



We will be starting soon!

Thanks for joining us



2022 Energy Code Nonresidential Central Coast and Ventura ICC Chapter Series



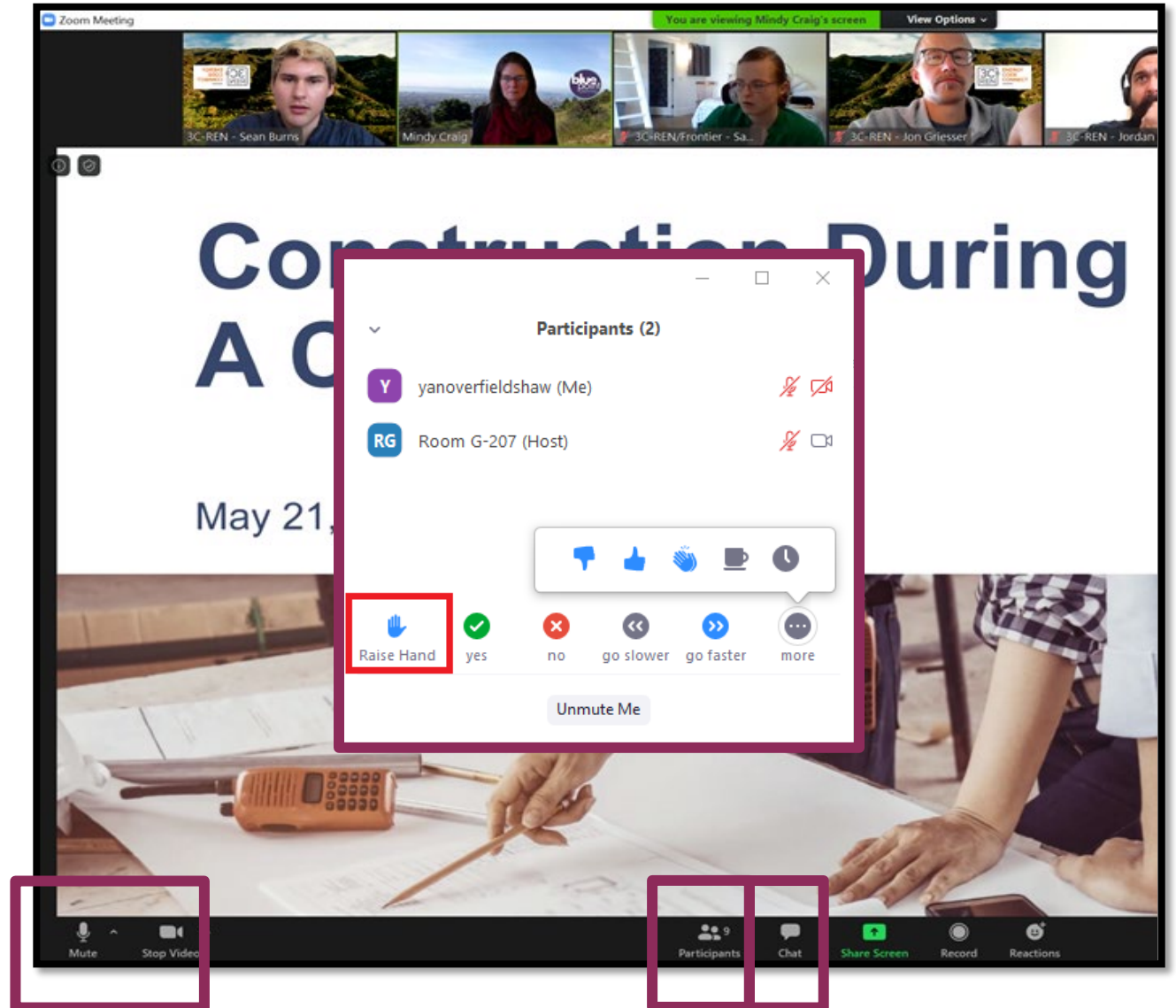
Jennifer Rennick, AIA, CEA – In Balance Green Consulting
Grant Murphy, CEA – In Balance Green Consulting

July 19, 2023



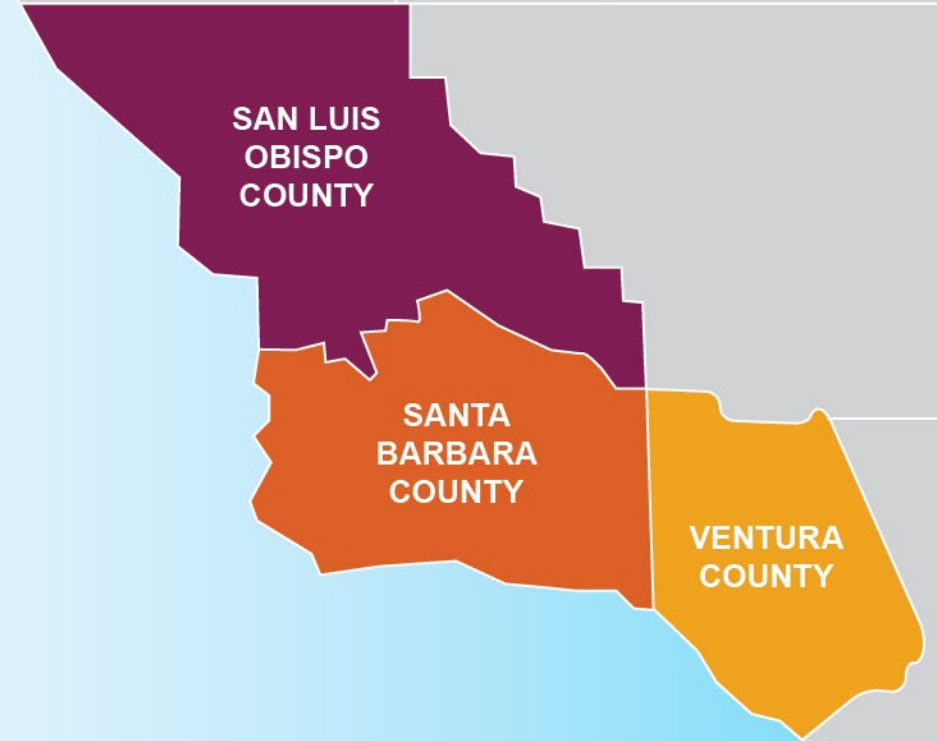
Zoom Orientation

- 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





- 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



- 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



Multifamily (5+ units)

- Rebates up to \$750/apartment plus additional rebates for specialty measures like heat pumps for property owners.

Single Family (up to 4 units)

- Contractors get paid for the metered energy savings of your customers

Enrollment:
[3C-REN.org/contractor-participation](https://3c-ren.org/contractor-participation)

CENTRAL COAST AND VENTURA ICC CHAPTER SERIES

Zoom Meetings
Wednesdays
2:00 pm - 3:00 pm

Partner



Co-Sponsors



Course Schedule:

- 5/10 Introduction to the Energy Code
- 5/31 2022 Energy Code: Single Family
- 6/14 2022 Energy Code: Multi Family
- 6/28 2022 Energy Code: ADUs and Other A + A
- 7/19 2022 Energy Code: Nonresidential
- 8/2 CALGreen Overview and 2022 Changes



Today's Learning Objectives

- Understand the organizational changes to the 2022 Energy Code
- Identify Big Pictures Goals of the California Energy Commission and how those goals influence changes.
- Recognize key updates including building envelope, lighting, mechanical and DHW systems, renewable energy and storage and field verification.
- Be able to access resources for energy code questions.



Agenda

1. Energy Code Re-organization and Key Terms
2. Non-Residential –High Level Changes
3. Mandatory Measures Code Changes
4. Performance and Prescriptive Code Changes
5. Additions and Alterations – Some Highlights
6. Q&A





Energy Code Re-organization



Big Picture Goals for the 2022 Code Updates

HOMES AND BUSINESSES USE
NEARLY **70 PERCENT**
OF CALIFORNIA'S ELECTRICITY AND
ARE RESPONSIBLE FOR A QUARTER
OF CALIFORNIA'S GREENHOUSE
GAS (GHG) EMISSIONS.

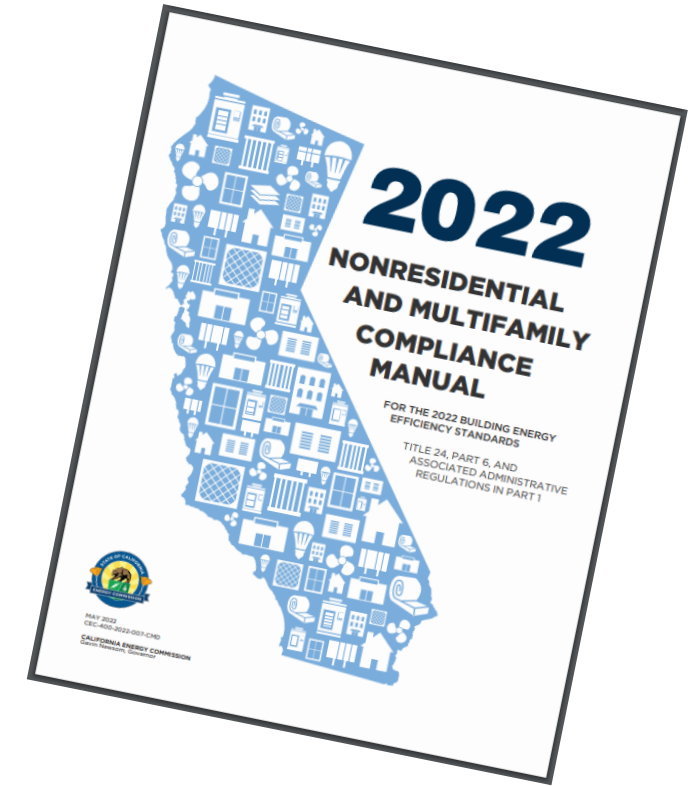


- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family and multifamily projects
- Expand PV systems and battery storage standards
- Strengthen ventilation standards



Non-Residential High-Level Changes

- Updates to Envelope and Fenestration
- HVAC –Heating System, Fans, and Outside Air Ventilation –incl'd DOAS
- Updates to Lighting –Indoor and Outdoor
- New Covered Processes –incl'd Controlled Environment Horticulture
- New Photovoltaic (PV) and Battery Systems
- Highrise Res Removed from Non-Res Sections
- Note: Hotel/Motel Guest Rooms Remained



