

# 2019 Energy Code

## Solar Ready Requirements



California Energy Commission  
Efficiency Division  
October 2020



# Agenda

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## 2019 Building Energy Efficiency Standards (Energy Code)

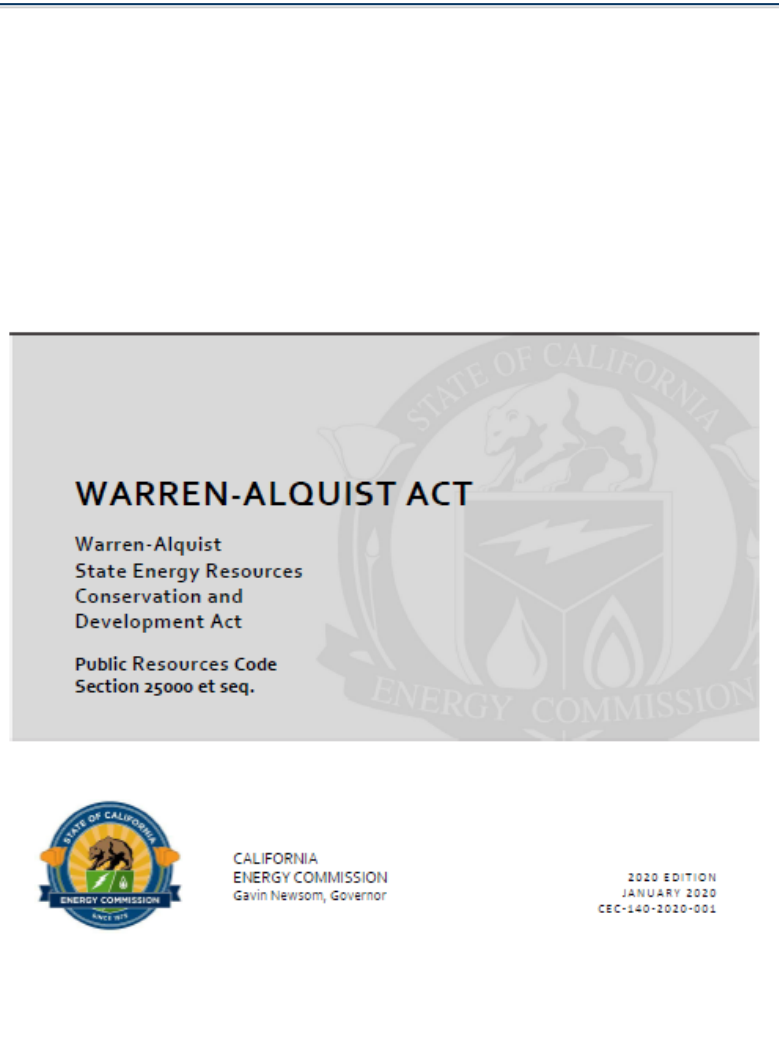
- Energy Code Basics
  - Navigating Title 24 - Part 1 and Part 6
- Solar Ready Requirements
  - All Buildings
  - Single Family Residential
  - Multifamily and Nonresidential
- Plan Check and Inspection
- Resources



# Energy Code Basics



# Energy Code History



## The Warren-Alquist Act established the California Energy Commission (CEC) in 1974

- Authority to develop, adopt, and maintain Energy Code
- Updated every three years
- Energy Code must be cost-effective over the economic life of the building



# 2019 Energy Code



## 2019 Building Energy Efficiency Standards

The 2019 Building Energy Efficiency Standards take effect January 1, 2020. Find compliance manuals, forms, software, and supporting content.

[LEARN MORE ABOUT THE 2019 STANDARDS >](#)



# 2019 Energy Code

## Effective January 1, 2020


- Building permit applications submitted on or after effective date
- Must use 2019 software and forms








# 2019 Documents Online

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## 2019 Building Energy Efficiency Standards

The 2019 Building Energy Efficiency Standards improve upon the 2016 Energy Standards for new construction of, and additions and alterations to, residential and nonresidential buildings. Buildings permitted on or after January 1, 2020, must comply with the 2019 Standards. The California Energy Commission updates the standards every three years.

[Expand All](#)

**2019 Building Energy Efficiency Standards and Compliance Manuals** 

**2019 Compliance Forms** 

**BUILDING ENERGY EFFICIENCY STANDARDS - TITLE 24**

- 2022 Building Energy Efficiency Standards
- 2019 Building Energy Efficiency Standards**
- 2016 Building Energy Efficiency Standards
- Online Resource Center
- Past Building Energy Efficiency Standards

**CONTACT**

[Building Energy Efficiency Standards - Title 24](#)

Toll-free in California: 800-772-3300  
Outside California: 916-654-5106

- Energy Code
- Reference Appendices
- Compliance Manuals
- Forms
  - Fillable dynamic
  - Energy Code Ace



# Energy Code Requirements

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## Mandatory measures

- Minimum efficiency requirements must always be met
- Can never trade-off

## Prescriptive measures

- Predefined efficiency requirements
- May supersede mandatory measures
- Different requirements for newly constructed buildings, additions, and alterations





# Compliance Approaches

## Prescriptive Approach

- Simple approach, no trade-offs
- Match the standard building baseline
- More common for alterations and nonresidential

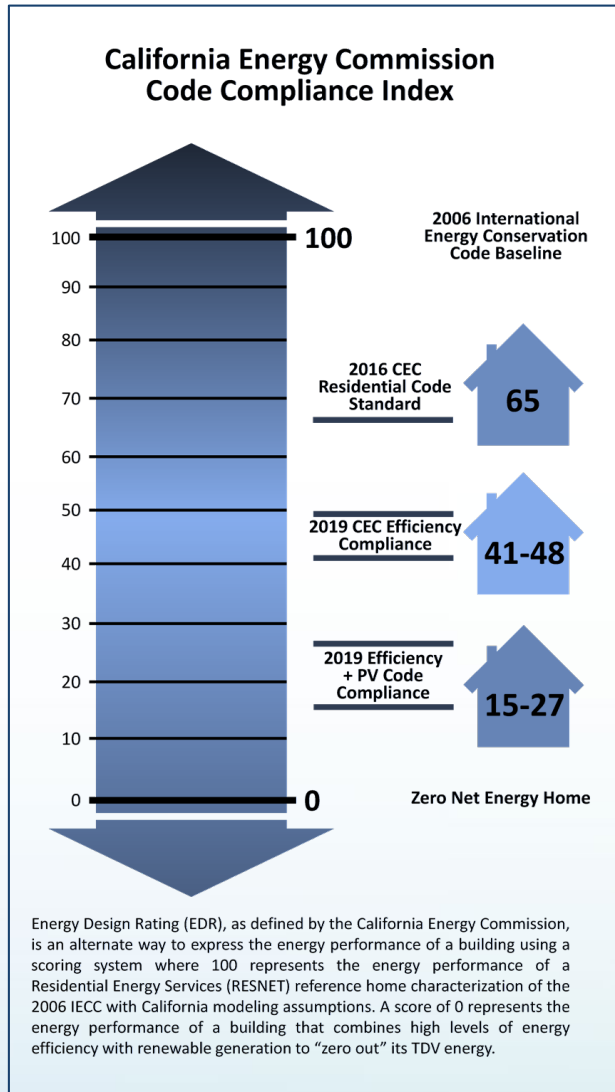
## Performance Approach

- Most flexible approach, allows for trade-offs
- Must meet all mandatory requirements
- Requires the use of CEC approved software
- Residential: proposed efficiency  $EDR \leq$  standard building design and total  $EDR$  (including PV)  $\leq$  standard building design
- Nonresidential: proposed  $TDV \leq$  standard building design





# Energy Design Rating (EDR)



## Low-rise residential EDR score based on total estimated energy use

- 100 represents a home built to 2006 IECC
- 0 represents a zero net energy home
- Two types of EDR must be met individually
  - **Efficiency EDR:** Includes energy savings for space heating, cooling, ventilation, water heating measures
  - **Total EDR:** Includes efficiency EDR minus compliance credit for PV, battery, and other demand flexibility measures



# 2019 Compliance Software

Performance approach compliance use most recently approved versions

- Residential
  - CBECC-Res 2019.1.3
  - EnergyPro 8.2 Residential
  - Right-Energy 2019.1.1
- Nonresidential
  - CBECC-Com 2019.1.3
  - EnergyPro 8.2 Commercial

