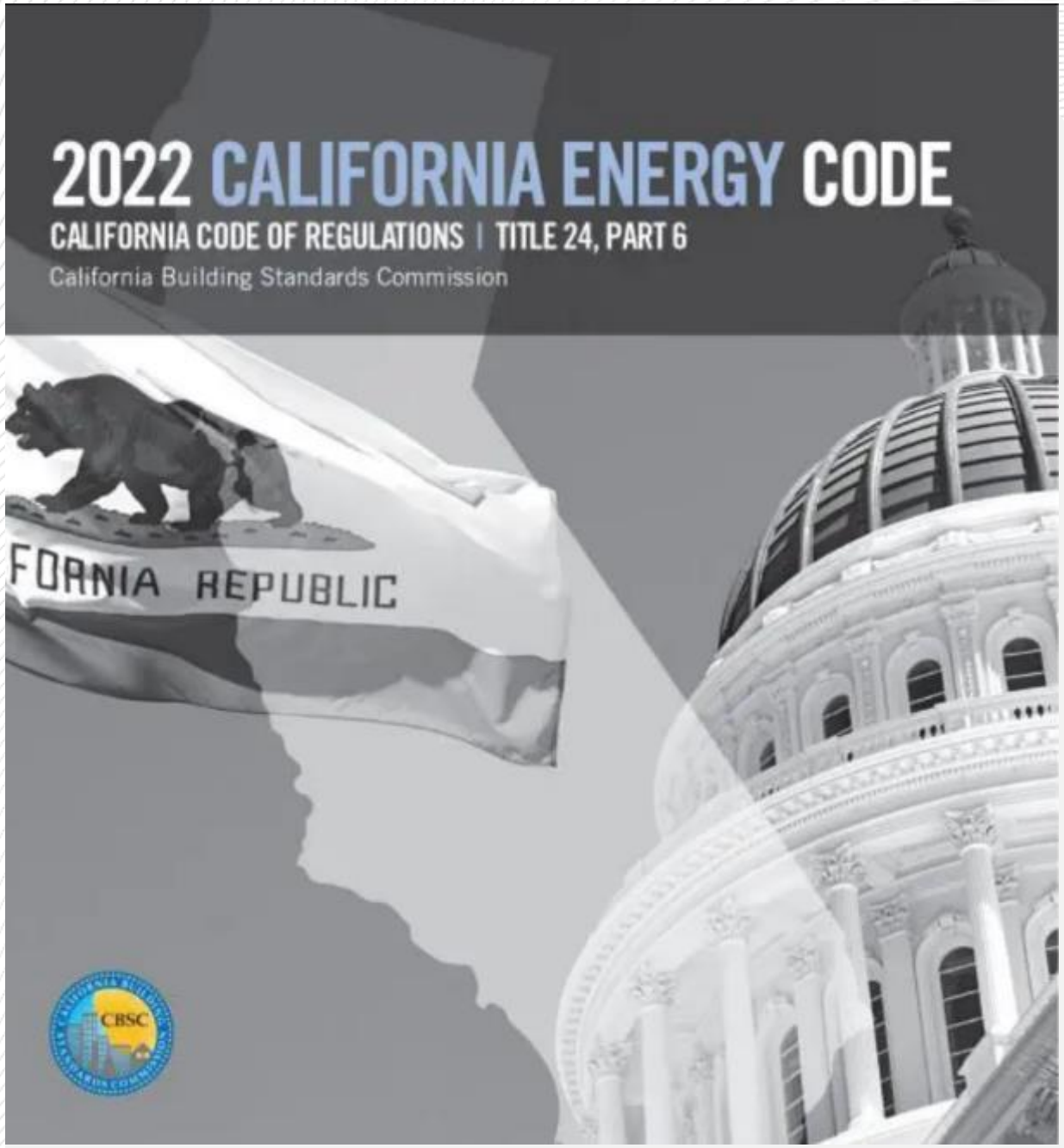
- All designers & contractor (often Mechanical)