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

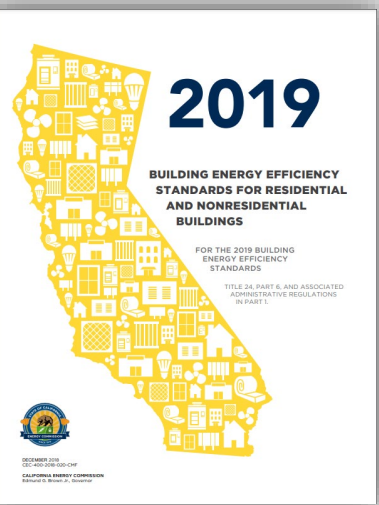
Nonresidential, Hotel/Motel -Sections
120, 130, 140, and 141

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

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 7 –Low-Rise Residential Mandatory Measures

Sec 150.0

Subchapter 5 –Performance and Prescriptive
[New Construction]

Sec 140.0-140.9

Subchapter 6 – Additions and Alterations

Sec 141.0-141.1

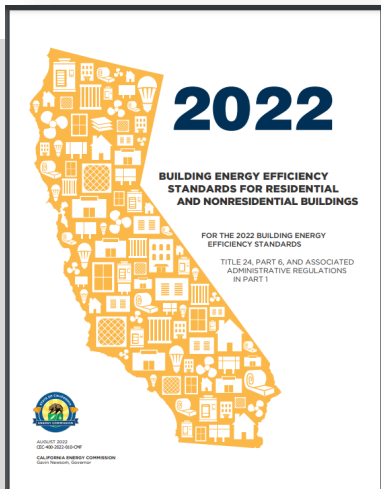
Subchapter 8 – Performance and Prescriptive
[New Construction]

Sec 150.1

Subchapter 9 – Additions and Alterations

Sec 150.2

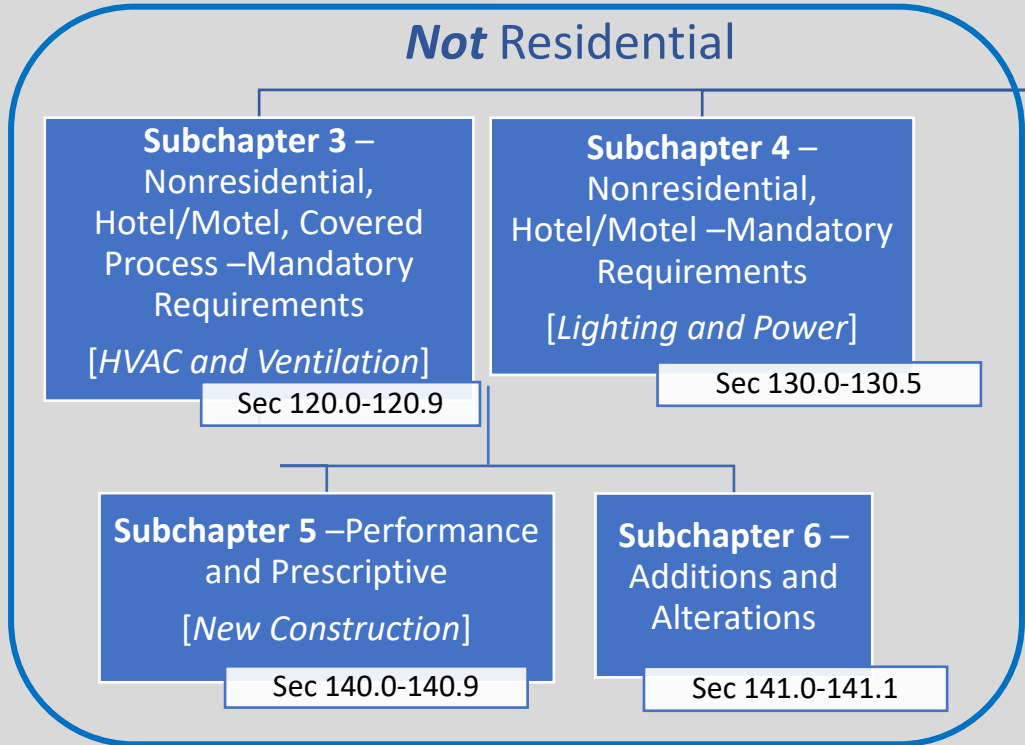
T24 Part 6 Energy Code – Subchapter Organization



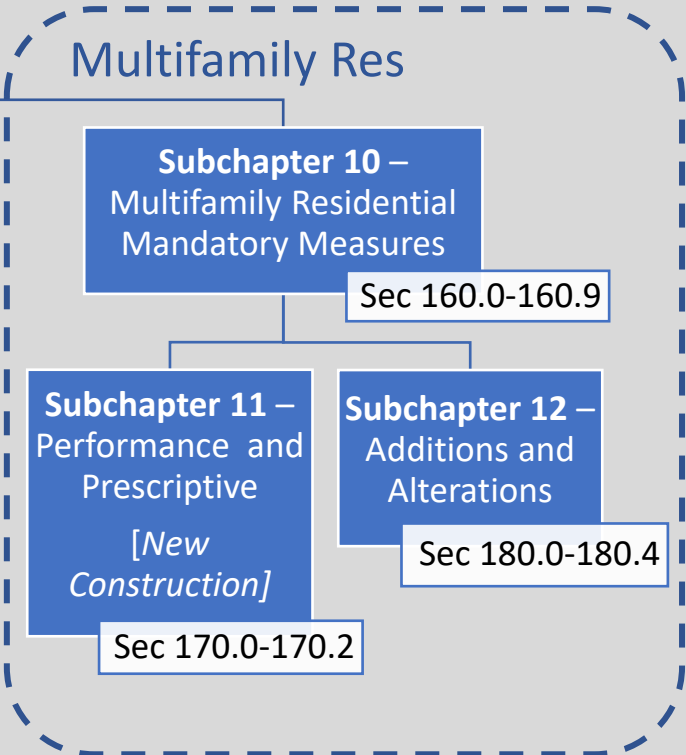
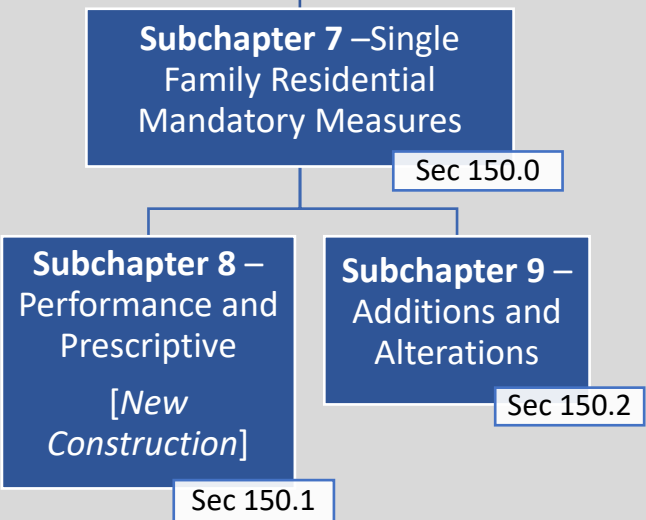
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Sec 100.0-100.3
&
Sec 110.0-110.12



Single Family Res



The Energy Code –Three Compliance Terms

Mandatory Requirements

Energy efficiency measures that are applicable to all projects.

Prescriptive Component Package

Mandatory Requirements are applicable

Follow all the parts of the prescriptive package

Note: used to determine the Standard Design Building

Essentially a **checklist** approach

Performance Method

Mandatory Requirements are applicable

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

Energy modeling approach

Performance Metrics (Computer Modeling)

Compliance is demonstrated via regulated energy:

- Space Heating and Cooling
- Ventilation
- Water Heating
- Indoor Lighting
- **Solar PV**
- **Battery Storage**
- Covered Process Loads

Compliance software has changes to the **Standard Design** which now **varies by climate zone** and includes **heat pumps**

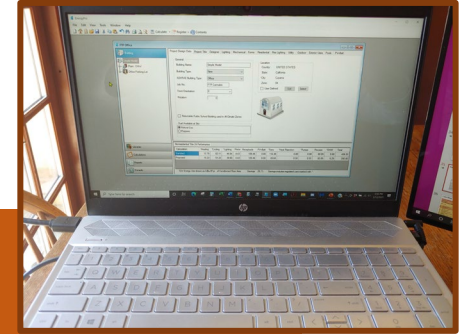
Community shared solar electric and/or battery system is allowable with specific requirements. See EXCEPTION Section 140.1(b)



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 Changes:

- **Solar Electric PV and Battery Storage** Systems were **added** to TDV-Total
- **Source Energy** metric **added** to Performance Compliance



SITE ENERGY

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

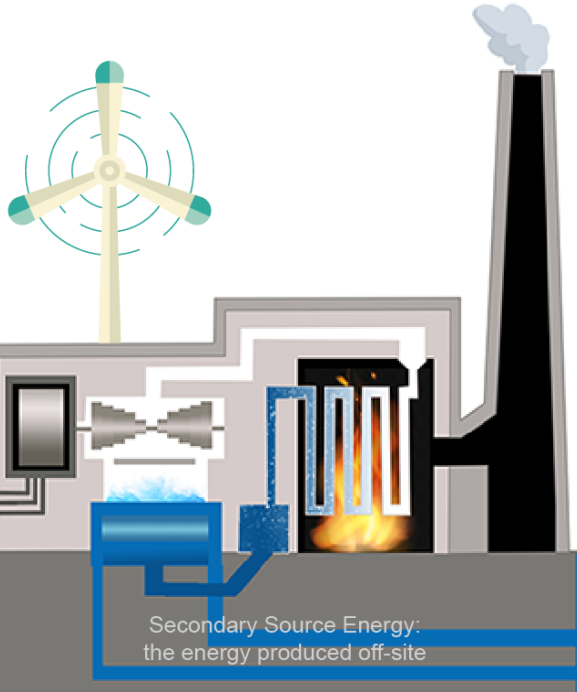
TDV ENERGY

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



Primary Source Energy: the energy produced on-site



Secondary Source Energy: the energy produced off-site

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



Example Office Building Project Results

CBECC-com 2022

Overall Result ³ : COMPLIES (not current)	Time Dependent Valuation:		Source Energy use: Total ² (kBtu/ft ² -yr)
	Efficiency TDV (kBtu/ft ² -yr)	Total ² TDV (kBtu/ft ² -yr)	
Standard Design	134.03	12.73	6.13
Proposed Design	131.10	1.06	5.66
Compliance Margins	2.93 Pass	11.67 Pass	0.47 Pass