Calculation Date/Time: 2019-07-08T18:42:27-07:00		CF1R-PRF-01E
Input File Name: Sample T24 2019 CBECC.ribd19		(Page 1 of 12)
05	Standards Version	2019
07	Software Version	CBECC-Res 2019.1.0 (1079)



# Demonstrating Compliance

## Compliance forms confirm Energy Code is met

- Completed by designers, consultants, builders, contractors, technicians, HERS raters, etc.
- Submitted to local jurisdiction for verification

Type of form	Residential	Nonresidential
Certificate of compliance	CF1R	NRCC
Certificate of installation	CF2R	NRCI
Certificate of acceptance	CF3R	NCRA
Certificate of verification		NRCV



# Mandatory Measures Summary

Solar Ready Buildings:	
§ 110.10(a)1:	<b>Single Family Residences.</b> Single family residences located in subdivisions with 10 or more single family residences and where the application for a tentative subdivision map for the residences has been deemed complete and approved by the enforcement agency, which do not have a photovoltaic system installed, must comply with the requirements of § 110.10(b) through § 110.10(e).
§ 110.10(a)2:	<b>Low-rise Multifamily Buildings.</b> Low-rise multi-family buildings that do not have a photovoltaic system installed must comply with the requirements of § 110.10(b) through § 110.10(d).
§ 110.10(b)1:	<b>Minimum Solar Zone Area.</b> The solar zone must have a minimum total area as described below. The solar zone must 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 must be comprised of areas that have no dimension less than 5 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. For single family residences, the solar zone must be located on the roof or overhang of the building and have a total area no less than 250 square feet. For low-rise multi-family buildings the solar zone must be located on the roof or overhang of the building, or on the roof or overhang of another structure located within 250 feet of the building, or on covered parking installed with the building project, and have a total area no less than 15 percent of the total roof area of the building excluding any skylight area. The solar zone requirement is applicable to the entire building, including mixed occupancy.*
§ 110.10(b)2:	<b>Azimuth.</b> All sections of the solar zone located on steep-sloped roofs must be oriented between 90 degrees and 300 degrees of true north.
§ 110.10(b)3A:	<b>Shading.</b> The solar zone must not contain any obstructions, including but not limited to: vents, chimneys, architectural features, and roof mounted equipment.*
§ 110.10(b)3B:	<b>Shading.</b> Any obstruction located on the roof or any other part of the building that projects above a solar zone must be located at least twice the distance, measured in the horizontal plane, of the height difference between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone, measured in the vertical plane.*
§ 110.10(b)4:	<b>Structural Design Loads on Construction Documents.</b> For areas of the roof designated as a solar zone, the structural design loads for roof dead load and roof live load must be clearly indicated on the construction documents.
§ 110.10(c):	<b>Interconnection Pathways.</b> The construction documents must indicate: a location reserved for inverters and metering equipment and a pathway reserved for routing of conduit from the solar zone to the point of interconnection with the electrical service; and for single family residences and central water-heating systems, a pathway reserved for routing plumbing from the solar zone to the water-heating system.
§ 110.10(d):	<b>Documentation.</b> A copy of the construction documents or a comparable document indicating the information from § 110.10(b) through § 110.10(c) must be provided to the occupant.
§ 110.10(e)1:	<b>Main Electrical Service Panel.</b> The main electrical service panel must have a minimum busbar rating of 200 amps.
§ 110.10(e)2:	<b>Main Electrical Service Panel.</b> The main electrical service panel must have a reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation. The reserved space must be permanently marked as "For Future Solar Electric".

## Low-rise residential

- Designers may include on plans
- Enforcement agencies may require on plans



# 2019 Energy Code

Navigating Title 24 - Part 1 and Part 6



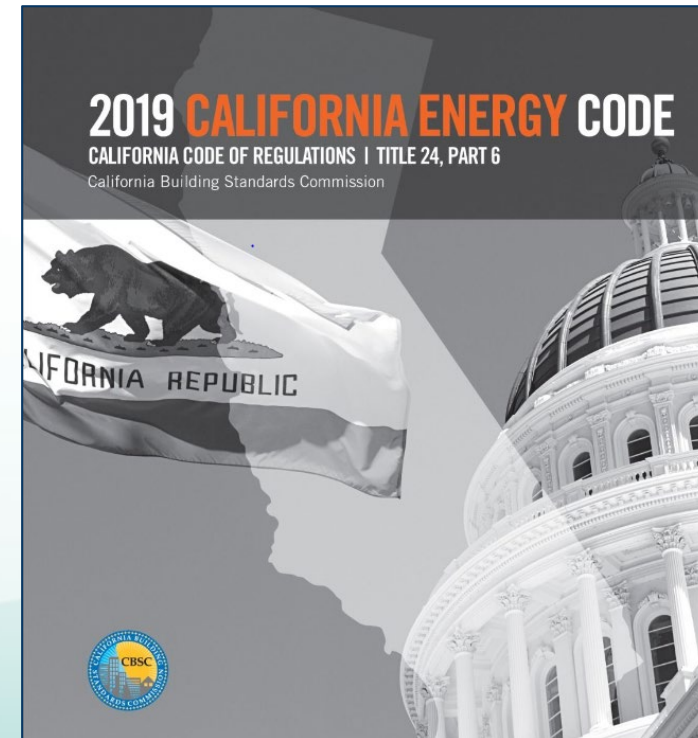
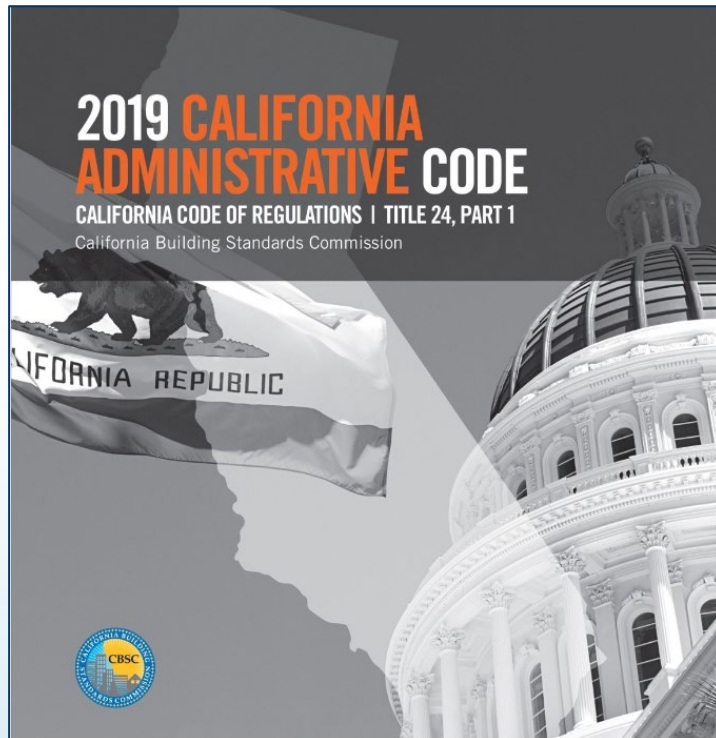
# Title 24 – California Building Code

## Part 1 - Administrative Code

- Chapter 10
- Sections 10-101 – 10-115
- Administrative requirements

## Part 6 - Energy Code

- Subchapters 1 - 9
- Sections 100.0 - 150.2
- Technical requirements







# Part 1 Administrative Code

## All Buildings § 10-115

### Community solar option

- Must be approved by the CEC
- Dependent on interconnection rules of local utility
- Alternative to rooftop PV systems
- Buildings must still comply with solar ready requirements





# Part 6 Energy Code

## All Buildings § 100.0 - Table 100.0-A

TABLE 100.0-A APPLICATION OF STANDARDS

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions/Alterations
General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0			
Low-Rise Residential	General	150.0			
		110.6, 110.7, 110.8,			
	General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0		
		150.0(q)			
	HVAC (conditioned)	110.2, 110.5, 150.0(h), 150.0(i), 150.0(j), 150.0(m), 150.0(o)	150.1(a, c)	150.1(a), 150.1(b)	150.2(a), 150.2(b)
	Water Heating	110.3, 150.0(j, n)			
	Indoor Lighting (conditioned, unconditioned and parking garages)	110.9, 130.150.0(k)	Solar Ready Buildings		110.10
	Outdoor Lighting	110.9, 130.0, 150.0(k)			
	Pool and Spa Systems	110.4, 150.0(p)	N. A.	N.A.	150.2(a), 150.2(b)
	Solar Ready Buildings	110.10	N. A.	N.A.	N.A.