Went into effect on January 1, 2023

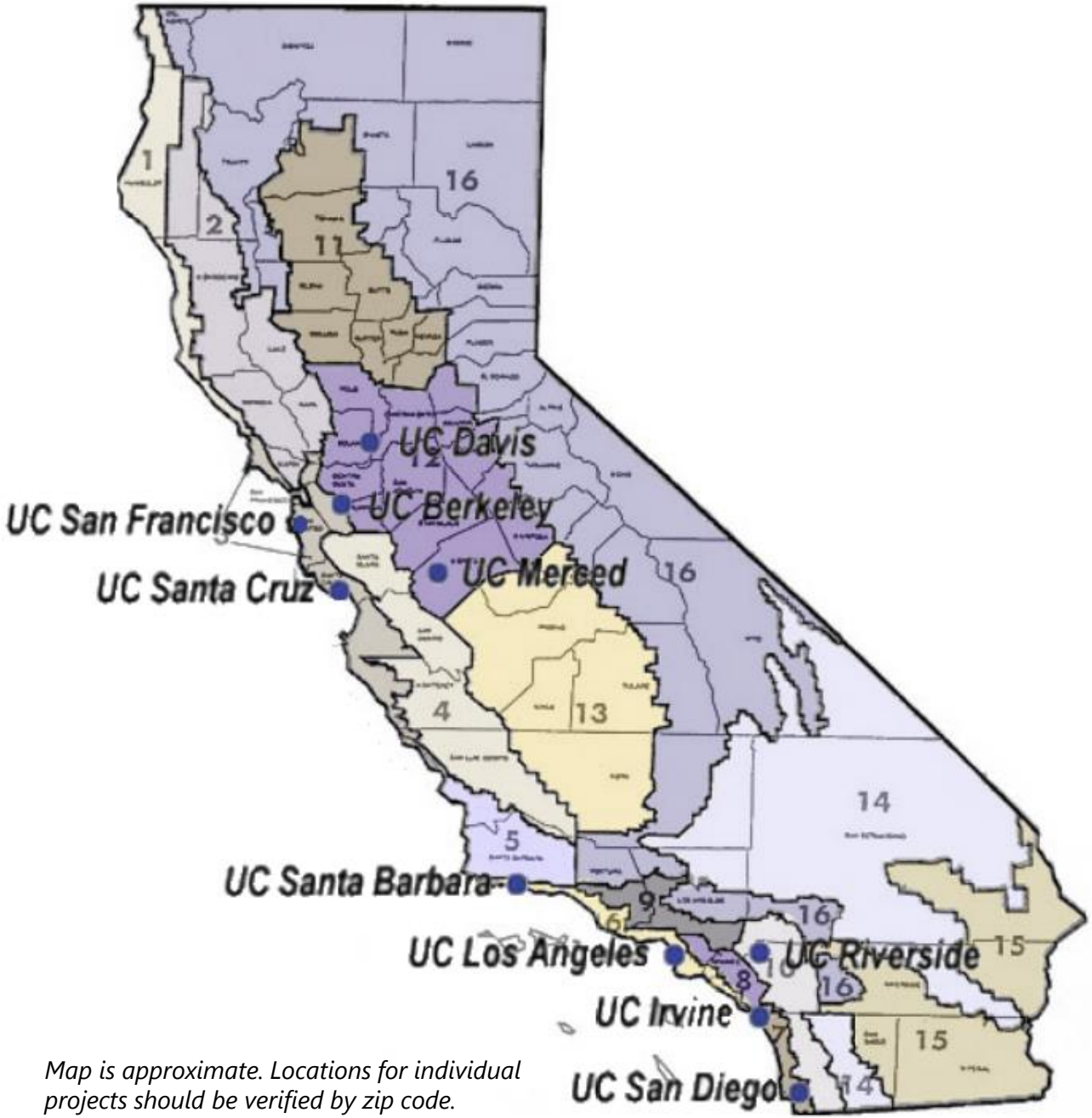
2022 Energy Code “Title 24”

- Applies to all projects requiring a standard building permit
- Applies in both new construction and renovations
- New edition went into effect January 1, 2023
- Format:
  - Mandatory Requirements
  - Prescriptive Compliance Requirements
  - Performance Compliance Approach



2022 Energy Code "Title 24"

- Requirements often vary by climate zone
- UC System campuses are located in the following climate zones:
  - CZ 3: Berkeley, San Francisco, Santa Cruz
  - CZ 6: Santa Barbara, Los Angeles, Irvine
  - CZ 7: San Diego
  - CZ 10: Riverside
  - CZ 12: Davis, Merced