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

² Compliance Totals include efficiency, photovoltaics and batteries

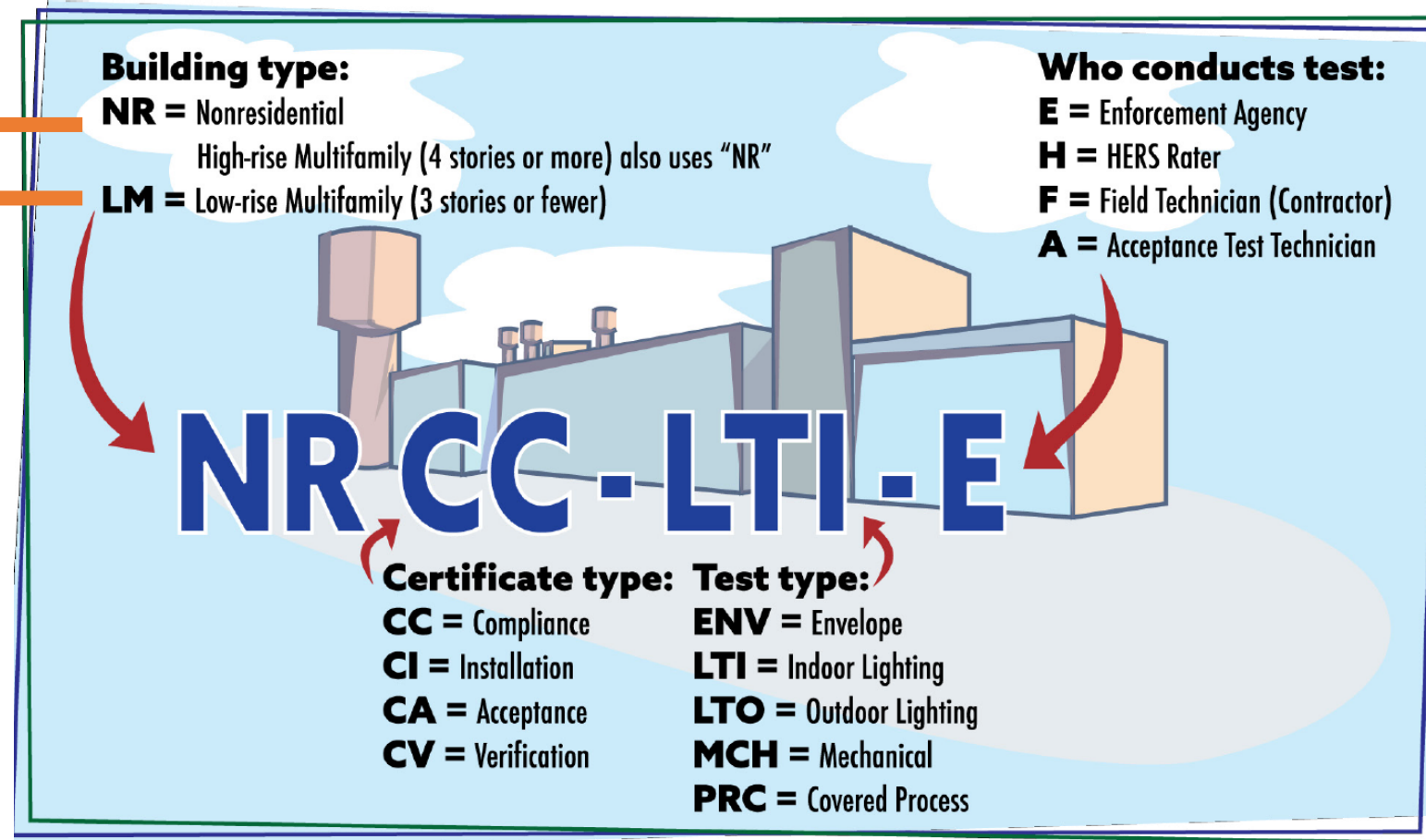
³ Building complies when all efficiency and total compliance margins are greater than or equal to zero and unmet load hour limits are not exceeded

Standard Design PV Capacity: 167.9 kWdc / Battery System Capacity: 296.8 kWh (power 70.50 kW)

Compliance Forms Nomenclature

Side Note:

Low Rise and High Rise Res will follow the same nomenclature and utilize the Non-Res CBECC-com software engine.



Resource: Energy Code Ace





Mandatory Measures

Overview of Equipment Efficiencies (All Occupancies)

Sections 120.0 - 130.5

Minor changes to Envelope and Lighting

Significant changes to HVAC and Controls

New Sections for Indoor Horticulture and Computer Rooms

Change for All Occupancies



Updated equipment efficiencies

Although it applies to all occupancies, the changes will most likely affect non-residential spaces for heating and cooling for medium to large capacity systems.



Increased HVAC Efficiencies:

- Various cooling systems
- Cooling towers
- Furnaces
- Boilers (starting 1/10/23)

New tables for:

- Dedicated Outdoor Air Systems (DOAS)
- Computer room units
- Heat pump and heat recovery chillers



Heat Pump with Waste Heat Recovery



Dedicated Outdoor Air System (DOAS)



Fenestration

NFRC certification of fenestration products and exterior doors other than field-fabricated

For U-factor, SHGC, and VT:

- NA6 formula can only be used for skylights $\leq 200 \text{ ft}^2$

Note: NA6 formula is no longer valid for vertical fenestration



Key Take Away:

Nearly all projects will be using **NFRC** rated windows through out the building.

Demand Response Lighting and Controlled Receptacles

(c) Lighting Demand Response Controls

New – Lighting systems of total installed lighting power of **4,000 watts** or greater (subject to Sec 130.1(b)) --**prior threshold was 10,000 sf**

(e) Controlled Receptacles

Receptacles must be connected to the **demand response** system if the building is required to have demand controlled lighting (subject to Sec 130.1(b))

- Except where health or life safety statute/ordinance/regulation does not allow for demand response

Reminder: Section 130.1(b) covers the mandatory controls for indoor lighting where **multilevel controls are required**



Demand control response shall reduce the lighting power by 15% or greater

Indoor Lighting Controls

(a) Manual Area Controls

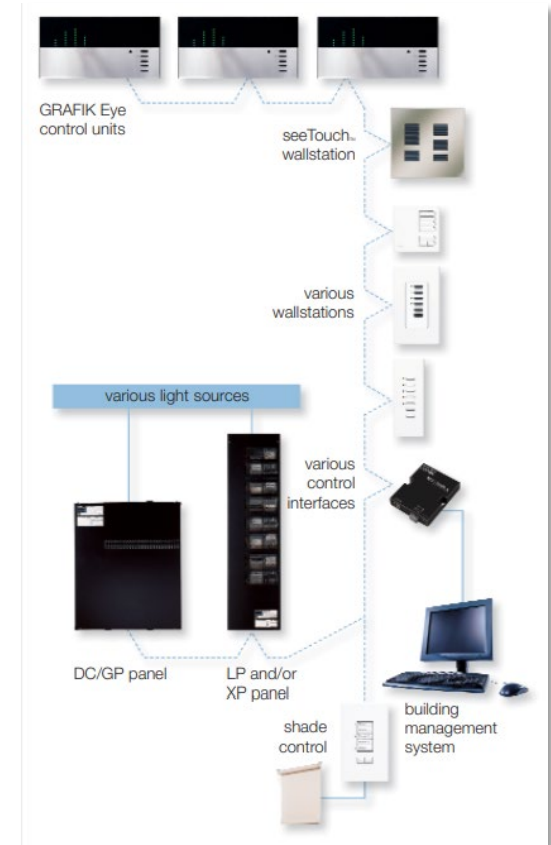
- Included language that specifies that **scene controllers** can be used if at least one scene turns on general lighting only, and the control provides a means to manually turn off all lighting
- Changed the exemption for **egress illumination to 0.1 watts/sf allowable** for continuous illumination (*previously 0.2 w/sf were allowable*)

(c) Shut-OFF Controls

- New requirements for offices > 250 ft²

(d) Automatic Daylighting Controls

- Automatic daylighting controls are NOW mandatory in secondary daylit zones



Example of Lutron Controls



HVAC Ventilation

- Ventilation rate based on Equation 120.1-F based on min ventilation rate and occupiable square footage
 - Alternate method based on occupants for spaces with fixed seating or subject to CBC 1004.5
- Design and control requirements for quantities of outdoor air:
 - Variable air volume (VAV) systems to be capable of maintaining measured outside air rates within 10% of designed minimum
 - **ALL** mechanical ventilation and space conditioning systems are to be tested to confirm they operate within 10% of the designed minimum outside air rate

Key Update:

Capabiliy and testing had only applied to constant volume systems under the previous code (2019) cycle.



Duct Leakage Testing

New duct systems meeting the following must be **HERS** tested to verify no more than **6% leakage**:

- Provides conditioned air to an occupiable space for a constant volume, single zone space conditioning system
- Serves <5,000 ft² of CFA
- Have more than 25% of ducts in unconditioned space or outdoors

Exemptions:

- Healthcare facilities
- New duct systems not subject to testing under Section 120.4(g)1 shall instead meet the duct leakage testing requirements of CMC 603.10.1



Key Update:

Duct leakage was a previously a Prescriptive component under the prior code (2019) cycle, but now it is a Mandatory measure.



Process Boilers, Compressed Air, and Steam Traps

- Boilers:
 - Requirements apply to newly installed process boilers with input capacity > 5,000,000 Btu/hr (was > 10,000,000 Btu/hr)
- Compressed Air:
 - New monitoring, testing, and pipe sizing requirements (Defined by hp or pip length)
- Steam Traps
 - New default diagnostics and other efficiency requirements when operating pressure is > 15 psig and total combined connected boiler input rating is > 5,000,000 Btu/hr

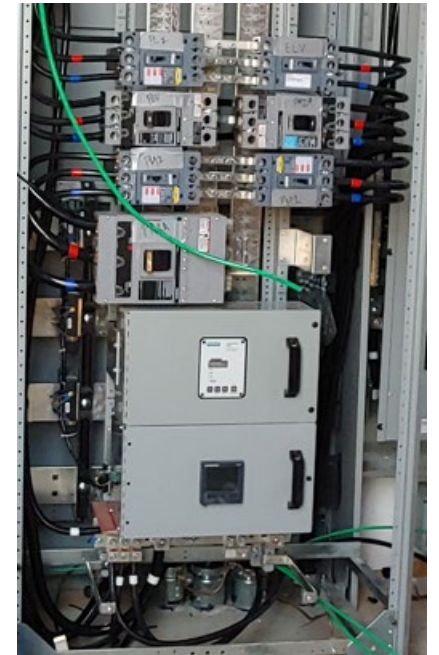
Key Take Away:

Code is addressing cost effective ways to prevent energy loss from boilers, potentially non-functional steam traps, and failed compress air systems.