## Residential relevant sections

§ 100.1 Definitions

§ 110.10 All buildings



# Part 6 Energy Code

## All Buildings § 100.0 - Table 100.0-A

TABLE 100.0-A APPLICATION OF STANDARDS

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions/Alterations
General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0			
Nonresidential, High-Rise Residential, And Hotels/Motels	General	120.0	140.0, 140.2		
	General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0		
	(unconditioned process spaces)	N.A.	140.3(c)	140.0, 140.1	141.0
	HVAC (conditioned)	110.2, 110.5, 120.1, 120.2, 120.3, 120.4, 120.5, 120.8	140.4		
	Water Heating	110.3, 120.3, 120.8, 120.9	140.5		
	Indoor Lighting (conditioned, process spaces)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6		
	Solar Ready Buildings	110.10	N.A.		141.0(a)
	Electrical Power Distribution	110.11, 130.5	N.A.	N.A.	
	Pool and Spa Systems	110.4, 110.5, 150.0(p)	N.A.		141.0
	Solar Ready Buildings	110.10	N.A.		141.0(a)
Covered Processes <sup>1</sup>	Envelope, Ventilation, Process Loads	110.2, 120.6	140.9	140.1	120.6, 140.9, 141.1
Signs	Indoor and Outdoor	110.9, 130.0, 130.3	140.8	N.A.	141.0, 141.0(b)2H

### Nonresidential relevant sections

§ 100.1 Definitions

§ 110.10 All buildings

§ 141.0 Additions



# **Solar Ready Requirements**

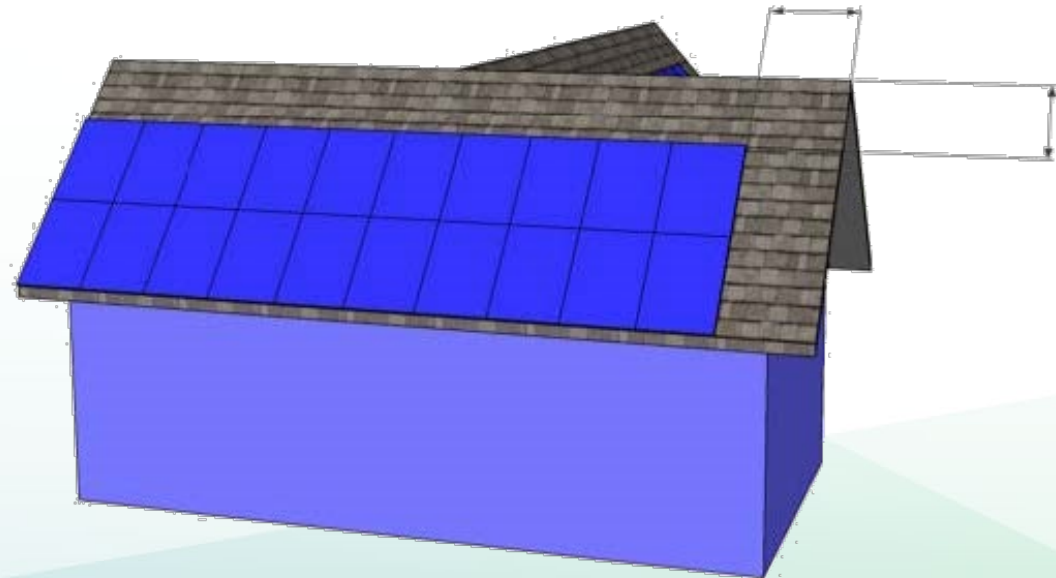
## All Buildings

Mandatory § 100.1



# Solar Ready Makes Sense

- Easy to install PV later
- Applied during the design phase
  - No renovation or moving existing equipment
- Reserved solar zone
  - Clearly marked
  - Obstruction-free





# Solar Ready Definitions

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- Solar zone - is a section of the roof designated and reserved for the future installation of a solar electric or solar thermal system
- Azimuth - the orientation in degrees from true north
- Steep-sloped roof - has a ratio of rise to run of 2:12 or greater
- Low-sloped roof - has a ratio of rise to run of less than 2:12



# **Solar Ready Requirements**

## **Single Family Residential**

Mandatory § 110.10(a-e)





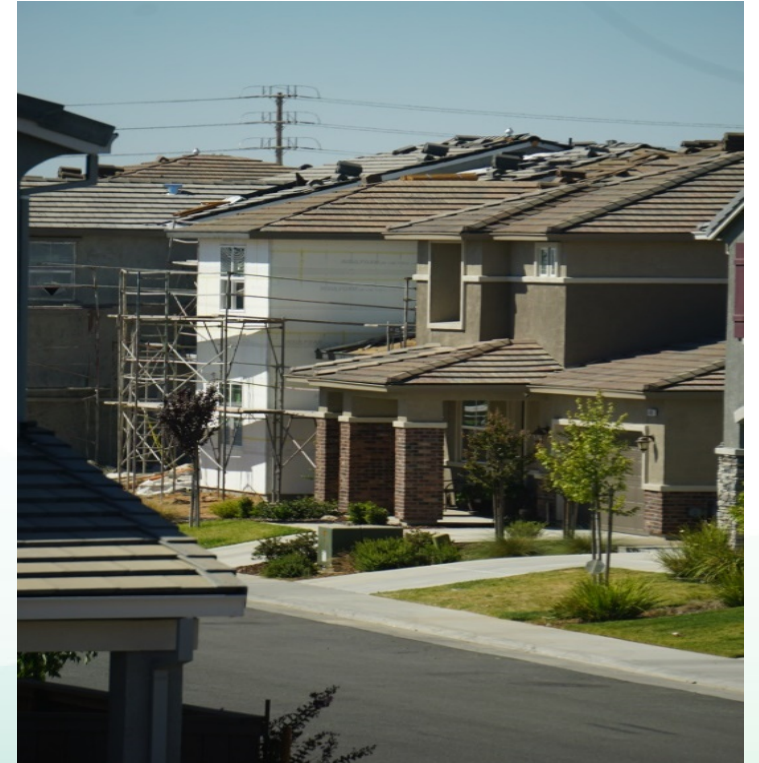
# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(a)1

## Covered occupancies - single family residential

- Located in subdivisions with ten or more single family residences
- Tentative subdivision map application approved
- No solar PV system installed

Low-rise multifamily is included with nonresidential





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(a)1



## Covered occupancies - single family residential

- Townhouses and duplexes considered single family residences
- Each unit complies separately
- Applies to subdivisions with 10 or more homes



# **Solar Ready Buildings Mandatory Requirements**

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All Buildings § 110.10(b)1

## **Solar zone minimum area**

- Comply with all access, pathway, smoke ventilation, and spacing requirements in Title 24, Part 9 or other parts
- Comply with all local jurisdiction requirements



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1

## Solar zone minimum area

- Each dimension is 5 feet or more in length
- Area – depends on the size of the roof
  - Total roof area is 10,000 square feet or less
    - 80 square feet or more total solar zone
  - Total roof area is more than 10,000 square feet
    - 160 square feet or more total solar zone
- Multiple subareas can make up total area
  - No less than five feet



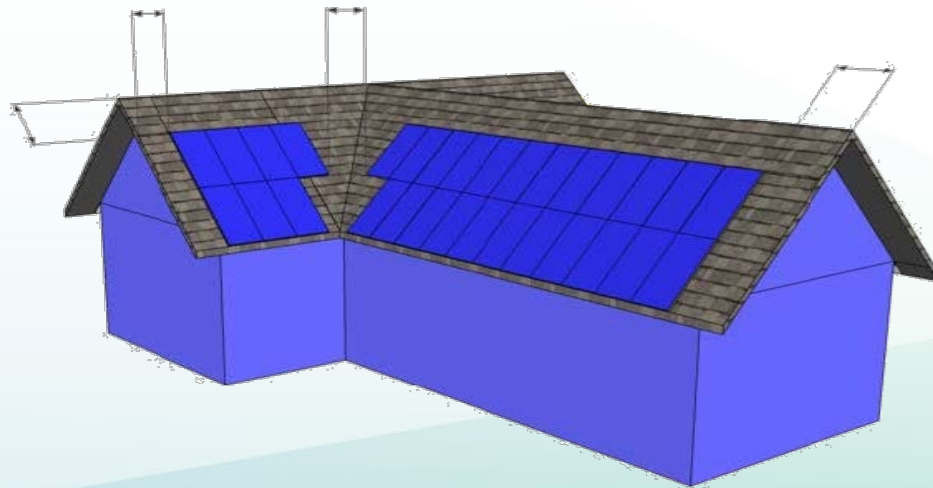


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1A

## Solar zone minimum area - single family residential

- Located on the building's roof or overhang
- Total area at least 250 square feet
- Exceptions may reduce or eliminate required solar area





