

# 2021 WSEC Commercial

## KEY CHANGES - RENEWABLE ENERGY SYSTEMS AND SOLAR READINESS



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# WSEC Commercial Technical Support

- ▶ On-call technical support thru 3 avenues
  - Telephone hot line – **360-539-5300**
  - Online form – **<https://www.waenergycodes.com>**
  - Email inquiries – **[com.techsupport@waenergycodes.com](mailto:com.techsupport@waenergycodes.com)**
- ▶ Classroom and webinar training
- ▶ We administer the technical support and compliance documentation webtool



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# Codes

## Increasing progressive effectiveness of energy codes

The NEEA Codes and Standards program supports regional stakeholders in the development and adoption, training and implementation of energy codes. States engage in the code development process along different cycles and code versions, but all states now use the International Energy Conservation Code (IECC) as a baseline for their commercial energy codes. All states except Oregon now use the IECC as the basis of their residential code. The adoption of codes is the responsibility of state code boards or agencies. Official state-by-state energy code information can be found on state building code websites:

Idaho - <http://dbs.idaho.gov/boards/index.html>

Oregon - <http://www.cbs.state.or.us/external/bcd/>

Washington - <https://sbcc.wa.gov/>

Montana - <http://svc.mt.gov/gov/boards/>



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WSEC technical support services are made possible thanks to the generous support of the Northwest Energy Efficiency Alliance

[www.neea.org](http://www.neea.org)

# Today's Presentation

- ▶ This presentation represents ETC's **unofficial** interpretation of code intent.
- ▶ Our technical support team is not an affiliate, nor do we speak for the Washington State Building Code Council (SBCC).
- ▶ The WSEC commercial technical support we provide is advisory only and non-binding.



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# Current Status of the 2021 WSEC-C

## **Effective date of the 2021 WSEC has been delayed until March 15, 2024**

- ▶ The Washington State Building Code Council conducted the rulemaking process to modify sections in the 2021 WSEC-C and 2021 WSEC-R to address legal uncertainty stemming from the decision in California Restaurant Association v. City of Berkeley recently issued by the Ninth Circuit Court of Appeals. **The Council is expected to vote on the proposed modifications in November 2023.**
- ▶ This presentation covers changes between the 2018 and 2021 WSEC-C that are not likely to be affected by this process.
- ▶ Follow the Washington State Building Council <https://www.sbcc.wa.gov/> for the latest news or to participate in the code development process.

# Topics we'll discuss today ~

1. Scope of Section C411 Renewable Energy
2. When are renewable energy generation systems and solar readiness required
3. On-site renewable energy system requirements and exceptions
4. Eligible off-site renewable energy sources
5. Documentation requirements for off-site renewable energy systems
6. Criteria for solar readiness zones and future supporting systems
7. Multidiscipline coordination for renewable energy systems and solar readiness
8. Q&A