Computer Rooms

New HVAC controls and efficiencies:

- Reheat controls shall prevent reheating, recooling, and simultaneous heating
- Humidification shall be adiabatic
- Variable fan controls when mechanical cooling capacity > 60,000 BTU/hr and limits on fan motor demand



Reminder:

Computer Rooms are conditioned floor areas with electronic equipment having a 20 W/sf of connected power density



Controlled Environmental Horticulture (CEH)

New Mandatory Requirements

Indoor Growing:

- Dehumidification
- Lighting
- Electrical power distribution

Conditioned Greenhouses:

- Envelope
- Space conditioning
- Lighting

Key Highlights:

- Grow lights must have **high photosynthetic photon efficacy (PPE)**, is spectrum efficient, and have **dimming and timeclock controls**.
- Dehumidifiers must **meet federal dehumidifier standards** or **recover at least 75% of the heat** used for reheat.
- Conditioned greenhouses must have at least **two glazing layers**.



Note:

This new section has a focus on cannabis growing. The space definition does not include building spaces where plants are grown for decoration.



Controlled Environment Horticulture and New Steam Traps Added as Process Systems Project Scope



CALIFORNIA ENERGY COMMISSION

PROCESS SYSTEMS

CEC-NRCC-PRC-E

B. PROJECT SCOPE

This table includes process systems that are within the scope of the permit application and are demonstrating compliance with mandatory requirements in §120.6/§160.7 or prescriptive requirements in §140.9.

My project consists of (check all that apply):

01		02	
<input type="checkbox"/>	Refrigerated Spaces <3,000 ft ² Total (no Title 24, Pt 6 requirements)	<input type="checkbox"/>	Escalator & Moving Walkway Speed Controls (mandatory §120.6(g))
<input type="checkbox"/>	Refrigerated Spaces >=3,000 ft ² Total (mandatory §120.6(a))	<input type="checkbox"/>	Controlled Environment Horticulture (mandatory §120.6(h)) ¹
<input type="checkbox"/>	Food/Beverage Stores > 8,000ft ² cfa (mandatory §120.6(b))	<input type="checkbox"/>	New Steam Traps (mandatory §120.6(i))
<input type="checkbox"/>	Enclosed Parking Garage Exhaust >= 10,000 cfm (mandatory §120.6(c))	<input type="checkbox"/>	Computer Rooms (mandatory §120.6(j) & prescriptive §140.9(a)) ¹
<input type="checkbox"/>	Newly Installed Process Boilers (mandatory §120.6(d))	<input type="checkbox"/>	Commercial Kitchen Ventilation/Exhaust (prescriptive §140.9(b)) ¹
<input type="checkbox"/>	Compressed Air Systems Combined HP >= 25 (mandatory §120.6(e))	<input type="checkbox"/>	Laboratory Exhaust/Factory Exhaust & Fume Hood (prescriptive §140.9(c)) ¹
<input type="checkbox"/>	Elevator Lighting & Ventilation Controls (mandatory §120.6(f)/§160.7)	<input type="checkbox"/>	Pool/Spa (mandatory §110.4/§160.7)

¹ FOOTNOTE: *These building features can comply using the performance method. If using the performance method for these features, compliance should be demonstrated on the NRCC-PRF-E compliance document.*

Alert! Refrigerated Warehouses and refrigerated spaces that are less than 3,000 square feet do not have requirements under Title 24, Part 6 and therefore are not documented on the NRCC-PRC-E. Systems serving these spaces shall meet the requirements of the Appliance Efficiency Regulations for walk-in coolers or freezers contained in the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through 1608).

Controlled Environmental Horticulture –Compliance Topics

Excerpt from Sample Form NRCC-PRC-E. Informational /Instructional forms are available on the CEC’s website.

P. CONTROLLED ENVIRONMENT HORTICULTURE

This table documents compliance with mandatory controlled environment horticulture requirements of §120.6(h).

Space Conditioning for Plant Production §120.6(h)1 and 5

01	02	03
System Name/ Description	Dehumidification System for Indoor Grow CEH Compliance Method §120.6(h)1	HVAC System Compliance Method §120.6(h)5

Lighting and Electrical Systems §120.6(h)2, 3 and 6

01	02	03	04	05	06
System Name/ Description	Indoor or Greenhouse Space	Photosynthetic Photon Efficacy (PPE) §120.6(h)2A & 6A	Lighting Controls §120.6(h)2B&C and 6B&C		Electrical System Monitoring Capability §120.6(h)3
			Timeswitch	Multilevel	

Opaque and Non-Opaque Envelopes

This table documents mandatory requirements for envelope assemblies in conditioned greenhouses. Envelope assemblies in Indoor Grow Facilities should be documented on the NRCC-ENV for prescriptive compliance or NRCC-PRF for performance compliance.

01	02	03	04
Tag/Plan Detail ID	Assembly Type	Non-Opaque Envelope Compliance Method §120.6(h)4B	Opaque Envelope Compliance Method §120.6(h)4A



Note: Compliance forms are available from Energy Code Ace as an on-line interview only. Paper and form-fillable pdf are not available for most of the 2022 Non-Res forms.



New Construction Prescriptive and Performance

Section 140.0

Minor changes to Envelope, Lighting, Service Hot Water

Major changes to Space Conditioning and Solar Electric

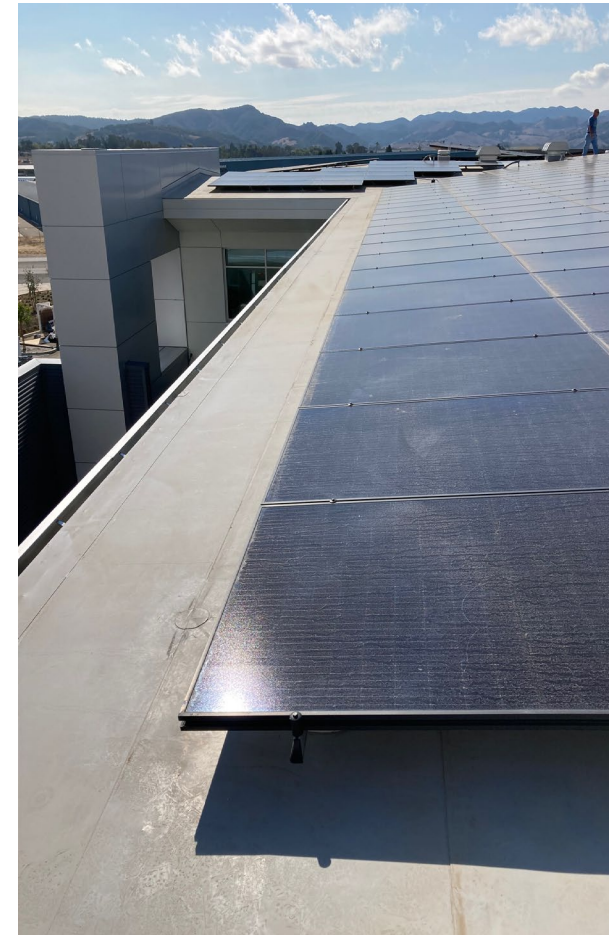
Section 140.0

- Section 140.0 –General
- Section 140.1 –Performance Approach
- Section 140.2 –Prescriptive Approach

- Nonresidential occupancies in a mixed occupancy building shall comply with nonresidential requirements in Sections 120.0 through 141.1.

Organization of Prescriptive Measures

- 140.3** Building Envelope
- 140.4** Space Conditioning Systems
- 140.5** Service Water Heating Systems
- 140.6** Indoor Lighting
- 140.7** Outdoor Lighting
- 140.8** Signs
- 140.9** Covered Processes
- 140.10** Photovoltaic and Battery Storage Systems



Roofing Products –Solar Reflectance Index (SRI)

Change for Non-Res Steep-sloped roofs

Steep-slope roofs in **CZ 1 and 3**:

- minimum aged solar reflectance of **0.20** and
- minimum thermal emittance of **0.75**, or
- minimum SRI of **16**

Steep-slope roofs **CZ 2 and 4-16**:

- minimum aged solar reflectance of **0.25** and
- minimum thermal emittance of **0.80**, or
- minimum SRI of **23**

Main Take-aways:

CZ 2, 4-16 have new requirements for steep-slope roofs.
 CZ 6,7,8 have new requirements for low-slope trade-off for aged solar reflectance.

Note: Separate sections for Guest Rooms of Hotel/Motel and Relocatable Public School Bldgs. (High-Rise Res has been removed.)

Change for Non-Res Steep-sloped roofs

Low-slope roofs in **CZ 1-16**:

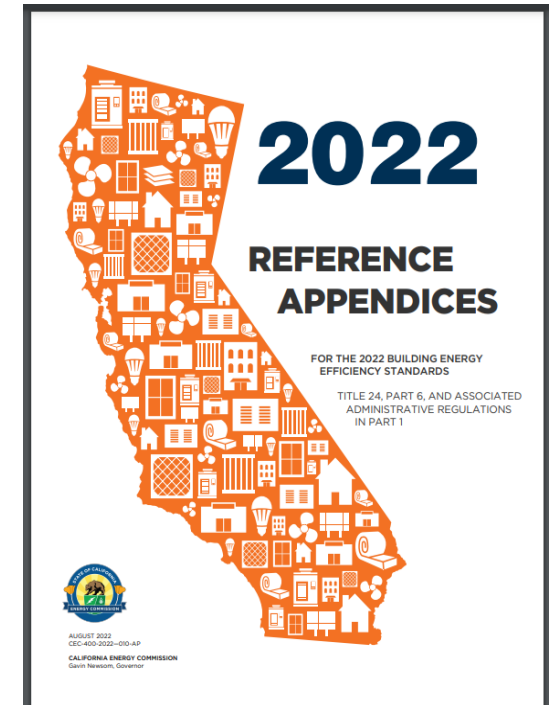
- minimum aged solar reflectance of 0.63 and
- minimum thermal emittance of 0.75, or
- minimum SRI of 75

TABLE 140.3 ROOF/CEILING INSULATION TRADEOFF FOR AGED SOLAR REFLECTANCE – NONRESIDENTIAL BUILDINGS

Aged Solar Reflectance	Metal Building Climate Zone 1-16 U-factor	Wood framed and Other Climate Zone 6-7-8 U-factor	Wood Framed and Other All Other Climate Zones U-factor
0.62-0.56	0.038	0.045	0.032
0.55-0.46	0.035	0.042	0.030
0.45-0.36	0.033	0.039	0.029
0.35-0.25	0.031	0.037	0.028

Examples... Prescriptive U-0.060, U-0.071 and U-0.055 for Nonresidential Metal Stud Wall Assemblies

Metal Stud	Cavity Insulation	Exterior Insulation	U-Factor
2x4 @ 16" o.c.	R-13 -high density batt	R-2	0.151 ← Min
	R-13 -high density batt	R-10	0.068
	R-15 mineral/rock wool	R-12	0.060 ← CZ 1, 6, 7
2x6 @ 16" o.c.	R-19 -low density batt	R-10	0.065
	R-21 - high density batt or dense-packed cellulose	R-10	0.064
2x4 @ 24" o.c.	R-13 -high density batt	R-14	0.053
2x6 @ 24" o.c.	R-19 -low density batt	R-8	0.071 ← CZ 3
	R-19 -low density batt	R-12	0.055 ← CZ 2, 4, 5, 8-16
	R-21 - high density batt or dense-packed cellulose	R-14	0.049



Mandatory Minimum Metal-Framed Wall is a weighted average U-factor of **U-0.151** (R-8 continuous insulation, or R-13 batt insulation between studs and 1/2" of continuous rigid insulation of R-2). It may be possible to meet the area-weighted average U-factor without continuous insulation if the appropriate siding materials are used.