# **Solar Ready Buildings Mandatory Requirements**

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All Buildings § 110.10(b)1A

## **Solar zone minimum area - single family residential**

- Exception 1 – no solar zone required
  - Permanently installed domestic solar water-heating system
    - Reference Residential Appendix RA4 installation criteria
    - 0.50 minimum solar savings fraction



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1A

## Solar zone minimum area - single family residential

- Exception 6 – No solar zone required
  - Demand responsive thermostats ([JA5 compliant](#))
  - Plus, one of these efficiency measures
    - Energy Star dishwasher and refrigerator, whole house fan, or EV charger
    - Demand responsive home automation system controlling appliances and lighting
    - Gray-water plumbing for landscape irrigation
    - Rainwater catchment system flow from 65% or more of roof area







# Solar Ready Buildings Mandatory Requirements

## All Buildings § 110.10(b)1A

### Solar zone minimum area - single family residential

- Exception 2: reduced solar zone area of minimum 150 square feet
  - Three or more stories with total floor area of 2,000 square feet or less
- Exception 3: reduced solar zone area of minimum 150 square feet
  - Located in wildland-urban interface fire area with whole house fan
- Exception 5: reduced solar zone area of minimum 150 square feet
  - All thermostats are demand responsive and capable prior to occupancy permit ([JA5 compliant](#))
  - Comply with Section 110.12(a)



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1A

## Solar zone minimum area - single family residential

- Exception 4: reduced solar zone area is 50% or more of the potential solar zone area
  - Potential solar zone total area
    - Low-sloped roof with annual solar access 70% or more
    - Steep-sloped roofs oriented between 90 degrees and 300 degrees of true north with annual solar access 70% or more





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1A

## Solar zone minimum area - single family residential

- Exception for reduced solar access due to obstructions
  - Use available [solar access tools](#)
  - Solar access area equals solar insolation with shade divided by solar insolation without shade
    - Include shade from existing buildings, parking lot lights, trees and similar objects outside control of the project
    - Exclude shade from potential obstructions within control of the project like the building itself, HVAC equipment, landscaping, and similar objects
  - Document on CF2R-SRA-02 Minimum Solar Zone Area worksheet



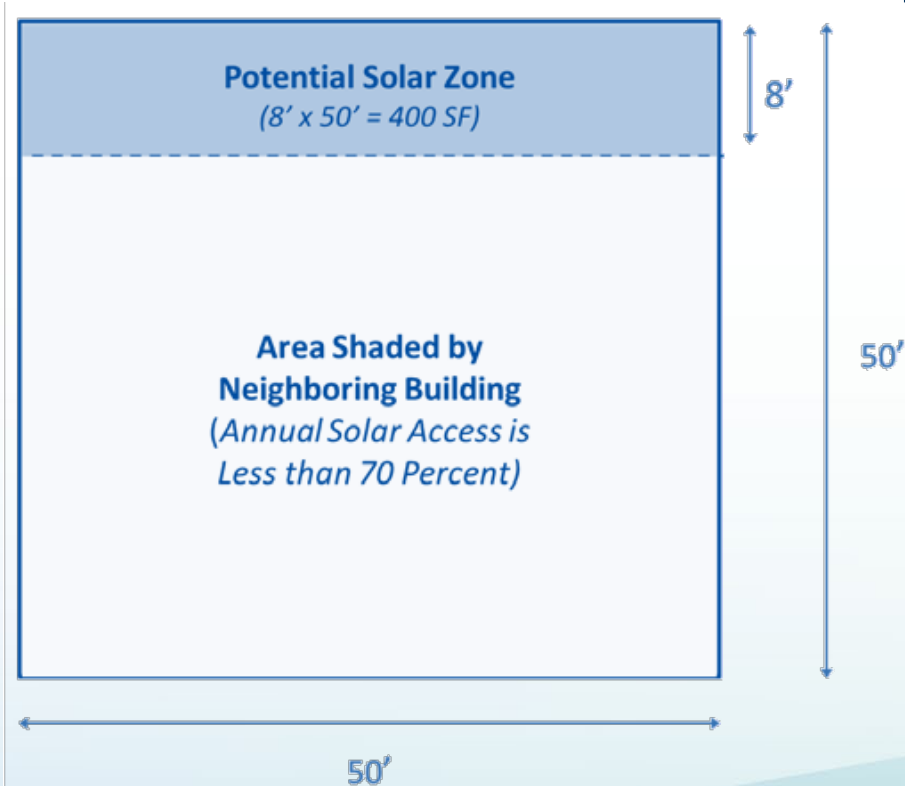
# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1A

## Solar zone minimum area - single family residential

- Example

- What size solar zone is needed on a house with a total roof area of 2,500 square feet that is shaded by the neighbor's house and trees so that 2,100 square feet of the roof has less than 70% annual solar access?
  - If the entire roof were to have an annual solar access of 70% or greater, the minimum solar zone would have been 250 square feet
  - Since the potential solar zone is only 400 square feet ( $2,500 - 2,100$ ), the minimum solar zone area can be reduced to 200 square feet (50% of the potential solar zone)





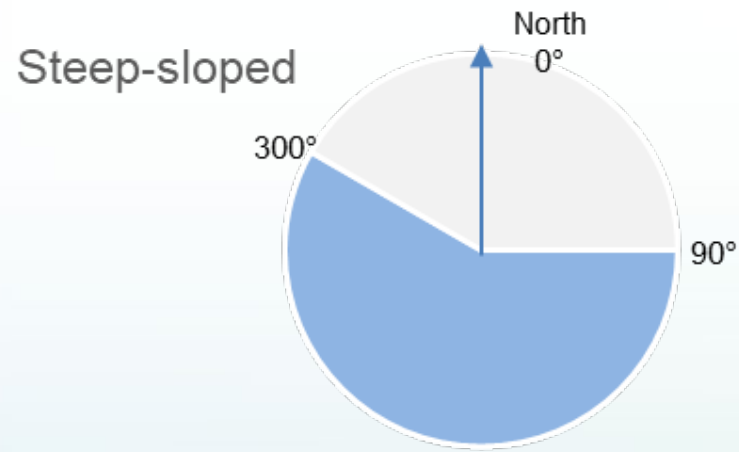
# Solar Ready Buildings Mandatory Requirements

## All Buildings § 110.10(b)2

### Solar zone azimuth

- All solar zone sections on steep-sloped roofs shall be oriented between 90 degrees and 300 degrees of true north.

Figure 7-4: Orientation when solar zone is located on a steep-sloped roof



If solar zone is located on a sloped roof with a rise to run ratio of 2:12 or greater, then the solar zone area must face between 90° and 300°.



■ Solar Zone Orientation

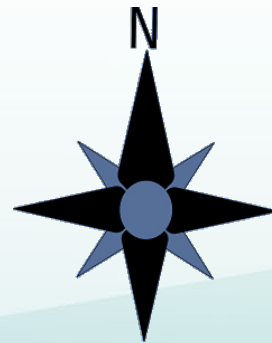


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)3

## Solar zone shading

- No obstructions in the solar zone
- Limited obstructions outside of solar zone
  - Distance from solar zone to obstruction is at least two times the obstruction height
  - Exception: Obstructions north of all points in the solar zone



