

## Building Codes for Net Zero

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October 10, 2019 | Getting to Zero Forum



### Objective

Foundational review of how building codes can steer the building stock towards net zero



# AGENDA

## 1 Introduction to Building Codes

- Scope: covered buildings and systems
- Types of building codes
- General structure

## 2 Strategies for Net Zero

- Measures for net zero
- Roles for local, state, and national codes
- Deploying all types of code requirement

## 3 Call to Action

- Writing for compliance
- Get involved

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## Scope of Building Codes?

### All building types



single family



multifamily



nonresidential

### All permitted construction

- New construction
- Additions
- Alterations

### All building systems



envelope



lighting



water heating



energy generation



water use



electric vehicle  
charging infrastructure



HVAC



plug loads &  
covered processes



Load management



energy storage

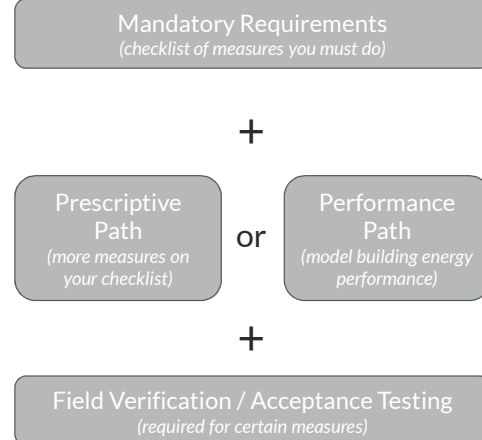


material selection

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## General Structure of Building Codes



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## Code Compliance and Enforcement

	Compliance Rate <sup>a</sup> (California Public Utilities Commission 2013 California Energy Code)	Missed Energy Savings	GHG Equivalencies
Electricity Use	88%	177.3 GWh	GHG Emissions from 26,620 cars <sup>b</sup>
Electricity Demand	88%	48.4 MW	
Natural Gas Use	84%	1.61 million therms	GHG Emissions from 1,022 average U.S. homes <sup>b</sup>

Sources:

a. DNV-GL, Cadmus Group, California Statewide Codes and Standards Program Impact Evaluation Phase Two, Volume Two: 2013 Title 24. (CALMAC Study ID: CPU0170.01). June 2017.

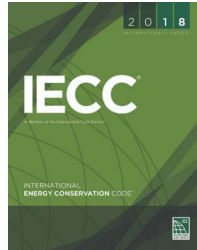
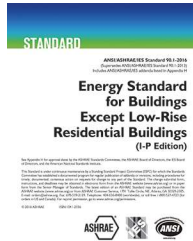
b. U.S. Environmental Protection Agency, Greenhouse Gas Equivalencies Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

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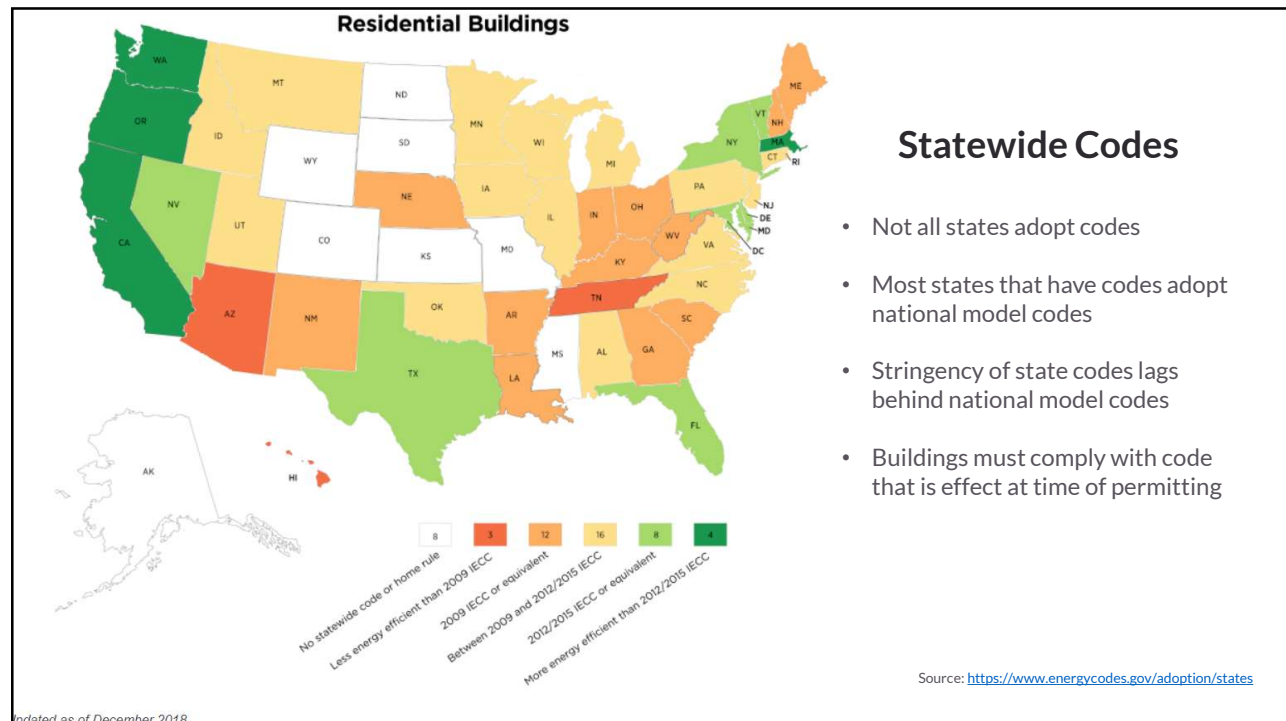
## National Model Building Codes