Vertical Fenestration –Con’t Table 140.3-B

Window performance is now climate zone specific for fixed windows, and curtainwalls or storefronts

Envelope	Fenestration	Vertical	Area-weighted Performance Rating	Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
				Fixed Window															
			<u>Max U-factor</u>	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.34	0.36	0.34	0.34	0.34	0.34	0.36
			<u>Max RSHGC</u>	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.25	0.22	0.22	0.22	0.22	0.25
			<u>Min VT</u>	0.42															
				Curtainwall or Storefront															
			<u>Max U-factor</u>	0.38	0.41	0.41	0.41	0.41	0.41	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
			<u>Max RSHGC</u>	0.25	0.26	0.26	0.26	0.26	0.26	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
			<u>Min VT</u>	0.46															
				Operable Window															
			<u>Max U-factor</u>	0.46															
			<u>Max RSHGC</u>	0.22															
			<u>Min VT</u>	0.32															
				Glazed Doors															
			<u>Max U-factor</u>	0.45															
			<u>Max RSHGC</u>	0.23															
			<u>Min VT</u>	0.17															
			<u>Max WWR%</u>	40%															

CZ 9,11-15
new values

CZ 1 and 7
new values



Space Conditioning

140.4(a)2 For Single zone systems with direct expansion (dx) cooling $\leq 240,000$ Btu/hr:

- School building spaces:
 - CZ 2-15: Heat pump
 - CZ 1 and 16: Dual-fuel heat pump
- Retail and Grocery building spaces
 - CZ 2-15: Heat pump
 - CZ 1 and 16: cooling capacity $<65,000$ Btu/hr: Furnace A/C; cooling capacity $\leq 65,000$ Btu/hr: Dual-fuel heat pump
- Office, Financial Institutions and Library building spaces:
 - CZ 1-15: Heat pump
 - CZ 16: cooling capacity $<65,000$ Btu/hr: Furnace A/C; cooling capacity $\geq 65,000$ Btu/hr: Dual-fuel heat pump
- Office Spaces within the Warehouses
 - CZ 1-16: heat pump



Takeaway:
Where demonstrated to be cost effective, the baseline is a heat pump.

EXCEPTION to Section 140.4(a)2: Systems utilizing recovered heat for space heating.



Fan Power Budget –new calculation method for Systems ≥ 1 kW

- Applies to **all fans** moving air in, out, and between conditioned spaces or circulating air to condition space
- Allowances vary by **system type, CFM, and floors served**
- At system design, flow cannot exceed budget
- See **Table 140.4-A Supply Fan Power Allowances** (Watts/cfm)-extensive—Includes 100% OA, Energy Recovery, low turndown single zone VAV, etc
- For elevations >3,000 feet, multiply fan budget by **Correction Factor listed in Table 140.4-C**

Excerpt from Table 140.4-A

<u>Airflow</u>	<u>Multi-Zone VAV Systems $\leq 5,000$ cfm¹</u>	<u>Multi-Zone VAV Systems >5,000 and $\leq 10,000$ cfm¹</u>	<u>Multi-Zone VAV Systems >10,000 cfm¹</u>	<u>All Other Fan Systems $\leq 5,000$ cfm</u>	<u>All Other Fan Systems >5,000 and $\leq 10,000$ cfm</u>	<u>All Other Fan Systems >10,000 cfm¹</u>
<u>Supply System Base Allowance for AHU serving spaces ≤ 6 floors away).</u>	<u>0.395</u>	<u>0.453</u>	<u>0.413</u>	<u>0.232</u>	<u>0.256</u>	<u>0.236</u>
<u>Supply system base allowance for AHU serving spaces > 6 floors away</u>	<u>0.508</u>	<u>0.548</u>	<u>0.501</u>	<u>0.349</u>	<u>0.356</u>	<u>0.325</u>
<u>MERV 13 to MERV 16 Filter upstream of thermal conditioning equipment (mid-<u>if two times the clean filter pressure drop</u>)²</u>	<u>0.136</u>	<u>0.114</u>	<u>0.105</u>	<u>0.139</u>	<u>0.120</u>	<u>0.107</u>

Takeaway:
 New method of calculating fan power budget is more nuanced.
 Applies to fans 1kW or larger –previously 5 hp (3.7 kW)

Economizers –Update to Cooling Air Handler Threshold

- Prescriptively required when the air handler has a **cooling capacity > 33,000 Btu/hr** (previously 54,000 Btu/hr)
 - Design criteria
 - Smaller rooftop units
 - Smaller split DX air handlers
 - VRFs and mini-splits
- Economizer **trade-off** for cooling system efficiency allowed –**Table 140.4-F**
- **New Exception** for air handlers that have a design **cooling capacity < 54,000 Btu/hr** and ventilation provided by a **DOAS with exhaust air heat recovery** –Refer to Sections 140.4(p),(q) and 120.1(c)3
- Guest Rms of Hotel/Motel and Computer Rms excluded from 140.4(e)
- **New Exception** for **controlled environment horticulture** spaces where carbon dioxide enrichment is required

Takeaway:
Broadening application
of requirements for
economizers to lower
capacity units



New –High Capacity Space Heating Gas Boiler Systems

For CZ 1-6, 9-14, and 16:

New requirements for space heating gas boiler systems with total input **1 million -10 million Btu/hr** (boilers <300,000 Btu/hr not included in the total system input)

- Boiler efficiency: **90% minimum thermal efficiency**
- Hot water distribution **design criteria** –Coils and other heat exchangers:
 - Entering/return water temp 120 deg F or less, or
 - flow rate is reduced to 20% or less of the design flow of the operating boilers

EXCEPTION to 140.4(k)8 Where **25%** of annual space heating requirement is provided by **renewable, site recovered energy or heat recovery chillers**.



Design implications: To achieve the 90% efficiency, some or all of the boilers used must have condensing capability. Boilers within the same building but on separate loops are not considered to be part of the same system.



Dedicated Outdoor Air System (DOAS)

–Section has been re-written

Units that are used to filter, condition or temper 100% outside air and are separate from space conditioning systems serving the same space:

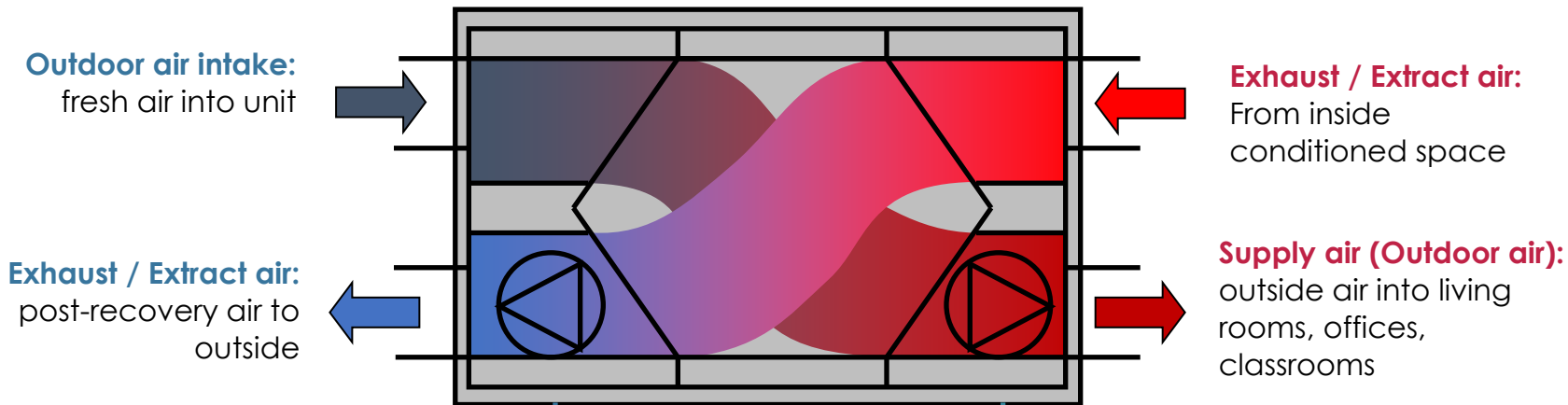
- Supply & exhaust fans:
 - ERV, HRV, DX-DOAS
 - Minimum of 3 speeds to facilitate system balancing
- DOAS with mechanical cooling providing ventilation to multiple zones and operating in conjunction with zone heating and cooling systems shall **not use heating or heat recovery** to warm supply air above 60°F when representative building loads or outdoor air temperature indicate that **majority of zones require cooling**



Meant to limit reheating,
and conserve energy



Example of One Type of Energy / Heat Recovery Ventilation (ERV / HRV)



Outdoor air intake:
fresh air into unit

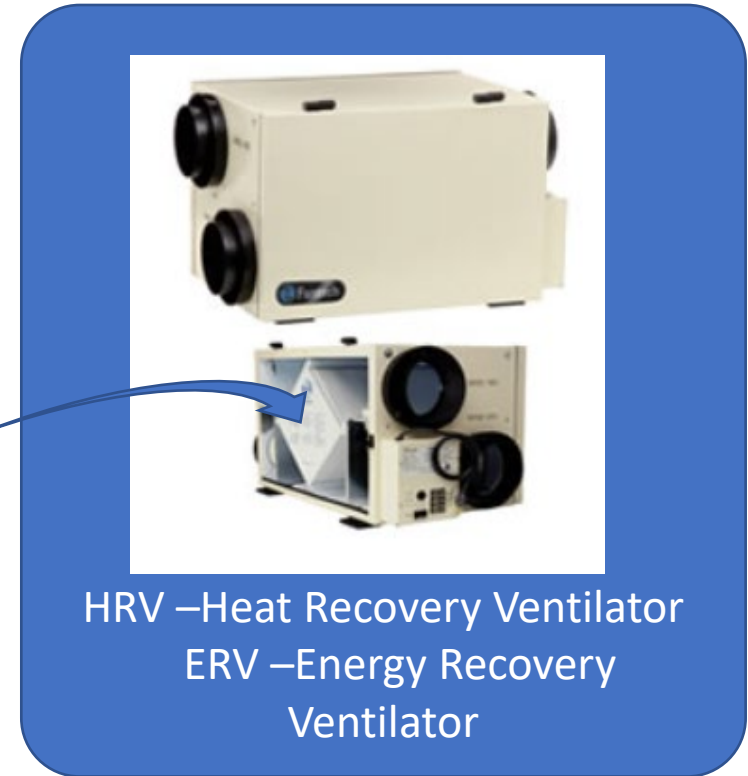
Exhaust / Extract air:
post-recovery air to outside