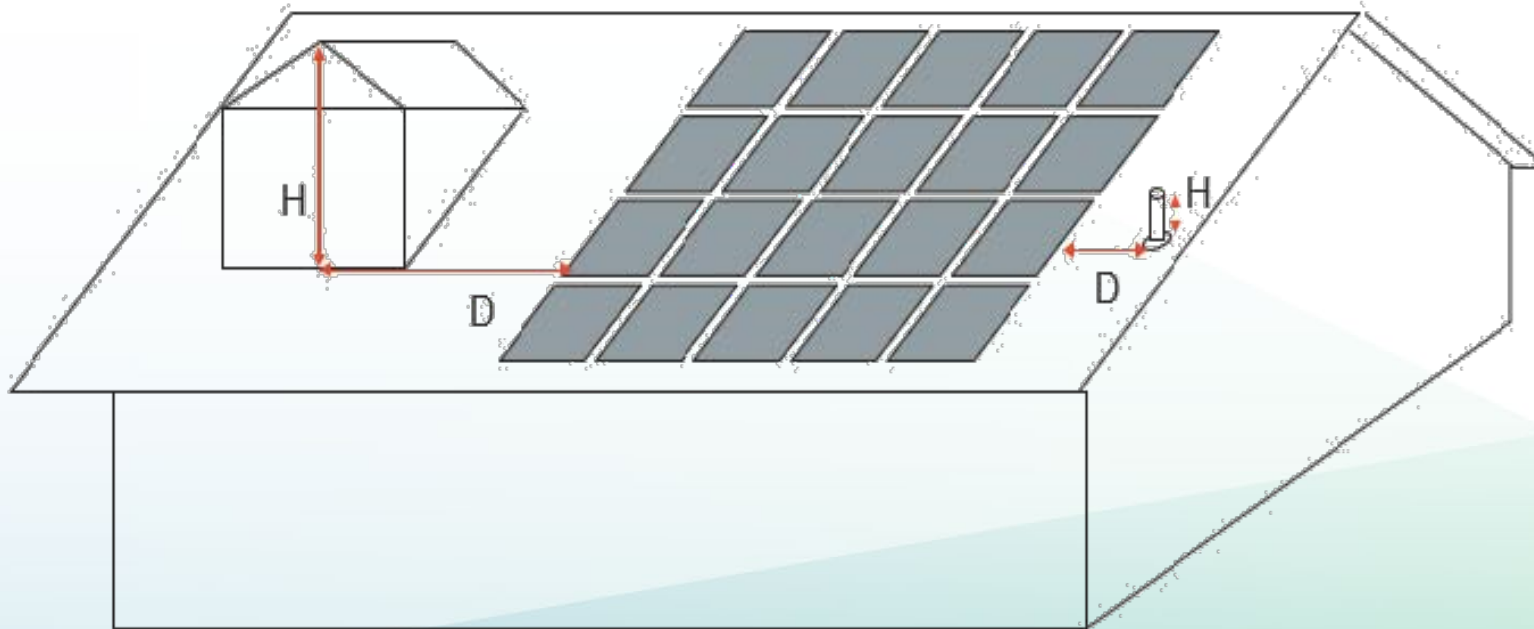


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)3A

## Solar zone shading

- Calculate distance from obstructions
  - Equation:  $D \geq 2H$







# **Solar Ready Buildings Mandatory Requirements**

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All Buildings § 110.10(b)4

## **Solar zone structural design loads on construction documents**

- Roof dead load and live load must be clearly indicated on construction documents (structural plans)
  - Collateral load for future solar installation is not required.



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(c)

## Interconnection pathways - single family residential

- Construction documents indicate locations
  - Inverters and meter equipment
  - Conduit route from solar zone to service connection
- Central water-heating systems
  - Plumbing route from solar zone to water-heating system
- Must comply with the California Fire Code solar access requirements





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(d)

## Documentation

- Copy to occupant
  - Construction documents showing the solar zone and pathways to interconnection





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(e)

## Main electrical service panel - single family residences

- Minimum 200-amp busbar rating
- Space reserved for future double pole circuit breaker
  - At opposite end from input feeder
  - Permanently marked “For Future Solar Electric”





# **Solar Ready Requirements**

## **Multifamily and Nonresidential**

Mandatory § 110.10(a-d)

Additions § 141.0(a)



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(a)

**Covered occupancies – multifamily, nonresidential, hotel and motel**

- Low-rise multifamily
  - Three or less habitable stories
- High-rise multifamily
  - Ten or less habitable stories
- Hotels and motels
  - Ten or less habitable stories
- Nonresidential buildings
  - Three or less habitable stories





# **Solar Ready Buildings Mandatory Requirements**

## **Nonresidential Additions § 141.0(a)**

### **Covered occupancies – nonresidential additions**

- Nonresidential additions that increase the roof area by more than 2,000 square feet
  - Exception 4: Additions that increase the roof area by 2,000 square feet or less are exempt from solar ready requirements



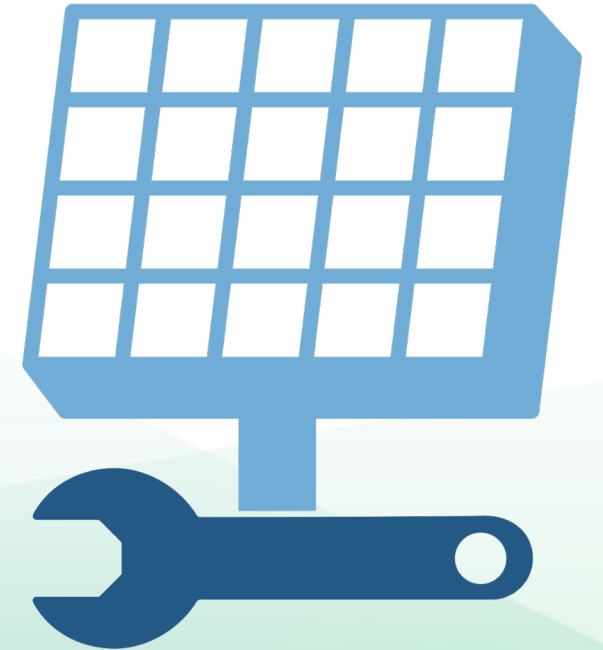


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1

## Solar zone minimum area

- Comply with all access, pathway, smoke ventilation, and spacing requirements in Title 24, Part 9 or other parts
- Comply with all local jurisdiction requirements
- Applicable to the entire building, including mixed occupancy



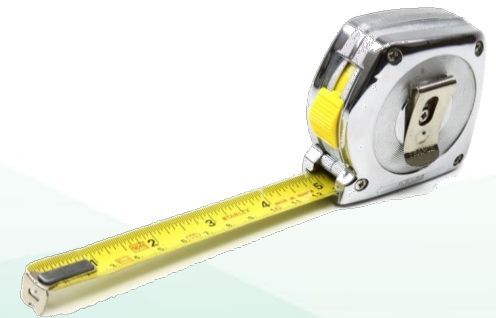


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1

## Solar zone minimum area

- Each dimension is 5 feet or more in length
- Area – depends on the size of the roof
  - Total roof area is 10,000 square feet or less
    - 80 square feet or more total solar zone
  - Total roof area is more than 10,000 square feet
    - 160 square feet or more total solar zone
- Multiple subareas can make up total area
  - No less than five feet





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1B

**Solar zone minimum area - multifamily, nonresidential, hotel and motel**

- Roof or overhang of building
- Roof or overhang of a structure located within 250 feet of the building
- Covered parking installed with the building project
- Area minimum 15% of building's total roof area, excluding skylight area
- Exceptions may reduce or eliminate required solar area





# **Solar Ready Buildings Mandatory Requirements**

## **All Buildings § 110.10(b)1B**

### **Solar zone minimum area - high-rise multifamily, nonresidential, hotel and motel**

- Exception 1 - no solar zone required
  - Permanently installed solar PV system
    - DC power rating nameplate
    - Minimum one watt per square foot of roof area
- Exception 2 - no solar zone required
  - High-rise multifamily, hotel and motel only
  - Permanently installed domestic solar water heating system
    - Compliant with § 150.1(c)8Biii



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1B

## Solar zone minimum area - all multifamily

- Exception 4 - No solar zone required
  - Demand responsive thermostats ([JA5 compliant](#)) in each dwelling unit
  - Plus electric vehicle charging spaces per Title 24, Part 11, or one of these efficiency measures in each dwelling unit
    - Energy Star dishwasher, plus refrigerator, or whole house fan with ECM
    - Demand responsive home automation system controlling appliances and lighting
    - Gray-water plumbing for landscape irrigation
    - Rainwater catchment system flow from 65% or more of roof area



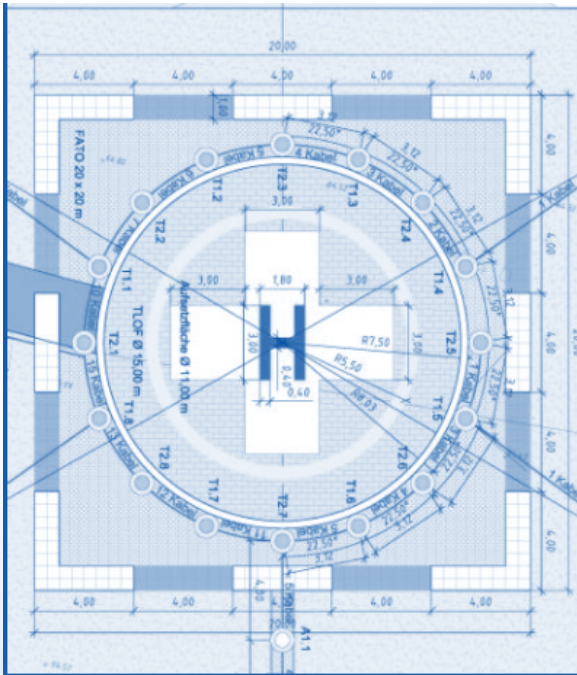


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1B

**Solar zone minimum area - multifamily, nonresidential, hotel and motel**

- Exception 5 – no solar zone required
  - Roof is designed and approved to be used for vehicular traffic, parking, or heliport