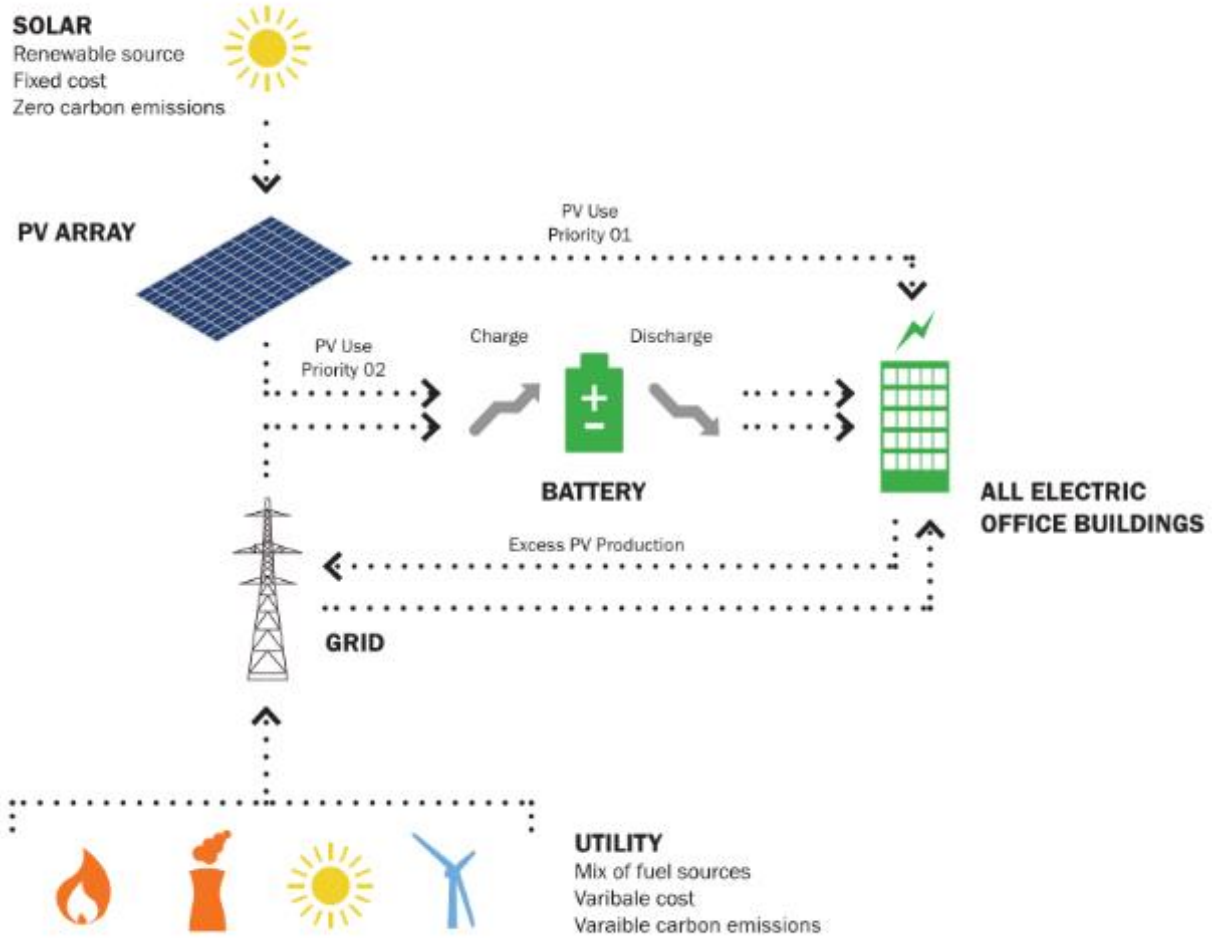


Map is approximate. Locations for individual projects should be verified by zip code.

General Trends

- Increase onsite renewables
- Increase grid harmonization through demand response and onsite storage
- Shift away from gas to heat pump technology
- Continued efficiency improvements

CEC estimates that the 2022 changes will reduce GHG by 10 million metric tons over the next 30 years. (equivalent to 2.2 million cars)

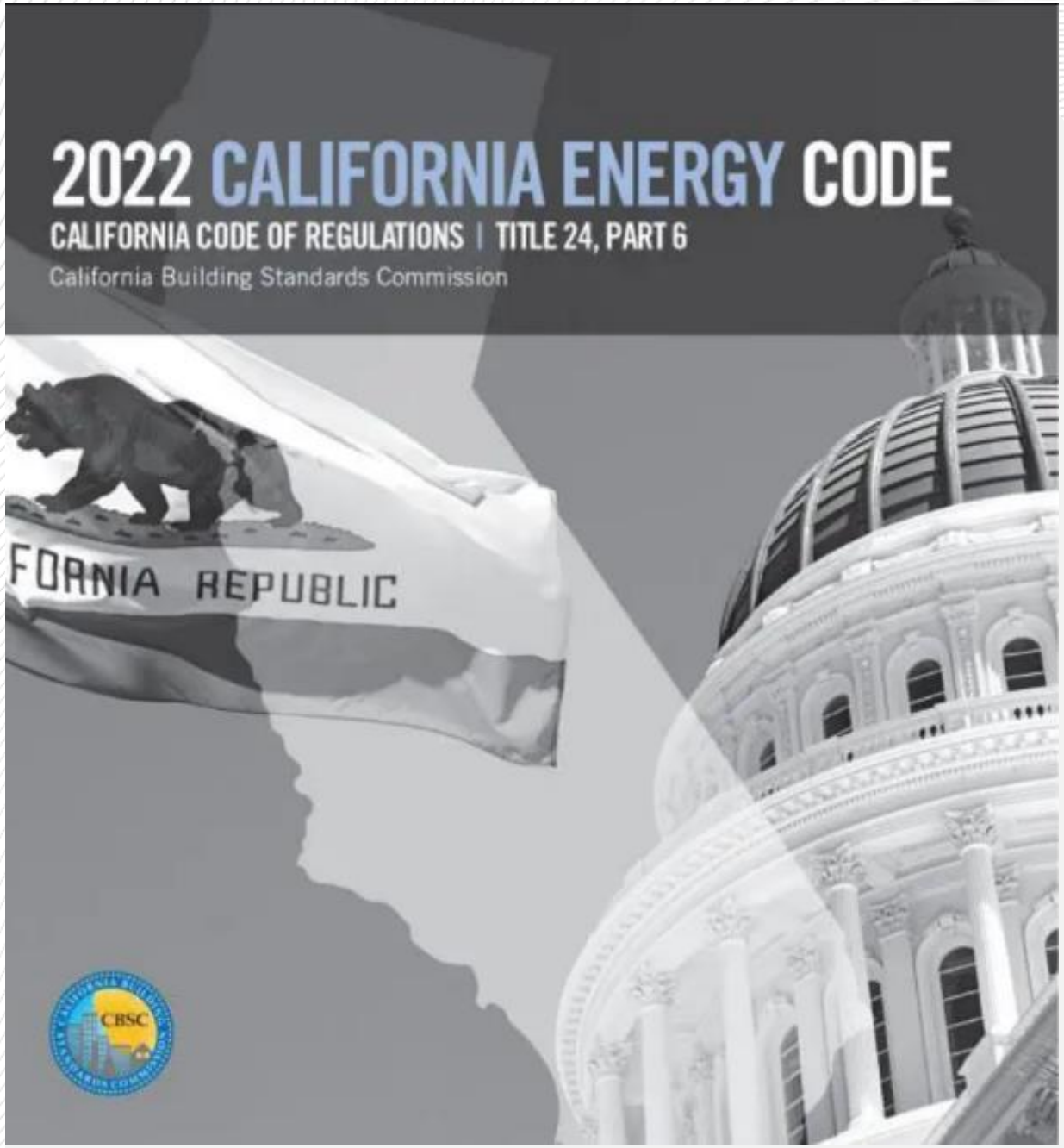


Title 24 2022 - The Big Ones

- **PV and battery storage prescriptive requirements**
- **Demand response controls**
- **Testing & verification requirements**
- **Prescriptive HVAC Equipment (Heat Pump) requirements**