Exhaust / Extract air:
From inside conditioned space

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



- 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



HRV –Heat Recovery Ventilator
ERV –Energy Recovery Ventilator



Dedicated Outdoor Air System (DOAS) –con't

- DOAS unit fan systems:
 - If input power < 1 kW, shall not exceed a total combined fan power of 1.0 W/cfm
 - In input power \geq 1 kW, shall meet requirements of 140.4(c)
- Supply air:
 - Shall be delivered directly to the occupied space or at the outlet of any terminal heating or cooling coils
 - Shall cycle off any zone heating and cooling equipment fans, circulation pumps and terminal unit fans when there is no call for heating or cooling in the zone.
 - Exceptions apply- 140.4(p)2

Meant to eliminate
energy waste



Prescriptive and Mandatory Compliance for HVAC –Incl'd DOAS, ERV and HRV Systems



MECHANICAL SYSTEMS

CEC-NRCC-MCH-E

F. HVAC SYSTEM SUMMARY (DRY & WET SYSTEMS)

This table is used to demonstrate compliance for mechanical equipment with mandatory requirements found in §110.1 and §110.2(a) and prescriptive requirements found in §140.4 (a), §140.4(b), §170.2(c)1, §170.2(c)3, §140.4(k) or §141.0(b)2 and §180.2(b)2 for alterations.

Space Conditioning System Information

01	02	03	04	05	06
Name or Item Tag	Quantity	System Serving	System Status	Space Type	Utilizing Recovered Heat
					<input type="checkbox"/>

Dry System Equipment Sizing (includes air conditioners, condensers, heat pumps, VRF, furnaces, unit heaters and DOAS systems)

01	02	03	04	05	06	07	08	09	10	11		
Name or Item Tag	Equipment Category per Tables 110.2, §140.4(a)2 and 170.2(c)3aii	Equipment Type per Tables 110.2 & Title 20	Smallest Size Available ¹ §140.4(a) & 170.2(c)3ai	Equipment Sizing per Mechanical Schedule (kBtu/h) §140.4 (a&b), §170.2(c)1 & §170.2(c)2								
				Heating Output ^{2,3}		Cooling Output ^{2,3}			Load Calculations ^{3,4}			
				Per Design (kBtu/h)	Rated (kBtu/h)	Supp. Heating Output (kBtu/h)	Sensible Per Design (kBtu/h)	Rated (kBtu/h)	Total Heating Load (kBtu/h)	Total Sensible Cooling Load (kBtu/h)		

¹ FOOTNOTES: Equipment shall be the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building per §140.4(a) and §170.2(c)1. Healthcare facilities are excepted.

² It is common practice to show rated output capacity on the equipment schedule. Sensible cooling output comes from specification sheet tables.

³ If equipment is heating only, leave cooling output and load blank. If equipment is cooling only, leave heating output and load blank.

⁴ Authority Having Jurisdiction may ask for load calculations used for compliance per §140.4(b) and §170.2(c)2.

Excerpt from Sample Form NRCC-MCH-E. Informational /Instructional forms are available on the CEC's website.

Note: Compliance forms are available from Energy Code Ace as an on-line interview only. Paper and form-fillable pdf are not available for most of the 2022 Non-Res forms.



Acceptance Testing Required for DOAS, ERV and HRV



CALIFORNIA ENERGY COMMISSION

ECONOMIZER DOAS HRV ERV 2022-CEC-NRCA-MCH-05-A

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

Building: Enter Value	Floor: Enter Value	Room: Enter Value	Control/tag: Value
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<input type="checkbox"/> Construction inspection and functional testing comply <input type="checkbox"/> Does not comply	Date Submitted to AHJ: Date
--	-----------------------------

Intent:	<p>This Certificate of Acceptance is intended to verify Energy Code compliance for nonresidential and hotel/motel (see NRCA-MCH-23-A for multi-family) buildings with newly installed economizers, dedicated outdoor air system (DOAS), Heat Recovery Ventilation (HRV) systems, and energy recovery ventilation (ERV) system.</p> <p>Economizers must be certified to the California Energy Commission in compliance with JA6.3. Submit one Certificate of Acceptance for each economizer, DOAS, HRV, or ERV system that must demonstrate compliance with the Energy Code. For direct Energy Code reference see JA6.3, NA7.5.4, §140.4(e), §120.5(a)4, §160.3(d)1D, and §170.2(c)4C.</p>
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Excerpt from Informational /Instructional Form available from the CEC's website.

The official NRCA-MCH-05-A must be completed by an authorized acceptance testing technician (ATT). The official document will be watermarked.



New –Exhaust Air Heat Recovery

Fan systems designed to operate to the criteria listed in either Table 140.4-J or K **shall include an exhaust air heat recovery system**. Tables are based on Climate Zone and the percent of outdoor air at full design airflow.

Table 140.4-J (< 8,000 hrs/yr)

Table 140.4-K (≥ 8,000 hrs/yr)

Values are the design supply fan airflow rate in CFM

Table 140.0-K ENERGY RECOVERY REQUIREMENTS BY CLIMATE ZONE AND PERCENT OUTDOOR AIR AT FULL DESIGN AIRFLOW (≥8,000 HOURS / YEAR)

<u>% Outdoor Air at Full Design Airflow</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>
≥10% and <20%	≥10,000	≥10,000	NR	NR	NR	NR	NR	NR	NR	≥40,000	≥40,000	≥20,000	≥10,000	≥10,000	≥10,000	≥10,000
≥20% and <30%	≥2,000	≥5,000	≥13,000	≥9,000	≥9,000	NR	NR	NR	NR	≥15,000	≥15,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000
≥30% and <40%	≥2,000	≥3,000	≥10,000	≥6,500	≥6,500	NR	NR	NR	≥15,000	≥7,500	≥7,500	≥3,000	≥3,000	≥3,000	≥3,000	≥3,000
≥40% and <50%	≥2,000	≥2,000	≥8,000	≥6,000	≥6,000	NR	NR	NR	≥12,000	≥6,000	≥6,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥50% and <60%	≥2,000	≥2,000	≥7,000	≥6,000	≥6,000	NR	NR	≥20,000	≥10,000	≥5,000	≥5,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥60% and <70%	≥2,000	≥2,000	≥6,000	≥6,000	≥6,000	NR	NR	≥18,000	≥9,000	≥4,000	≥4,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥70% and <80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	≥15,000	≥8,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	≥12,000	≥7,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000

New Section—Exhaust Air Heat Recovery

- Fan System must meet either
 - Sensible energy recovery ration of at least 60% OR
 - Enthalpy recovery ratio of at east 50% for both heating and cooling design conditions, and be rated in accordance to AHRI 1060
- AND Energy recover bypass or control to:
 - Disable energy recovery AND directly economize with ventilation air based on outdoor air temperature limits specified in Table 140.4-G
 - For energy recovery systems where the transfer of energy cannot be stopped, bypass shall prevent total airflow rate of either outdoor air or exhaust air through the energy recovery exchanger from exceeding 10% of the full design airflow rate




Many Exceptions
included, see
Section 140.4(q)



Exhaust Air Heat Recovery –Compliance Topics

Excerpt from Sample Form
 Informational /Instructional forms are
 available on the CEC’s website.



CALIFORNIA ENERGY COMMISSION

MECHANICAL SYSTEMS

CEC-NRCC-MCH-E

H. FAN SYSTEMS & AIR ECONOMIZERS

Exhaust Air Heat Recovery 140.4(Q), 170.2(C)4o

01	02	03	04	05	06	07	08	09	10	11
Name or Item Tag	Hours of Operation Per Year	Qty	Design Supply Airflow Rate	Outdoor Airflow	% Outdoor Air at Full Design Airflow	Exemptions to Exhaust Air Heat Recovery Requirement per §140.4(q) & §170.2(c)4o	Exhaust Air Heat Recovery §140.4(q) & §170.2(c)4o	Type Of Heat Recovery Rating	Required Recovery Ratio	Energy Recovery Bypass

Note: Compliance forms are available from Energy Code Ace as an on-line interview only. Paper and form-fillable pdf are not available for most of the 2022 Non-Res forms.



Domestic Hot Water –Prescriptive (140.5) or Performance (140.1)

Hotel/Motel

- Same requirements as multifamily section 170.2(d) for individual or central system

Other Occupancies

- Any water heater that meets the Mandatory requirements
- Must be at least **90% efficiency** if the combined input rate is $\geq 1,000,000$ Btu/hr, with some exceptions
- **Exception:** A water heating system serving an **individual bathroom** space may be an **instantaneous electric** water heater

School Buildings <25,000 ft² and <4 stories

- CZ 2-15: a **HPWH** system



Residential – Single and Multifamily



Commercial – Hospitality, Retail, Schools

Indoor Lighting

Category	Table	Change
Power Adjustment Factors (PAF)	Table 140.6-A	Savings reductions in <u>office</u> applications
Complete Building Lighting Allowances	Table 140.6-B	Reductions in some lighting power density values; <u>Museum Building</u> type added
Area Category Lighting Allowances	Table 140.6-C	Lighting power density and additional allowance changes –both reductions and increases
Tailored Lighting Allowances	Table 140.6-D	Lighting power density values have been reduced
Tailored Lighting General Allowances	Table 140.6-G	All lighting power density values have been reduced



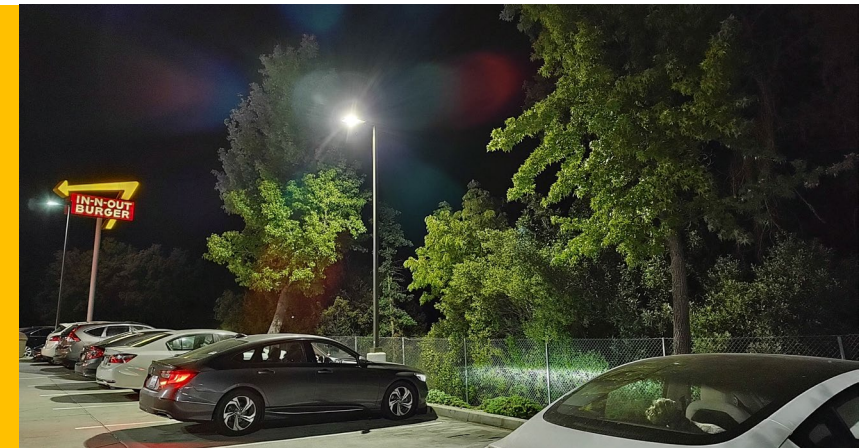
Outdoor Lighting

Category	Table	Change
Lighting Zone Designations	Table 10-114-A	Examples for each category given; Urban now has 2 zones- urban clusters and urbanized areas
General Hardscape Allowances	Table 140.7-A	All values reduced; Asphalt and concrete are no longer differentiated; more details in footnotes
Specific Lighting Applications	Table 1407-B	Security cameras added as new application for urban designations for illuminated general hardscape

The Census Bureau identifies two types of urban areas (2010 Census):

- Urbanized Areas (UAs) of 50,000 or more people;
- Urban Clusters (UCs) of at least 2,500 and less than 50,000 people.
- Rural encompasses all population, housing, and territory not included within an urban area.