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1B

**Solar zone minimum area - multifamily, nonresidential, hotel and motel**

- Exception 3: reduced solar zone area is 50% or more of the potential solar zone area
  - Low-sloped roof with annual solar access of 70% or greater
  - Steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where annual solar access of 70% or greater







# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)1A

## Solar zone minimum area - multifamily, nonresidential, hotel and motel

- Exception for reduced solar access due to shading
  - Use available [solar access tools](#)
  - Solar access area equals solar insolation with shade divided by solar insolation without shade
    - Include shade from existing buildings, parking lot lights, trees and similar objects outside control of the project
    - Exclude shade from potential obstructions within control of the project like the building itself, HVAC equipment, landscaping, and similar objects
  - Document on NRCC-SRA-E Minimum Solar Zone Area worksheet



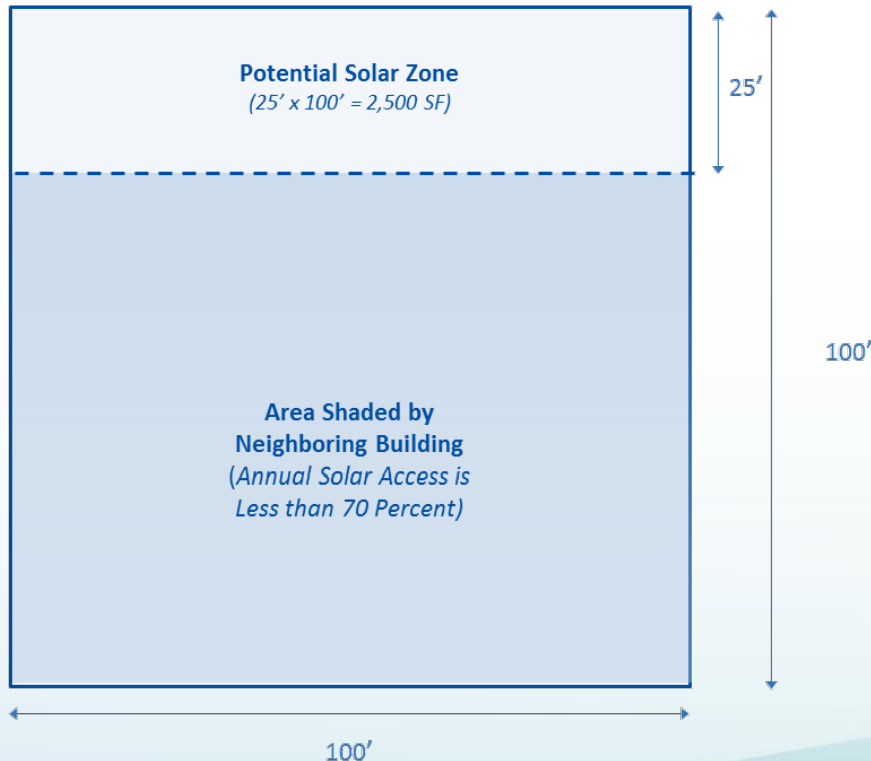
# Solar Ready Buildings Mandatory Requirements

## All Buildings § 110.10(b)1A

### Solar zone minimum area - single family residential

- Example

- What size solar zone is needed on a 10,000 square foot roof with no skylights that is shaded by a neighboring building so that 7,500 square feet of the roof has less than 70% annual solar access?
  - If the entire roof were to have an annual solar access of 70% or greater, the minimum solar zone would have been 1,500 square feet (15% of the total roof area)
  - Since the potential solar zone is 2,500, the minimum solar zone area can be reduced to 1,250 square feet (50% of the potential solar zone)





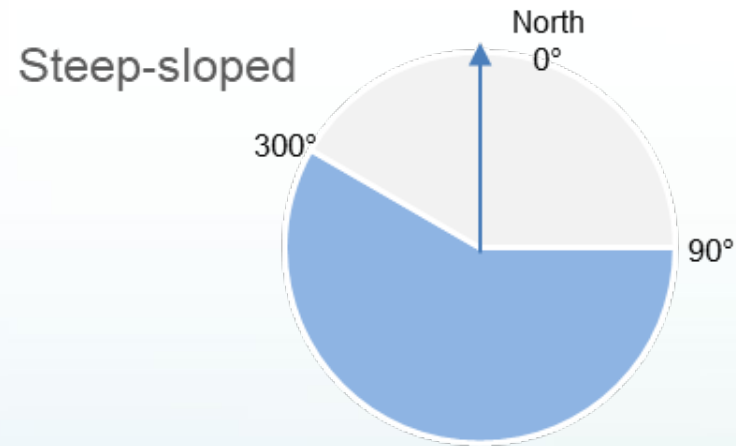
# Solar Ready Buildings Mandatory Requirements

## All Buildings § 110.10(b)2

### Solar zone azimuth

- All solar zone sections on steep-sloped roofs shall be oriented between 90 degrees and 300 degrees of true north.

Figure 9-1: Orientation when solar zone is located on a steep-sloped roof



■ Solar Zone Orientation

If solar zone is located on a sloped roof with a rise to run ratio of 2:12 or greater, then the solar zone area must face between 90° and 300°.





# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)3

## Solar zone shading

- No obstructions in the solar zone
- Limited obstructions outside of solar zone
  - Distance from solar zone to obstruction is at least two times the obstruction height
  - Exception: Obstructions north of all points in the solar zone



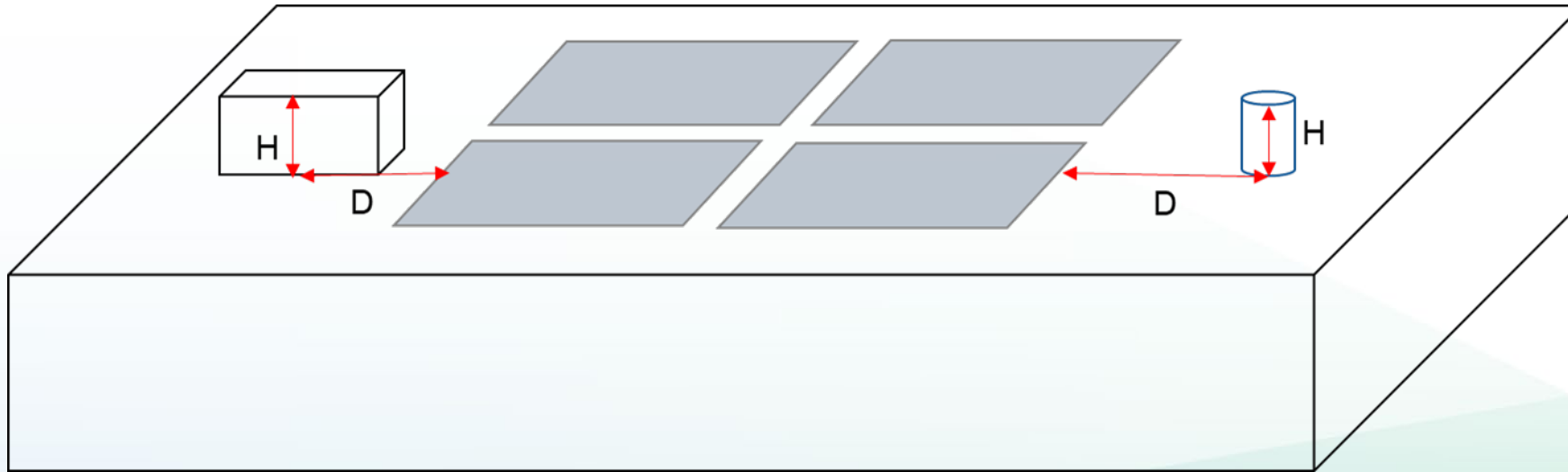


# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(b)3A

## Solar zone shading

- Calculate distance from obstructions
  - Equation:  $D \geq 2H$





# **Solar Ready Buildings Mandatory Requirements**

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All Buildings § 110.10(b)4

## **Solar zone structural design loads on construction documents**

- Roof dead load and live load must be clearly indicated on construction documents (structural plans)
  - Future solar equipment load is not required



# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(c)

## Interconnection pathways - multifamily, nonresidential, hotel and motel

- Construction documents indicate reserved locations
  - Inverters and meter equipment
  - Conduit route from solar zone to service connection
- Must comply with the California Fire Code solar access requirements







# Solar Ready Buildings Mandatory Requirements

All Buildings § 110.10(d)

## Documentation

- Copy to occupant
  - Construction documents showing the solar zone and pathways to interconnection





# Plan Check and Inspection



# Residential Forms

- CF2R-PVB-01
  - Verifies PV exception
  - Triggers solar ready
- CF2R-SRA-01
  - Verifies compliance
  - With or without exceptions
- CF2R-SRA-02
  - Solar zone worksheet
  - Documents solar zone area
  - Verify specifications on plans
- All forms must be registered with HERS provider when HERS verification is required for project

STATE OF CALIFORNIA  
SOLAR READY BUILDINGS – NEW CONSTRUCTION  
CEC-CF2R-SRA-01-E (Revised 01/19) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION  
Solar Ready Buildings–New Construction  
Project Name: \_\_\_\_\_ Date Required: \_\_\_\_\_  
(Page 1 of 2)

**A. General Information**  
Only use this form if the newly constructed do not have a PV system installed. Do not use this form to show solar ready compliance for hotel/motel occupancies and high-rise multifamily buildings with ten stories or fewer and all other nonresidential buildings with three stories or fewer. In stead, use form NRCI-SRA-01-E.

01 Building Type: \_\_\_\_\_  
02 Method of Compliance: \_\_\_\_\_

**B. Building Meets the Solar Ready Requirements**  
01 Compliance with Solar Ready Requirements: \_\_\_\_\_  
The construction documents indicate:  
• The solar zone.  
• A location for inverters and metering equipment.  
• A pathway for routing of conduit from the solar zone.  
• A pathway for routing of plumbing from the solar zone.  
• The structural design loads for roof dead load.

03 A copy of the construction documents including all the following:  
For Single Family Residences only:  
• The main electric service panel shall have a reserved space shall be positioned at the top of the reserved space shall be permanently marked.

04 \_\_\_\_\_  
The responsible person's signature on this compliance document

**C. Residence Not in an Applicable Subdivision**  
01 The single family residence is located in a subdivision.  
The responsible person's signature on this compliance document

**D. Permanently Installed Solar Water Heating System**  
01 Solar Water Heating System Rating: \_\_\_\_\_  
02 Solar Savings Fraction of the Proposed Solar Water Heating System: \_\_\_\_\_  
03 Compliance Statement: \_\_\_\_\_  
The responsible person's signature on this compliance document

**E. Smart Thermostats and Alternative Efficiency Measures**  
01 All thermostats comply with Reference Joint Appendix prior to granting of an occupancy permit by the enforcement agency.  
02 Alternative Efficiency Measure: \_\_\_\_\_  
The responsible person's signature on this compliance document

**F. Smart Thermostats and Alternative Efficiency Measures**  
01 All thermostats comply with Reference Joint Appendix prior to granting of an occupancy permit by the enforcement agency.  
02 Alternative Efficiency Measure: \_\_\_\_\_  
The responsible person's signature on this compliance document

**G. Roof is Designed for Vehicle Traffic or Parking or for Solar Panels**  
01 The roof is designed and approved by the Authority Having Jurisdiction (AHJ).  
02 Provide Building Plan Reference: \_\_\_\_\_  
The responsible person's signature on this compliance document

Registration Number: \_\_\_\_\_ Reg:  
CA Building Energy Efficiency Standards - 2019 Residential Compliance

STATE OF CALIFORNIA  
MINIMUM SOLAR ZONE AREA WORKSHEET – NEW CONSTRUCTION  
CEC-CF2R-SRA-02-E (Revised 01/19) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION  
Minimum Solar Zone Area Worksheet – New Construction  
Project Name: \_\_\_\_\_ Date Required: \_\_\_\_\_  
(Page 1 of 3)

Solar Zone Area (requirements in §110.10 (b)(1A) Exception 1 or 6, and §110.10 (b)(1B) Exception 4)  
This worksheet applies to:  
• Single family residences with out PV that wish to show compliance with the Solar Ready requirements (Section 110.10(b)) by providing a solar zone on the roof of the residence. Note that Exceptions 1 and 6 to Section 110.10(b)(1A) exempt a residence from the solar ready requirements and are documented on the Certificate of Compliance document CF2R-SRA-01-E. Check the exception being used and fill in the relevant details.  
• Low-rise multifamily projects without PV that wish to show compliance with the Solar Ready requirements (Section 110.10(b)) by providing a solar zone on the roof of the building. Note that Exceptions 4 and 5 to Section 110.10(b)(1B) exempt a multifamily building from the solar ready requirements and are documented on the Certificate of Compliance document CF2R-SRA-01-E. Check the exception being used and fill in the relevant details.

**A. General Information**  
01 Building Type: \_\_\_\_\_

**B. Minimum Required Solar Zone Area for Single Family Residence**  
01 Does the residence have three stories or more, and a total floor area less than or equal to 2,000 sq ft?  
02 Is the residence located in Climate Zones 9-14, in a Wildland-Urban Interface Fire Area as defined in Title 24, Part 2, and have a whole house fan?  
03 What is the total area of low-sloped roofs where the annual solar access is 70% or greater (sq ft)?  
04 What is the total area of steep-sloped roofs oriented between 110 and 270 degrees relative to true north, where the annual solar access is 70% or greater (sq ft)?  
05 Solar Zone Area – Solar Access Method (R)  
06 Are all the thermostats Occupant Controlled Smart Thermostats (OCSTs) certified to the Energy Commission and listed on the Commission's appliances database? Alternatively, a networked system of devices may be installed that provides functionality equivalent to an OCST.  
07 Minimum Required Solar Zone Area (sq ft)

**C. Minimum Required Solar Zone Area for Multifamily Building**  
01 What is the total area of the roof of the building? (sq ft)  
02 What is the total area of skylights installed in the roof of the building? (sq ft)  
03 What is the total area of low-sloped roofs where the annual solar access is 70% or greater (sq ft)?  
04 What is the total area of steep-sloped roofs oriented between 110 and 270 degrees relative to true north, where the annual solar access is 70% or greater (sq ft)?  
05 Solar Zone Area – Net Roof Area Method (R)  
06 Solar Zone Area – Solar Access Method (R)  
07 Minimum Required Solar Zone Area (sq ft)

CA Building Energy Efficiency Standards - 2019 Residential Compliance January 2019




# Plan Check

## Residential subdivision building permit applications

- CF2R-SRA-01-E needed for each lot before inspection
- CF2R-SRA-02-E worksheet for homes with a solar zone
- Verify solar zone and orientation
- Compliance options could differ within the group of homes
  - Depends on actual dwelling's orientation, size, shade
- Form submission timing is up to building department
  - Verify as-built on lot matches plans and compliance forms
  - PSR will show when the lot-specific forms comply