2022 Energy Code "Title 24"

- **Section 110** – MANDATORY All Occupancies
- **Section 120** – MANDATORY Architectural & MEP components for Non-Residential & Hotel/Motel
- **Section 130** – MANDATORY Electrical for Non-Residential & Hotel/Motel
- **Section 140** – PRESCRIPTIVE Non-Residential & Hotel/Motel
- **Section 141** – Additions, Alterations & Repairs Non-Residential & Hotel/Motel (Mandatory & Prescriptive) - ***check for exceptions***
- **Section 150** – Single-Family Residential
- **Section 160** – MANDATORY Multifamily
- **Section 170** – PRESCRIPTIVE Multifamily
- **Section 180** – Additions, Alterations & Repairs for Multifamily



Section 110 – Mandatory All Occupancies

Architectural

- 110.6(a) Exceptions for NFRC Certification for small area and replacements removed for vertical glazing. (i.e. all vertical glazing needs NFRC 100 certification)
- 110.10 Solar Readiness – Exception for “Healthcare buildings” tightened to just I-2 & I-2.1 occupancies

Section 110 – Mandatory All Occupancies

HVAC

- Efficiency Table 110.2A – Changes to equipment efficiency – not all increases (mostly increase IEER, some decrease in peak EER, to encourage variable speed)
- Efficiency Table 110.2A – New tables for DX-DOAS units, CRAC units, Heat Pump & Heat Recovery chillers

Section 110 – Mandatory All Occupancies

Lighting

- Outdoor Lighting Zone requirements revised (based on changed to definitions in Part 1 – Administrative Code)
- **110.12 Demand Responsive Lighting controls required for buildings with installed lighting of 4000W (changed from 10,000sf)**
  - Must meet prescriptive control requirements of 130.1(b) for all general lighting
  - Exception for <0.5 W/SF removed
- **130.4 Acceptance testing for demand response-controlled lighting required**

Section 110 – Mandatory All Occupancies

Receptacles

- **110.12(e) Demand responsive controlled receptacles required in all building with demand responsive controlled lighting**
- **130.4 Acceptance testing for demand response-controlled receptacles required**

Section 120 – Mandatory Arch & MP for Nonresidential

Ventilation

- 120.1(c)3 Ventilation calcs to be Area-based *unless* designed for an exception based on occupancy
- 120.1(c)3 Demand control ventilation calculation
- **120.1(c)5 Occupant Sensor ventilation control is required for any space that is allowed to go to 0 cfm when unoccupied and is required to have occupancy sensing lighting controls.** Requires unoccupied temperature setback as well
- 120.1(f) All systems require verification testing to confirm operation within 10% of Outside air requirements. (previously only constant volume)
- 120.1(h) Ventilation air flow controls required for ventilation-only systems (i.e. even with no heating/cooling)

Section 120 – Mandatory Arch & MP for Nonresidential

HVAC Equipment & Systems

- 120.1(c)1.A.iii MERV 13 Filters now required on HRV systems (may be upstream or downstream of the HRV)
- 120.1(c)1.D Filter racks require gaskets
- 120.4(b)1.D &2.D All ductwork with a pressure class required Seal Class A (except visible exposed ductwork)
- **120.4(g) Duct leakage testing required for constant volume systems** (Changed from prescriptive to mandatory requirement)
- 120.10 Mandatory Requirements for Fans. All fans/fan arrays >1 hp, must have a Fan Energy Index (FEI) of 1 for constant volume and 0.95 for variable volume. (FEI provided by the manufacturer)

Section 120 – Mandatory Arch & MP for Nonresidential

120.6 Covered Processes

- 120.6(a) & (b) Refrigerated warehouses and commercial refrigeration: Updated verbiage, especially related to CO2 refrigerants
    - 120.6(b)6 Acceptance testing now required for commercial refrigeration systems
- 120.6(d) Process Boiler emission criteria for >10 MMBtuh now applies down to >5 MMBtuh
- 120.6(e) **Compressed air systems** require monitoring systems; pipe leakage testing; and minimum pipe sizing criteria for pressure drop depending on system size
- 120.6(i) New Section for Steam Traps
    - Applies to >15 psig & >5Mbtuh. Automatic fault detection, strainers and acceptance testing

Section 120 – Mandatory Arch & MP for Nonresidential

120.6 Covered Processes

- 120.6(h) New Section for Controlled environment horticulture (CEH) spaces NEW
  - Dehumidification heat recovery required
  - Lighting level controls
  - Electrical metering
  - Envelope requirements: double glazing and minimum roof insulation required.