The specific criteria used to define urban areas for the 2010 Census were published in the Federal Register of August 24, 2011.



Covered Processes

(a) Computer Rooms with a power density > 20 W/sf:

- New language added allowing for refrigerant economizers with Net Sensible COP by climate zone
- Other language changes affecting unit selections
- New language for Uninterruptible Power Supplies (UPS) efficiencies

Table 140.9-A: Minimum Pumped Refrigerant Economizer CRAC Net Sensible COP by Climate Zone

<u>Climate Zone</u>	<u>Net Sensible COP</u>
<u>Climate Zone 1</u>	<u>5.5</u>
<u>Climate Zone 2</u>	<u>4.5</u>
<u>Climate Zone 3</u>	<u>4.2</u>
<u>Climate Zone 4</u>	<u>3.8</u>
<u>Climate Zone 5</u>	<u>4.3</u>
<u>Climate Zone 6</u>	<u>2.7</u>
<u>Climate Zone 7</u>	<u>2.3</u>
<u>Climate Zone 8</u>	<u>2.8</u>
<u>Climate Zone 9</u>	<u>3.3</u>
<u>Climate Zone 10</u>	<u>3.4</u>
<u>Climate Zone 11</u>	<u>3.9</u>
<u>Climate Zone 12</u>	<u>4.0</u>
<u>Climate Zone 13</u>	<u>3.7</u>
<u>Climate Zone 14</u>	<u>3.7</u>
<u>Climate Zone 15</u>	<u>3.6</u>
<u>Climate Zone 16</u>	<u>3.0</u>

UPS in Computer Rooms

Uninterruptible Power Supply (UPS) efficiency requirement when serving a computer room:

- Alternating current-output UPS systems shall meet or exceed minimum average efficiencies in Table 140.9-B

Table 140.9-BA Alternating Current-Output Uninterruptible Power Supply Minimum Average Efficiency

	<u>Voltage and Frequency Dependent</u>	<u>Voltage Independent</u>	<u>Voltage and Frequency Independent</u>
<u>P < 350 W</u>	$5.71 \times 10^{-5} \times P + 0.962$	$5.71 \times 10^{-5} \times P + 0.964$	$0.011 \times \ln(P) + 0.824$
<u>350 W < P < 1,500 W</u>	<u>0.982</u>	<u>0.984</u>	<u>$0.011 \times \ln(P) + 0.824$</u>
<u>1,500 W < P < 10,000 W</u>	$0.981 - E_{MOD}$	$0.980 - E_{MOD}$	$0.0145 \times \ln(P) + 0.800 - E_{MOD}$
<u>P > 10,000 W</u>	<u>0.970</u>	<u>0.940</u>	<u>$0.0058 \times \ln(P) + 0.886$</u>

New Table!



Computer Room System –Compliance Topics

Excerpt from Sample Form NRCC-PRC-E. Informational /Instructional forms are available on the CEC’s website.

M. COMPUTER ROOM SYSTEM SUMMARY

This table contains all computer room systems to demonstrate compliance with mandatory requirements of §120.6(j) and the prescriptive requirements of §140.9(a). Prescriptive requirements only apply to computer rooms with a power density greater than 20 W/ft².

Computer Room HVAC								
01	02	03	04	05	06	07	08	09
Computer Room Name/ ID	Economizer Compliance Method §140.9(a)1	Reheat §120.6(j)1	Humidification §120.6(j)2	Fan Power §140.9(a)2			Fan Controls §120.6(j)3	Air Containment §140.9(a)3
				Sensible Cooling Capacity ¹ (kBtuh)	Total Fan System Power per Design (Watts)	Maximum Fan System Power Allowed (Watts)		

¹ FOOTNOTE: Refers to net sensible cooling capacity at design conditions.

Computer Room Uninterruptible Power Supply (UPS)					
01	02	03	04	05	06
Computer Room Name/ ID	Alternating Current Output UPS Compliance Method §140.9(a)4	Type of UPS	UPS Rated Output Power (W)	Minimum Efficiency Required Table 140.9-B	Design Efficiency Specified

Note: Compliance forms are available from Energy Code Ace as an on-line interview only. Paper and form-fillable pdf are not available for most of the 2022 Non-Res forms.



Solar Access Roof Area (SARA)



- Area of a buildings' roof space capable of supporting PV system
- Area of all roof space on covered parking areas, 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
- Occupied roof areas per CBC 503.1.4
- Roof area not otherwise available due to compliance with other building code requirements if confirmed by the Executive Director

Photovoltaic (PV) –Applicable Bldg Type and System Size

Use the smaller of:

1. $kW_{PV} = (CFA \times A)/1000$

- CFA = conditioned floor area in square feet
- A = PV capacity factor from Table 140.10-A

OR

2. Total SARA x 14 W/ft²

Table 140.10-A – PV Capacity Factors

Climate Zone	Factor A – Minimum PV Capacity (W/ft ² of conditioned floor area)		
	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

Applies to new construction as listed in Table 140.10-A or mixed occupancy where one or more of these building types constitute at least 80% of the floor area of the building



PV System Size (kW_{dc}):

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

EQUATION 140.10-A

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

SARA is the Solar Accessible Roof Area (area receiving 70% solar insolation)



VTA Housing Ohlone Station, San Jose, CA (CZ 4)

Restaurant -- 2,000 sf

SARA = 4,500 sf

Retail – 3,500 sf

Office and Unleased – 7,000 sf

$$kW_{PV} = (2000 \times 0.44) + (3500 \times 2.91) + (7000 \times 3.13) / 1000$$

$$kW_{PV} = 33 \text{ kW}$$

OR

$$kW_{PV} = 14 \text{ W/sf} \times 4,500 \text{ sf} / 1000$$

$$kW_{PV} = 63 \text{ kW}$$

Photovoltaic (PV) –Compliance Topics



CALIFORNIA ENERGY COMMISSION

SOLAR AND BATTERY

CEC-NRCC-SAB-E

J. PHOTOVOLTAIC (PV) AND BATTERY SYSTEMS

This table documents compliance with prescriptive photovoltaic and battery system requirements in §140.10/§170.2(g & h). Unless the project meets one of the listed exceptions or trades-off PV in an energy model using the performance path, §140.10/§170.2(g & h) requires installed photovoltaic and battery systems for newly constructed buildings. The installed PV systems must meet the minimum requirements in Joint Appendix 11.

Photovoltaic (PV) System

01	02	03	04	05	06	07	08
Occupancy Covered by Roof	Conditioned Floor Area (ft ²)	Area of New Roof ¹ (ft ²)	Roof Area < 70% Solar Access ² (ft ²)	Plansheet or Document showing Solar Access Calculations	Occupied Roof Area ³ (ft ²)	Solar Access Roof Area (SARA) (ft ²)	Min Size of PV System Required (kW _{dc})
						Total Min Size PV System Required for all Spaces (kW_{dc}):	
						Total Size PV System in Design (kW_{dc}):	

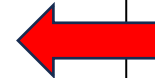
¹ FOOTNOTES: Includes the area of the building's roof space capable of structurally supporting a PV system, and the area of all roof space on covered parking areas, carports, and all other newly constructed structures on the site that are compatible with supporting a PV system per Title 24, Part 2, Section 1511.2.

² Solar access must be determined using CEC approved solar access calculation tools found at: <https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/solar-assessment-tools>.

³ As specified by CBC Section 503.1.4

Informational /Instructional forms are available on the CEC's website.

Note: Compliance forms are available from Energy Code Ace as an on-line interview only. Paper and form-fillable pdf are not available for most of the 2022 Non-Res forms.



Battery Storage

All buildings **required** to have a **PV system** shall also have a **battery storage system**.

Reminder: Battery system must meet **both** rated **energy** capacity (kWh) and the rated **power** capacity (kW)
 Calculate the energy and power capacities for each occupancy type in mixed use buildings, and sum the values.

Table 140.10-B – Battery Storage Capacity Factors

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

Rated Energy capacity :

$$kWh = kW_{PVdc} \times B / D^{0.5}$$

D is the rated single charge-discharge cycle AC to AC efficiency of the battery

Rated Power capacity:

$$kW = kW_{PVdc} \times C$$

Battery Storage

Exceptions:

- If installed PV system size $< 15\%$ of the size determined by Equation 140.10-A
- In buildings with system requirements with < 10 kWh rated capacity
- For multi-tenant buildings, the energy and power capacities of the battery storage system shall be based on the tenant spaces with more than 5,000 ft² of conditioned floor area
- In climate zone 1, no battery storage system is required for offices, schools, and warehouses.



Battery Storage System –Compliance Topics



CALIFORNIA ENERGY COMMISSION

SOLAR AND BATTERY

CEC-NRCC-SAB-E

Battery Storage System

Installed battery storage systems must meet the minimum requirements in Joint Appendix JA12.

01	02	03	04	05
Space Type Covered by Roof	Min Size of PV System Required (kW _{dc})	Rated Single Charge-Discharge AC Efficiency of Battery System ¹	Min Battery Rated Energy Capacity Required (kWh)	Min Power Capacity of Battery Required (kW _{dc})
Total Min Energy (kWh) and Power (kW) Capacity Required:				
Total Energy (kWh) and Power (kW) Capacity in Design:				

¹ FOOTNOTE: Rated single charge-discharge cycle AC to AC (round-trip) efficiency of the battery storage system.