### Model Base Codes



- Updated every three years
- Industry experts and public stakeholders develop and refine changes

### Model Reach Code



## California Building Codes

### Base Code

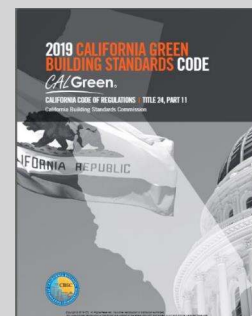
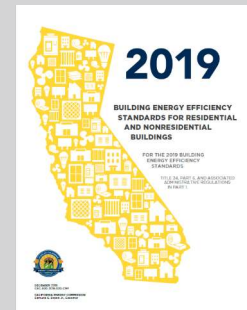
- California Energy Code (Title 24, Part 6)
- Adopted by the **California Energy Commission**

### Model Reach Code

- California Green Building Standards (CALGreen or Title 24, Part 11)
- Adopted by:
  - Voluntary energy efficiency requirements – **California Energy Commission**
  - All other residential requirements – **California Department of Housing and Community Development**
  - All other nonresidential requirements – **California Building Standards Commission**

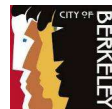
### Energy Utilities support codes!

- updates to building code
- compliance improvement
- priming technologies for code  
(emerging technology and incentive programs)



## Local Ordinances

- Enable jurisdictions to achieve more stringent energy and climate goals
- Can accommodate requirements that have impacts beyond the building site
- Development process
  - Local jurisdiction staff develop ordinances
  - Approved by town/city council
  - Resources are available to support jurisdictions

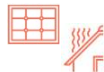




## Strategies for Net Zero – Measure for Net Zero



### Energy Efficiency



envelope



other efficiency measures



### Load Management



### Electric Vehicle Charging Infrastructure



### Energy Generation (low carbon energy sources)



### Energy Storage

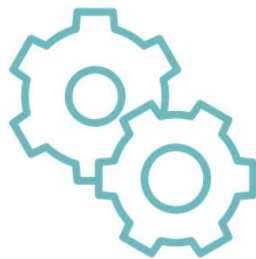


### Water and Material Use (including refrigerants)

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## Strategies for Net Zero – Lead Locally



Local ordinances influence statewide building codes and national model codes

- Pursue reach codes and ordinances
- Demonstrate feasibility and enforceability locally
- Move more stringent local ordinances into national model codes and statewide codes

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## Strategies for Net Zero – Encourage New Design Approaches

### Prime Market for Emerging Technologies

Alternatives to mandatory measures  
Prescriptive alternatives  
Performance approach compliance credit  
Coordination with incentive programs

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### Example 2:

#### Alternative Prescriptive Pathway

Title 24, Section 150.1(c)8 Prescriptive Water Heating

- Primary path: gas instantaneous water heater
- Alternatives:
  1. Small gas storage water heater with compact hot water distribution, or drain water heat recovery
  2. Large gas storage water heater
  3. Heat pump water heater with:
    - Compact hot water distribution and drainwater heat recovery; or
    - Solar photovoltaic (PV) system
  4. NEEA Tier 3 heat pump water heater with compact hot water distribution or solar PV