Section 120 – Mandatory Arch & MP for Nonresidential

120.6 Covered Processes

- 120.6(j) Computer Rooms
  - No reheat allowed
  - Humidification must be adiabatic
  - HVAC units >60,000 btuh (5 tons) must be variable air flow
  - (New as mandatory, previously prescriptive requirements)

Section 130 – Mandatory Electrical for Nonresidential

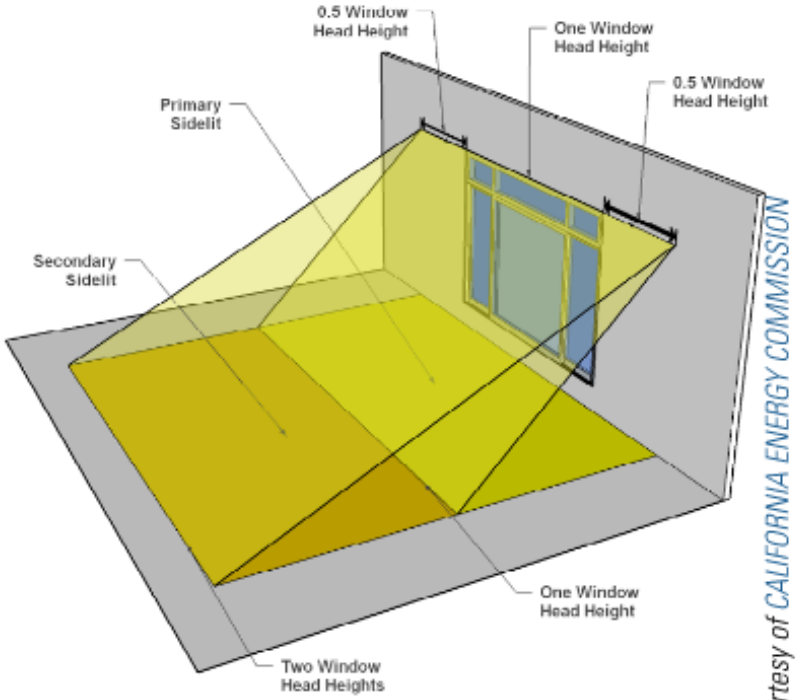
Lighting

- **130.1(c)6.D Full & Partial-off occupancy sensing now required in office spaces >250 SF**
  - Control zones <600 SF
  - Dimming to 80% off when zone is unoccupied; full off when entire office is unoccupied

Section 130 – Mandatory Electrical for Nonresidential

Lighting

- **130.1(d) Automatic daylighting controls required in secondary daylit zones (previously only required in primary daylit zones)**
  - Daylighting controls to reduce lighting power by 90% (previously 65%)



Courtesy of CALIFORNIA ENERGY COMMISSION

The primary sidelit daylit zone is an area on a plan directly adjacent to each vertical glazing, one window head height deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window.

The secondary sidelit daylit zone is the area on a plan directly adjacent to each vertical glazing, two window head heights deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window.

Section 140 – Prescriptive Arch & MEP for Nonresidential

Envelope

- 140.3(a)1.A.i.b Minimum reflectance for steep sloped roofs increased from 0.2 to 0.25
- 140.3(a)7 Exterior doors >25% glass are considered glazed (reduced from 50%)
- Table 140.3-B Prescriptive envelope performance
  - Metal Framed wall U values reduced by ~10%
  - Glazing performance changed to be by climate zone (Climate zone 7 stays about the same)
- 141.0(b)2 Roof recover & replacement projects must upgrade to prescriptive insulation levels (R-17 in climate zone 6-8, R-23 elsewhere)

Section 140 – Prescriptive Arch & MEP for Nonresidential

Envelope

- **140.3(a)9. Air Barrier – required in all climate zones (previously only required in climate zones 10+)**
  - Documentation required:

    "Construction documents shall include air barrier boundaries, interconnections and penetrations, and associated square foot calculations for all sides of the air barrier"

  - Materials clarified
  - Verification of the installed air barrier may be performed. Verification requirements clarified

Section 140 – Prescriptive Arch & MEP for Nonresidential

HVAC Systems

NEW

- **140.4(a)2 Single zone DX systems <240,000 MBH (20 tons) are required to be heat pump heating (i.e. no gas) for the following spaces types:**
  - **Retail, Grocery, School, Office, Financial Institution, Library**
  - Applies to new construction only per exceptions in 141.0
- 140.4(c) All fan systems >1 kW must meet a "Fan power budget" (W/cfm) stipulated in Table 140.4-A
- 140.4(e) **Economizers required for all systems >33 MBH** (formerly 54 MBH) unless provided with a DOAS & Heat recovery
- 140.4(k)8 Boiler System requirements (1,000-10,000MBH) added for climate zones 1-6, 9-14 and 16
  - Minimum efficiency of 90%, Max return water temperature of 120F in all operating conditions.