K. DECLARATION OF REQUIRED CERTIFICATES OF INSTALLATION

Selections have been made based on information provided in this document. If any selections have been changed by the permit applicant, an explanation should be included in Table E. Additional Remarks. These documents must be provided to the building inspector during construction and can be found online.

YES	NO	Form/Title	Field Inspector	
			Pass	Fail
<input checked="" type="radio"/>	<input type="radio"/>	NRCI-SAB-E - Must be submitted for all buildings that must comply with solar readiness or PV/Battery requirements.	<input type="checkbox"/>	<input type="checkbox"/>

L. DECLARATION OF REQUIRED CERTIFICATES OF ACCEPTANCE

There are no Certificates of Acceptance applicable to solar readiness or PV/battery requirements.

Informational /Instructional forms are available on the CEC's website.

Note: Compliance forms are available from Energy Code Ace as an on-line interview only. Paper and form-fillable pdf are not available for most of the 2022 Non-Res forms.





Additions and Alterations

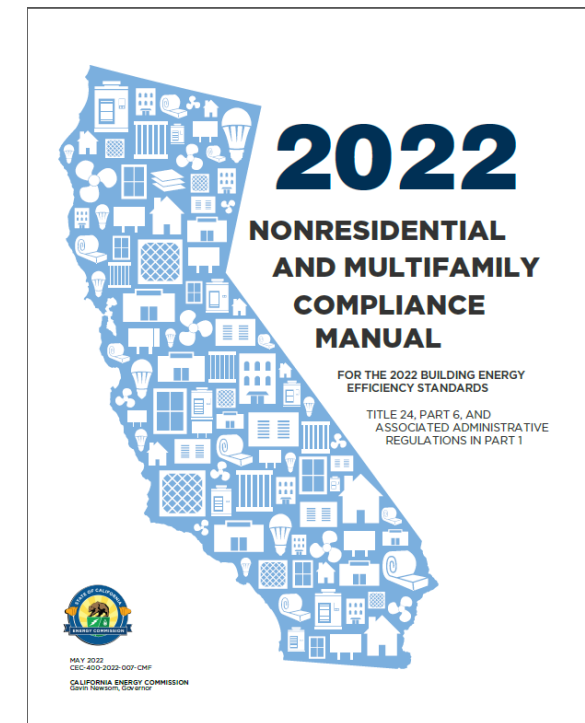
Section 141.0

Minor Changes: Highlight Alterations for HVAC, Hot Water and Roofing

Alterations

Wall Alterations

- When **25% or more of the building envelope wall area** is altered it needs to meet the air barrier design and material requirements for newly constructed building
- **See 3.2.4 for air barrier details and blower door testing**
- If the **air leakage rate exceeds 0.4 cfm/sq ft** a Visual Inspection and Diagnostic Evaluation must be completed in accordance with Nonresidential Appendix NA5.7 to find the sources of excessive leakage. The leaks shall then be sealed.



Tip:

The 2022 Nonresidential and Multifamily Compliance Manual has numerous **alteration scenarios with potential cost effective solutions and considerations, especially for roofing and HVAC roof top units**— See Section 3.6 starting at pg 3-84.

Alterations

Roofing Alterations

- When 50% or 2000 sf of existing roof is replaced or recovered, the new requirements under **Section 140.3(a)1A** are triggered
- **Table 141.0-B** Roof/Ceiling Insulation Trade-offs for Low-Sloped Aged Solar Reflectance has updated U-factors and a new climate zone organization
- For **low-sloped roofs**, the area of the roof recover or roof replacement shall be insulated to the level specified in **Table 141.0-C**.

End result of changes is higher levels of roof insulation

TABLE 141.0-C INSULATION REQUIREMENTS FOR ROOF ALTERATIONS

<u>Climate Zone</u>	<u>Continuous Insulation R-value</u>	<u>U-factor</u>
<u>1-5, 9-16</u>	<u>R-23</u>	<u>0.037, with at least R-10 above deck</u>
<u>6-8</u>	<u>R-17</u>	<u>0.047, with at least R-10 above deck</u>



Additions and Alterations

- **HVAC alterations –New or replacement space conditioning system or components:**
 - **Additional fan power allowances** are available in **Table 141.0-D** and can be added to the allowances in Tables 140.4-A and 140.4-B (exceptions apply)
- **Duct alterations** (considered ‘new’ ducts if replacing 75% of the duct system)
 - The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed and HERS tested < **6%** leakage
 - Duct extensions for constant volume, single zone systems serving less than 5,000 sf, shall be sealed and HERS tested < **15%**
- **Water Heater alterations**
 - Service water heating systems shall meet the requirements of 140.5(a)2 and 140.5(b), except for the solar water heating requirements
 - Follows the new requirements for Hotel/Motel, Non-Res, and large capacity boiler efficiency

Excerpt from Table 141.0-D

<u>Airflow</u>	<u>Multi-Zone VAV Systems¹ ≤5,000 cfm</u>	<u>Multi-Zone VAV Systems¹ >5,000 and ≤10,000 cfm</u>	<u>Multi-Zone VAV Systems¹ >10,000 cfm</u>	<u>All Other Fan Systems ≤5,000 cfm</u>	<u>All Other Fan Systems >5,000 and ≤10,000 cfm</u>	<u>All Other Fan Systems >10,000 cfm</u>
<u>Supply Fan System Additional Allowance</u>	<u>0.135</u>	<u>0.114</u>	<u>0.105</u>	<u>0.139</u>	<u>0.12</u>	<u>0.107</u>
<u>Supply Fan System Additional Allowance In Unit with Adapter Curb</u>	<u>0.033</u>	<u>0.033</u>	<u>0.043</u>	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>
<u>Exhaust/Relief/Return/Transfer Fan System Additional Allowance</u>	<u>0.07</u>	<u>0.061</u>	<u>0.054</u>	<u>0.07</u>	<u>0.062</u>	<u>0.055</u>

Reminder: Additions and Alterations can be shown to comply with the Energy Code via Performance (computer modeling) or Prescriptively (checklist).



Energy Code Coach

www.3c-ren.org

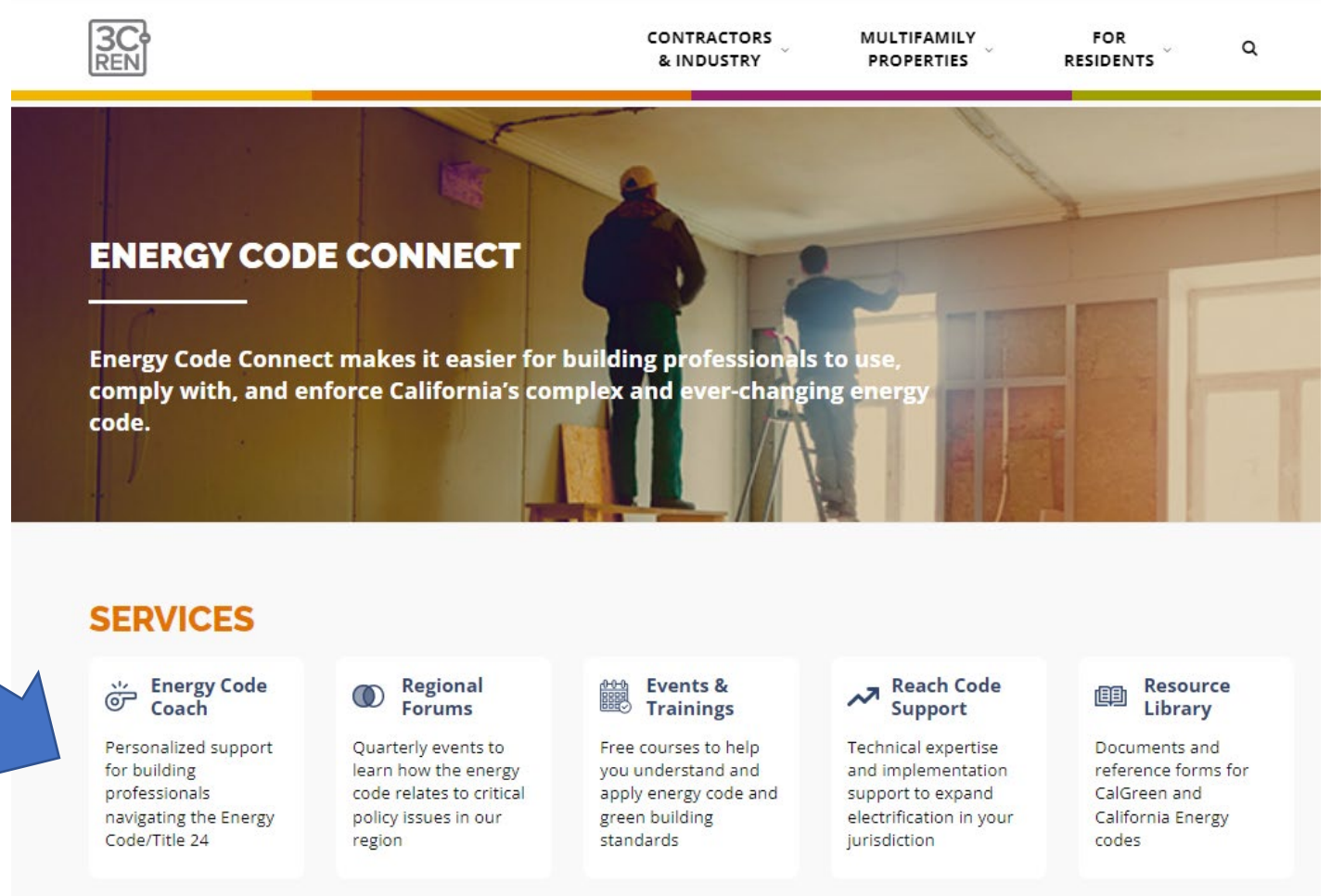
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Closing

- 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 ICC Chapter Energy Code Courses:
 - August 2 – [CALGreen Overview and 2022 Changes](#)
- Other Upcoming Courses:
 - August 9 - [Breaking Barriers – Energy Friendly Permitting \(Regional Forum\)](#)
 - August 10 - [What Energy Consultants Need to Know About QII](#)
 - August 15 - [Passive House Windows](#)
 - September 6 - [High Performance Buildings & Careers – Class 1: High Performance Fundamentals \(HPF\) Series](#)
 - September 11 - [Introduction to Passive House Retrofits](#)
 - September 13 - [Installing Heat Pumps: Lessons from the Field](#)
 - September 14 - [Using Building Science to Design and Build High Performance Homes – Class 2: HPF Series](#)





Thank you!

For more info:
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For questions:
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