## Code for Maximum Compliance

Consider the compliance process when writing code

Well-crafted code language leads to improve compliance

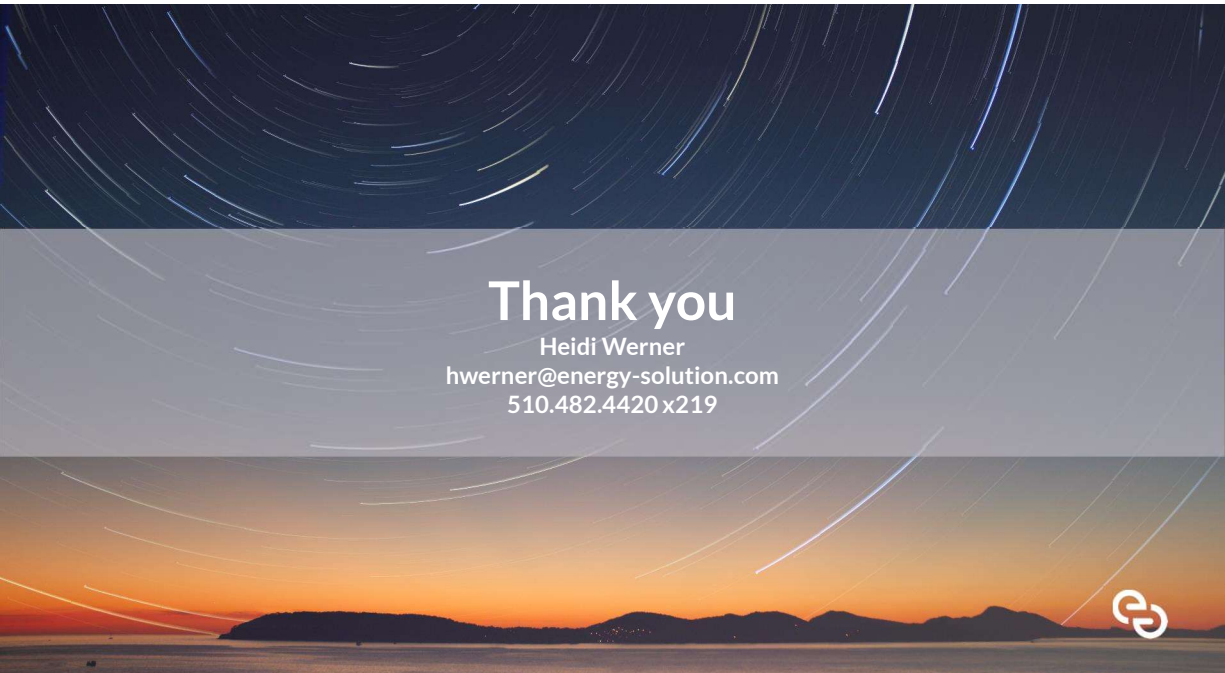
1. Use correct grammar and simple sentence structure.
2. Use defined terms.
3. Avoid ambiguity.
4. Minimize exceptions.
5. Create code language that is only as complex as necessary.
6. Be clear about when and where the requirement apply.
7. Include all relevant requirements in one section of code.
8. If you must direct readers to another section of the energy code or another code entirely, do so clearly and direct them to exactly where they need to go.
9. Consider if change should use existing structure or if a larger restructuring is needed; recommend the approach that will create the clearest code language.
10. Do not use the "prohibited words and phrases" identified in Table 1 ASHRAE Guide to Writing Standards in Mandatory Language.