# Project Status Report

Project Status Report		CalCERTS, Inc		
		1 of 2		
<b>GENERAL INFORMATION</b>				
Code Year Standards:	2013	 Easy to Verify @ calcerts.com		
Project Name:	Shewmaker Performance Demo			
Project Type:	New Construction SFR			
Address:	1516 9th Street			
City / State / Zip:	Sacramento / CA / 95814			
Enforcement Agency:	City of Sacramento			
Permit Number:	123456789			
HERS VERIFIABLE MEASURES: <b>NOT COMPLETE</b>				
OVERALL STATUS: <b>NOT COMPLETE</b>				
<b>CF1R INFORMATION - Certificate of Compliance</b> ✓				
Certificate Type: Compliance				
Registered Form: CF1R-PRF-01-E				
Registered Date: 04/05/2016 08:30				
Registration Number: 216-N0125429A-000000000-0000				
<b>ADDITIONAL CF1Rs</b>				
System	Form	Registered Date	Registration Number	
	CF1R-SRA-01		216-N012543A-000000000-0000	●
<b>CF2R INFORMATION - Certificate of Installation</b>				
System	Form	Registered Date	Registration Number	
	CF2R-ENV-01 (Penetration Installation)		216-N0125429A-E0100001A-0000	●
	CF2R-ENV-02 (Envelope Air Sealing)		216-N0125429A-E0200001A-0000	●
	CF2R-ENV-03 (Insulation Installation)		216-N0125429A-E0300001A-0000	●
	CF2R-ENV-04 (Roofing-Radiant Barrier)		216-N0125429A-E0400001A-0000	●
	CF2R-MCH-01 (Space Conditioning Systems, Ducts and Fans)	04/05/2016 09:40	216-N0125429A-M0100001A-0000	✓
System 1	CF2R-MCH-20 (Duct Leakage)	04/05/2016 09:40	216-N0125429A-M2000002A-0000	✓
System 1	CF2R-MCH-23 (Airflow)	04/05/2016 09:40	216-N0125429A-M2300002A-0000	✓
System 1	CF2R-MCH-22 (Fan Efficacy)	04/05/2016 09:40	216-N0125429A-M2200002A-0000	✓
System 1	CF2R-MCH-25 (Refrigerant Charge)	04/05/2016 09:40	216-N0125429A-M2500002A-0000	✓
	CF2R-MCH-27 (IAQ and MV)	04/05/2016 09:40	216-N0125429A-M2700001A-0000	✓
	CF2R-PLB-02 (SD HWS Distribution)	04/05/2016 09:40	216-N0125429A-P0200003A-0000	✓
<b>CF3R INFORMATION - Certificate of Verification</b>				
System	Form	Registered Date	Registration Number	
	CF3R-MCH-27 (IAQ and MV)		216-N0125429A-M2700001A-M27A	●
System 1	CF3R-MCH-20 (Duct Leakage)	04/11/2016 12:52	216-N0125429A-M2000002A-M20A	✓

CA Building Energy Efficiency Standards      2013 Residential Compliance      HERS Provider: CalCERTS Inc. Dec 2015

- Summarizes status of all required forms
- Available for all projects registered with HERS provider
- Direct access to registry
- Request hard copy at final inspection to verify compliance
- HERS and Overall Status marked **Complete** to pass inspection



# Nonresidential forms

- NRCC-SRA-E dynamic form
  - Scope specific
  - Auto-fill
  - Add or delete rows
  - Adds table
  - Auto-calculates solar zone area
  - Interactive instructions
- NRCI-SPV-01-E
  - Verifies solar PV system installed

STATE OF CALIFORNIA  
**Solar Ready Areas**  
NRCC-SRA-E (Created 11/19)

CALIFORNIA ENERGY COMMISSION  
NRCC-SRA-E

CERTIFICATE OF COMPLIANCE

This document is used to demonstrate compliance with mandatory requirements in §110.10 for newly constructed buildings which are either high-rise multifamily ten stories or fewer, hotel/motel ten stories or fewer or all other nonresidential buildings three stories or fewer. It is also used to demonstrate compliance for additions to these building types which add more than 2,000 ft<sup>2</sup> of roof area. Alterations or additions of less than 2,000 ft<sup>2</sup> of roof area are not required to comply with §110.10.

Project Name: \_\_\_\_\_ Report Page: \_\_\_\_\_ Page 1 of 4  
Project Address: \_\_\_\_\_ Date Prepared: \_\_\_\_\_

**A. GENERAL INFORMATION**

01 Project Location (city) \_\_\_\_\_ 04 Building Type \_\_\_\_\_  
02 Climate Zone \_\_\_\_\_ 05 Construction Type \_\_\_\_\_  
03 ☐ Roof is designed for vehicle traffic, parking or for heliport

**B. PROJECT SCOPE**

Table Instructions: Select the compliance path the project is using to comply per §110.10(b)18.

My project consists of (check one):

01

☐ Provide Solar Ready Area no exceptions The project has allocated a solar zone on the roof plan per requirements in §110.10(b), as documented in Table F.

☐ Exception to Solar Ready Area:  
☐ Installed Solar Photovoltaic System The project includes a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test Conditions, of no less than one watt per square foot of roof area, as documented in Table G.

☐ Exception to Solar Ready Area:  
☐ Installed Solar Water Heating System The project is a hotel/motel or high-rise multifamily occupancy and includes a permanently installed domestic solar water-heating system complying with §150.1(c)88iii and Reference Residential Appendix RA4, as documented in Table H.

☐ Exception to Solar Ready Area:  
☐ Smart Thermostat and Alternative Energy Efficiency Measure The project is a high-rise multifamily occupancy where all thermostats in each dwelling unit comply with §110.12(a) AND at least one additional measure listed in Exception 4 to §110.10(b)18 is installed, as documented in Table I.

**C. COMPLIANCE RESULTS**

Table Instructions: If any cell on this table says "DOES NOT COMPLY" or "COMPLIES with Exceptional Conditions" refer to Table D, for guidance or see the applicable Table referenced below

Allocated Solar Zone		Installed PV System		Installed SWH System		Smart Tstat and Alternative EE Measure		Compliance Results	
01	02	03	04	05	06	07	08	09	
Required Minimum Area (ft <sup>2</sup> )	≤	Designated Area (ft <sup>2</sup> )	≤	Required Minimum DC Power Rating (Watts)	≤	Designed/ Rated Solar Savings Fraction	JAS Compliant Thermostat Specified?	Alternative Energy Efficiency Measure	
(See Table F)		(See Table G)		(See Table H)		(See Table I)			
≤		OR	≤	OR	≤	OR			
Location in construction documents showing the location for inverters and metering equipment and a pathway for the routing of conduit/ plumbing to the electrical service/ water heating system per §110.10(c).									Not Applicable

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance: <http://www.energy.ca.gov/title24/2019standards> November 2019



# Plan Check

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## **Nonresidential building permit applications**

- NRCC-SRA required for all covered occupancies
  - Including solar zone exceptions
- Verify compliance with multifamily, nonresidential, hotel and motel
- Verify specs on plans
- Verify solar zone and orientation





# Field Inspection

## Verify at Final

- Refer to CF2R-SRA or NRCC-SRA for compliance method
- Solar zone location, size, obstructions
- Electrical panel marked (single family only)
- Exceptions
  - Smart thermostats
  - Energy Star appliances
  - Gray or rain-water irrigation
  - Solar PV or solar hot-water system
    - Installation forms required
  - Heliport or parking lot



# Resources



# Online Resource Center

## Online Resource Center

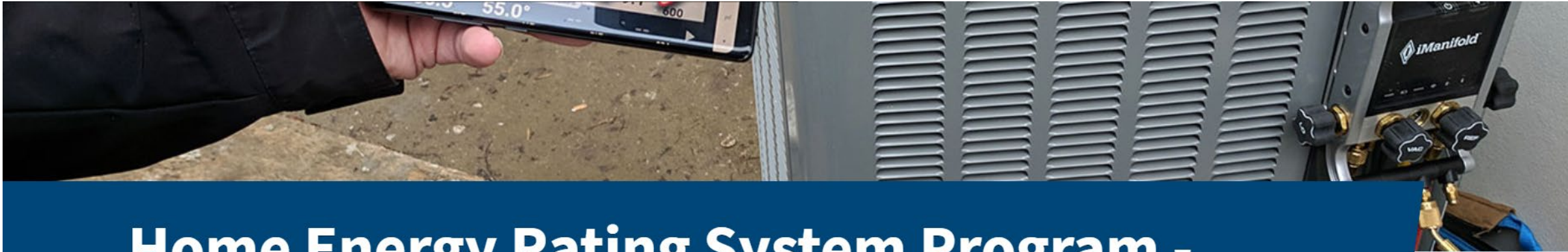
Educational documents and training information for building communities and enforcement agencies to assist with building energy standards compliance.

[LEARN MORE >](#)





# 2019 HERS Providers



## Home Energy Rating System Program - HERS

The Home Energy Rating System (HERS) Program tests and rates the energy performance of a home. The California Energy Commission's HERS Program addresses construction defects and poor equipment installation, including HVAC systems and insulation. The Energy Commission has a list of approved HERS providers who train and certify raters.

### SUBSCRIBE

Building Energy Efficiency Standards

First Name \*





# Blueprint Newsletter

## Blueprint Newsletter

Blueprint is the California Energy Commission's quarterly e-newsletter that delves into the Building Energy Efficiency Standards and provides examples of projects. The newsletter provides updates, answers to frequently asked questions, clarifications to requirements, announcements, and educational resources and training.

### NEWSROOM

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  - Appliances
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## Follow the California Energy Commission





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8:00 a.m. to 12:00 p.m.

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Email

[Title24@energy.ca.gov](mailto:Title24@energy.ca.gov)



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**Thank you**