Section 140 – Prescriptive Arch & MEP for Nonresidential

HVAC Systems

- 140.4(p) New section for DOAS units NEW
  - Fan power must be <1W/cfm
  - Must have minimum of 3 speeds
  - Supply air air must be delivered to the space so that local heating/cooling equipment can cycle off.
- 140.4(q) New section for Exhaust Air Heat Recovery NEW
  - Table 140.4-J & 140.4-K Required Energy recovery based on % OA and climate zone (Not required for climate 7)
  - Sensible recovery >60%, enthalpy recovery >50% in both heating & cooling

Section 140 – Prescriptive Arch & MEP for Nonresidential

Water Heating

- 140.5(a)1 Heat pump water heaters required for schools <25,000 SF
- 140.5(a)2 Gas water heaters > 1MMBh must be minimum 90% efficient

Section 140 – Prescriptive Arch & MEP for Nonresidential

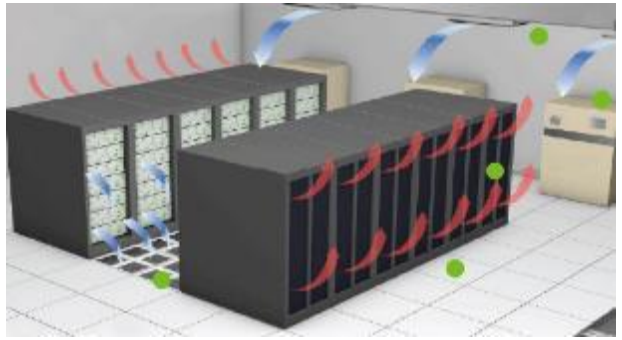
Lighting

- Table 140.6-B Whole Building Lighting Power densities reduced for many space types.
- Table 140.6-C Area Lighting Power Densities reduced for most indoor area types
- Table 140.7-A Outdoor hardscape power allowances reduced for most lighting zones

Section 140 – Prescriptive Arch & MEP for Nonresidential

Prescriptive covered processes

- 140.9(a) Computer rooms
  - Partial cooling control required for air & water economizers
  - Reheating & Humidification moved from prescriptive to mandatory requirements
  - **Hot aisle/cold aisle containment required for rooms >10 kW(2.8 tons) – down from 175kW (50 tons)**
  - Minimum efficiencies for UPS systems added



Section 140 – Prescriptive Arch & MEP for Nonresidential

Photovoltaics & Battery Storage NEW

- 140.10(a) PV Added as a prescriptive requirement for Non-residential new construction
  - Min System size to be the smaller of:

    = (*Solar Access Roof Area) x (14 w/SF)*

    = *(Conditioned Floor Area) x (Table 140.10-A Factor) / 1000*

  - *some exceptions apply based on project size & roof area
  - Part 1 Administrative Code - Community shared PV/renewables may be used to offset part or all of the required PV where specific requirements are met

TABLE 140.10-A
PV CAPACITY FACTORS

	FACTOR A—MINIMUM PV CAPACITY (W/ft² of conditioned floor area)		
CLIMATE ZONE	**1, 3, 5, 16**	**2, 4, 6–14**	**15**
Grocery	2.62	2.91	3.53
High-Rise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space	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, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.58

Section 140 – Prescriptive Arch & MEP for Nonresidential

Photovoltaics & Battery Storage NEW

- 140.10(b) All buildings required to have PV **must also have battery storage**
    - Min Storage and power capacity Size dictated by PV system size a space type

*some exceptions apply based on PV system size and calculated battery size

Section 140 – Prescriptive Arch & MEP for Nonresidential

UCOP Interpretation for Battery and PV requirements

- Where the campus has owned electrical distribution systems located behind a single utility meter, the entire campus is included as the project site.
- Existing or new solar and battery storage resources connected anywhere on the same campus-owned utility distribution grid may be used to satisfy the code requirement using the same standard sizing equations.
- To avoid double counting, Campus approach requires comprehensive accounting and annual reporting of all campus solar and battery storage resources by Campus Energy Manager or other designated staff.
- See University of California Facilities Manual, Resource Directory RD 4.6 for specific requirements.

Multi-family Residential – General Trends

NEW

- Multi-family residential requirements used to be divided based on building size with low-rise (3 stories or less) in a separate section and high-rise (4 stories or more) in with non-residential.
- Many of the “new” 2022 Multi-family Residential requirements are the same as or similar to the 2019 requirements for low-rise residential.
- General nudge toward electrification without heavy handed mandatory measures.

Section 160.0 – Multifamily Residential - Mandatory

HVAC

- **160.2(b)2A – New capture efficiency (CE) requirements added for range hoods, depended on gas vs electric stoves.**
- 160.2(b)2A & B – Fan efficacy and verification requirement of <1W/cfm added for fans serving a single dwelling unit.
- 160.2(b)2C – Duct sealing and verification required for systems serving multiple (by HERS rater for low-rise, but contractor for high-rise)
- **160.4(f) Table 160.4 – Hot water pipe insulation thickness increased from 1.5” to 2” for pipes 1-1/2” and larger.**

Section 160.0 – Multifamily Residential - Mandatory

Lighting & Electrical

- 160.5(a) – Dwelling unit lighting requirements similar to previous low-rise requirements
  - **Indoor and Outdoor lighting is required to comply with Reference Joint Appendix JA8 for lighting efficacy with some exceptions.**
  - **Screw base lamp sockets no longer allowed in recessed downlights**
- 160.5(b) – Common area lighting requirements are similar to non-residential requirements.
- 160.6 – Common area electrical distribution requirements are similar to nonresidential requirements, including requiring demand-controlled receptacles where there is demand-controlled lighting.

Section 160.0 – Multifamily Residential - Mandatory

Electric-ready Requirements NEW

- 160.9 To make future conversion to all-electric appliances easier, **gas appliances must have electrical infrastructure (conductor or raceway and space in panel) provided for future use.**
- Applies to
  - Gas/propane furnaces serving individual dwelling units
  - Gas/propane cooktops
  - Gas/propane clothes dryers in individual units and common areas.