## Get involved

- Advocate for appropriate goals
- Lead with local ordinances
- Encourage statewide codes
- Participate in development of national model codes



## Thank you

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## ASHRAE

[Guide to Writing Standards  
in Mandatory Language](#)

Table 1. Prohibited Words and Phrases in Normative Sections

acceptable	adequate(ly)	advise	also
and/or	and the like	appreciable	approximate(ly)
aspire	available	avoid (ed)	can
care	careful(ly)	consider (ed) (ation)	could
chance (on the chance)	desire (ed) (able)	easy(ily)	effectively
e.g.	encourage	ensure	equivalent(ly)
etc.	exception	excess(ive)	familiar
feasible	few	firm(ly)	frequent(ly)
general(ly)	good	grant	guide(line)
i.e.	imply	infer	in lieu of
insure	it(s)	legible (ly)	light(ly)
like(ly)	many	may	maybe
might	most(ly)	near(ly)	neat(ly)
no	note	ought / ought to	normal(ly)
periodic(ally)	possible	practice	practical(ly)
preferred	presume	Probable(ly)	properly
ready (ily)	reasonable (ly)	recommend(ation)	request
safe(ly)	satisfactory	secure(ly)	several
should	significant (ly)	similar	some
substantial (ly)	sufficient(ly)	suitable	suggest (tion)
they	them	typical(ly)	which
would	urge	usual(ly)	via
vice versa			

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## Example of Ineffective Code Language

## (b) Solar Zone.

1. **Minimum Solar Zone Area.** The solar zone shall have a minimum total area as described below. The solar zone shall comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or other Parts of Title 24 or in any requirements adopted by a local jurisdiction. The solar zone total area shall be comprised of areas that have no dimension less than five feet and are no less than 80 square feet each for buildings with roof areas less than or equal to 10,000 square feet or no less than 160 square feet each for buildings with roof areas greater than 10,000 square feet.

- A. **Single Family Residences.** The solar zone shall be located on the roof or overhang of the building and have a total area no less than 250 square feet.

**EXCEPTION 1 to Section 110.10(b)1A:** Single family residences with a permanently installed domestic solar water-heating system meeting the installation criteria specified in the Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.50.

**EXCEPTION 2 to Section 110.10(b)1A:** Single family residences with three habitable stories or more and with a total floor area less than or equal to 2000 square feet and having a solar zone total area no less than 150 square feet.

**EXCEPTION 3 to Section 110.10(b)1A:** Single family residences located in the Wildland-Urban Interface Fire Area as defined in Title 24, Part 2 and having a whole house fan and having a solar zone total area no less than 150 square feet.

**EXCEPTION 4 to Section 110.10(b)1A:** Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

**EXCEPTION 5 to Section 110.10(b)1A:** Single family residences having a solar zone total area no less than 150 square feet and where all thermostats are demand responsive controls and comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.

**EXCEPTION 6 to Section 110.10(b)1A:** Single family residences meeting the following conditions:

- A. All thermostats are demand responsive controls that comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.

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SECTION 110.10 – MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS

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## Example of Ineffective Code Language and Improvements in Mark-up

**130.1(c)2:** Countdown timer switches ~~shall not~~may be used to comply with the automatic shut-OFF control requirements in Section 130.1(c)1 only in closets less than 70 square feet, and server aisles in server rooms. The maximum timer setting shall be 10 minutes for closets, and 30 minutes for server aisles.

**EXCEPTION 1 to Section 130.1(c)2:** ~~Single-stall bathrooms less than 70 square feet, and closets less than 70 square feet may use countdown timer switches with a maximum setting capability of ten minutes to comply with the automatic shut-Off requirements.~~

**EXCEPTION 2 to Section 130.1(c)2:** ~~Lighting in a Server Aisle in a Server Room, as defined in Section 100.1, may use countdown timer switches with a maximum setting capability of 30 minutes to comply with the automatic shut-OFF requirements.~~



## Example of Ineffective Code Language and Improvements

### Language is not clear or succinct

**130.1(c)2:** Countdown timer switches shall not be used to comply with the automatic shut-OFF control requirements in Section 130.1(c)1.

**EXCEPTION 1 to Section 130.1(c)2:** Single-stall bathrooms less than 70 square feet, and closets less than 70 square feet may use countdown timer switches with a maximum setting capability of ten minutes to comply with the automatic shut-Off requirements.

**EXCEPTION 2 to Section 130.1(c)2:** Lighting in a Server Aisle in a Server Room, as defined in Section 100.1, may use countdown timer switches with a maximum setting capability of 30 minutes to comply with the automatic shut-OFF requirements.

### Language is clearer and more succinct

**130.1(c)2:** Countdown timer switches may be used to comply with the automatic shut-OFF control requirements in Section 130.1(c)1 only in closets less than 70 square feet, and server aisles in server rooms. The maximum timer setting shall be 10 minutes for closets, and 30 minutes for server aisles.