Section 170.0 – Multifamily Residential - Performance

Performance Compliance & Verification

- 170.1 – Performance compliance modeling was previously only based on Time Dependent Valuations (TDV) energy use per sqft. **Now compliance modeling requires meeting energy budgets of of TDV Energy and Source Energy separately.** NEW
- 160.3(b)5 & 170.1(d) – Compliance verification required to ensure installed systems match those in the performance compliance model. Existing requirement for low-rise, must be done by a HERS rater. New requirement for high-rise, may be done by installing contractor.

Section 170.0 – Multifamily Residential - Prescriptive

Envelope - Insulation

- 170.2(a) –Attic & Roof insulation changed to match previous low-rise requirements
- 170.2(a) –Exterior Floor insulation changed to match previous low-rise requirements
- 170.2(a) –Wall insulation requirements (R-Values) increased.
- 170.2(a) – Quality Insulation Installation HERS verification still only required for 3 stories or fewer.
- 180.2 – Alterations/re-roofing triggers upgrades to solar reflectance and continuous insulation depending on climate zone and steep vs low slope.

Section 170.0 – Multifamily Residential - Prescriptive

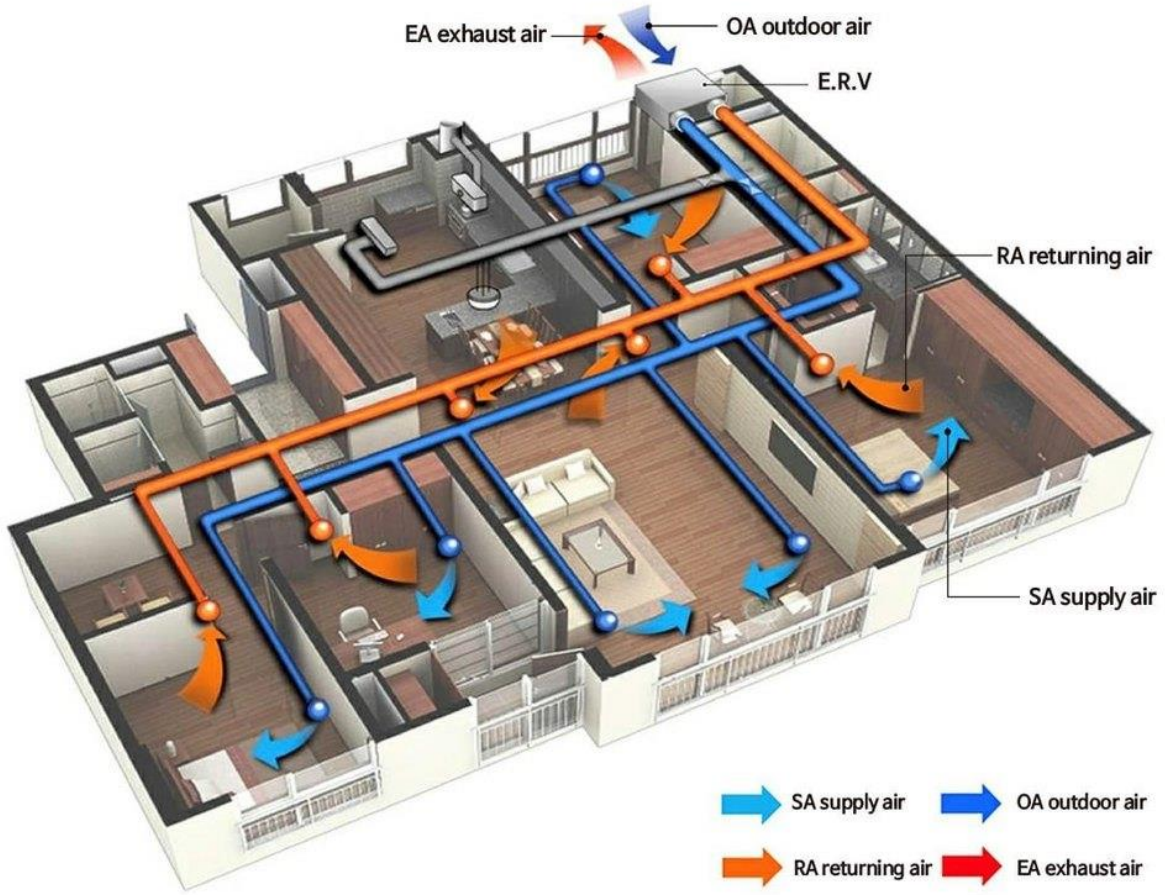
Envelope - Fenestration

- 170.2(a) – Fenestration product type categories changed (curtainwall/storefront, NAFS AW Class, All others). Performance changed to be per climate zone (previously the same for all zones). Many prescriptive values have improved.
- **170.2(a) – Prescriptive maximum window-to-floor ratio of 20% added, in addition to existing window-to-wall ratio of 40%.**
- 170.2(a) – New U-factor requirements for opaque doors based on climate zone.

Section 170.0 – Multifamily Residential - Prescriptive

HVAC

- 170.2(c)3 – Dwelling unit HVAC systems:
  - Heat pump systems required for dwelling units in most climate zones
  - Balanced ventilation systems for dwelling units require energy recovery ventilators in warm/cool climates (CZ 1,2,11-16) and have fan efficacy requirements. Specific performance requirements vary for high-rise vs low-rise.
- 170.2(c)4 – Common Area HVAC Systems
  - Fan power budget applies to all systems >1kW. Specific requirements vary by system type. (Similar to calcs required for non-residential)



Section 170.0 – Multifamily Residential - Prescriptive

HVAC

- 170.2(c)4 – Common Area HVAC Systems
  - **Fan power budget applies to all systems >1kW. Specific requirements vary by system type. (Similar to calcs required for non-residential)**
  - **Equipment with capacity >33,000 btuh require airside economizers (similar to non-residential)**
  - New requirements added if using Dedicated Outside Air Systems (DOAS) depending on configuration (e.g. economizer, heat recovery, DCV, fan control, fan power).

Section 170.0 – Multifamily Residential - Prescriptive

Water Heating

- 170.2(d)1 – For systems serving individual dwelling units, it must be one of the following options:
  - 240V heat pump water heater (plus compact distribution and drain heat recovery in CZ 1&16)
  - NEEA Tier 3 heat pump water heater (plus drain heat recovery in CZ 16)
  - Instantaneous gas or propane tankless heater <200MBH.
  - **Storage type gas heaters are no longer an option for individual units.**

Section 170.0 – Multifamily Residential - Prescriptive

Water Heating

- 170.2(d)2-4 – For central systems serving multiple dwelling units, it must be one of the following options:
  - **Heat pump water heater** (with specific requirements for recirc piping and setpoints)
  - **Gas/Propane system plus Solar Thermal** (with specific requirements for efficiency)
  - Both systems require recirculation if serving more than 8 dwelling units.

Section 170.0 – Multifamily Residential - Prescriptive

Photovoltaics (PV)

- 170.2(f)-(g) – Newly installed PV systems is required for all newly constructed high-rise & low-rise residential (previously only required on low-rise, high-rise had to be “PV ready”).
- 170.2(f)-(g) – Solar Access Roof Area (SARA) is the total building roof area capable of structurally supporting PV and with at least 70% solar access (i.e. not shaded more than 30% of the time). Excludes occupied areas.
- 170.2(f)-(g) – PV systems must meet the qualifications of Reference Joint Appendix JA11.
- Note “Solar Ready” remains a mandatory requirement (160.8) even if PV’s are not included.

Section 170.0 – Multifamily Residential - Prescriptive

Photovoltaics (PV) – Low-rise Residential

- 170.2(f) – Low-rise residential PV requirements are similar to the 2019 Code.
- Required size based on:
  - Conditioned floor area and number of dwelling units:

$$\mathbf{kW\_PV = (CFA \times A)/1000 + (NDU \times B)}$$

kW_PV = kWdc size of the PV system
CFA = Conditioned floor area
NDU = Number of dwelling units
A = CFA adjustment factor from Table 170.2-T
B = Dwelling unit adjustment factor from Table 170.2-T

  - Maximum PV size that can fit in the SARA

Section 170.0 – Multifamily Residential - Prescriptive

Photovoltaics (PV) – High-rise Residential NEW

- 170.2(g) – Similar to the new PV requirements for non-residential.
- Required size based on:
  - Conditioned floor area:

    kW_PV = (CFA × A)/1000

    kWPV = kWdc size of the PV system
    CFA = Conditioned floor area
    *Separate equation for mixed use with <80% residential

  - Building SARA x 14W/SF
- Exceptions for:
  - Total SARA less than 3% of conditioned floor area
  - Required PV size less than 4 kWdc
  - SARA less than 80 ft² contiguous area
  - Enforcement authority determines PV system cannot meet ASCE 7-16, Snow Loads

Section 170.0 – Multifamily Residential - Prescriptive

Battery Storage NEW

- 170.2(h) – Applies only to High-rise Residential with a PV system. Similar requirements to Nonresidential.
- Battery systems must meet the qualifications of Reference Joint Appendix JA12.
- Min Storage and power capacity Size dictated by PV system size (and space type if mixed use)
- Exceptions for:
  - PV Size less than 15% of the equation calculation
  - Required batter size less that 10kWh rated capacity

Cal Green 2022

EV Charging – Residential (4.106.4.2)

- Of the total number of parking spaces:
  - 10% shall be EV Capable (panel space & capacity)
  - **25% shall be EV Ready (with circuit & receptacle)**
  - **5% shall be equipped with Level 2 EVSE (applies for >20 Dwelling units only)**
- 4.106.4.3 – When parking spaces are added or electrical/lighting systems of parking facilities are altered, **10% of added/altered spaces shall be EV capable.**

Cal Green 2022

- **EV Charging – Nonresidential**
  - **Non-Res: Charging Stations required for >26 spaces per Table 5.106.5.3.1**
  - **Provisions for future medium- & heavy-duty EV charging for warehouse, grocery & retail**

TABLE 5.106.5.3.1

TOTAL NUMBER OF ACTUAL PARKING SPACES	NUMBER OF REQUIRED EV CAPABLE SPACES	NUMBER OF EVCS (EV CAPABLE SPACES PROVIDED WITH EVSE)[2]
0–9	0	0
10–25	4	0
26–50	8	2
51–75	13	3
76–100	17	4
101–150	25	6
151–200	35	9
201 and over	20 percent of total[1]	25 percent of EV capable spaces[1]

Introba

2022 California Code

What's new in "Title 24"?

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