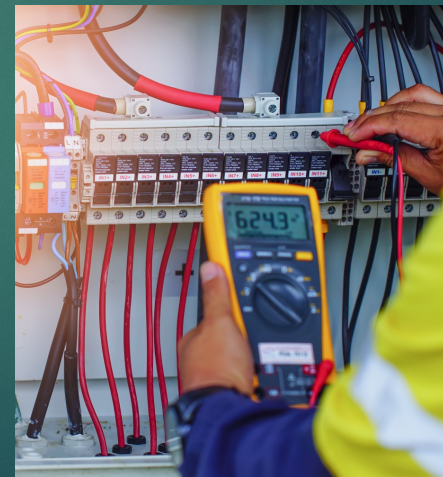
# Renewable Energy & Solar Readiness



# Renewable Energy Requirements

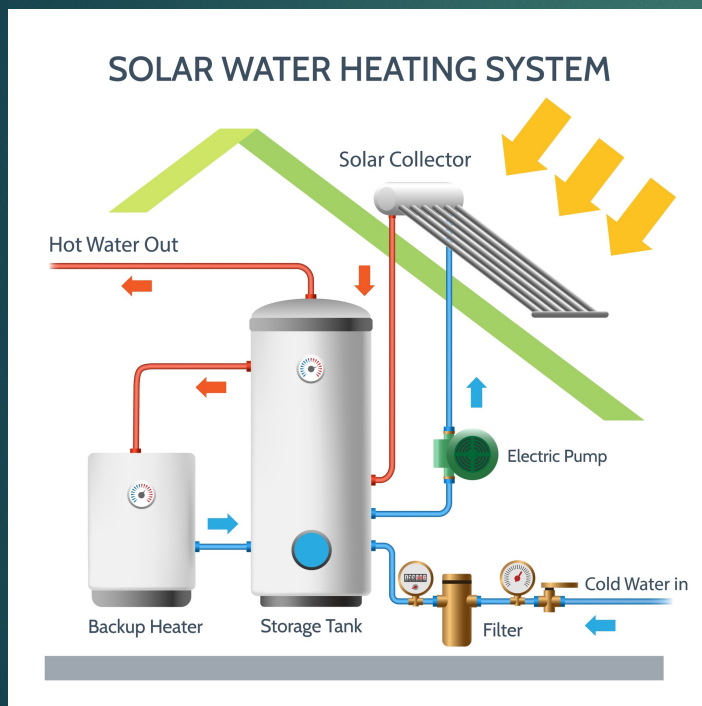
There are now **THREE** elements to the renewable energy provisions

- ▶ C411.1 On-site renewable energy systems
- ▶ C411.2 On-site & off-site renewable energy accounting
- ▶ C411.3 Solar readiness





# On-Site Renewable Energy



## Purpose

- ▶ To achieve the target of 70% energy use reduction by 2030 as mandated by WA State RCW 19.27A, it will be necessary to incorporate renewable energy capacity into buildings to offset energy use
- ▶ Renewable energy systems will create industry capacity to meet anticipated energy needs in the building sector
- ▶ New & updated renewable energy requirements in the 2021 WSEC-C starts down this path with modest renewable energy deployment in commercial buildings

# Off-site Renewable Energy Alternative



## Purpose

- ▶ Compliance alternatives when installing renewable energy systems on-site is not feasible
- ▶ Provides a compliance path for buildings that receive energy from off-site renewable energy systems owned by the building project owner
- ▶ Recognizes building projects that receive energy from community renewable energy resources
- ▶ Allows projects to comply with the renewable energy requirements via a Renewable Power Purchase Agreement (PPA)



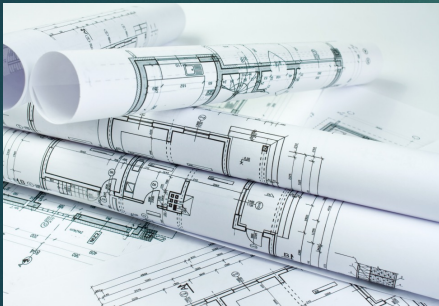
# Solar Readiness



## Purpose

- ▶ Encourages utilization of on-site renewable energy systems
- ▶ Requires accommodations when a new building is constructed that will support the installation of future renewable energy systems
- ▶ If these accommodations are not incorporated when the building is first constructed, it is often difficult and expensive to add renewable energy systems in the future

# Multi-Discipline Coordination



- ▶ ARCHITECT – Designate areas that are free of obstructions to accommodate solar arrays, wind generators or other on-site renewable energy systems
- ▶ STRUCTURAL – Design building structure to accommodate future loading of renewable energy systems equipment
- ▶ ELECTRICAL – Design electrical systems to accommodate interconnection to renewable energy systems
- ▶ MECHANICAL – Design mechanical systems to utilize renewable heat energy sources (if applicable); coordinate locations of mechanical equipment with renewable energy equipment
- ▶ FIRE PROTECTION – Refer to SBCC Expedited Rulemaking for updated IFC requirements for energy storage systems



When do the renewable energy systems & solar readiness provisions apply?

## THRESHOLDS WHEN PROVISIONS APPLY

	<b>C411 Renewable Energy &amp; Solar Readiness</b>	Project conditioned floor area ≤ 10,000 sf	Project conditioned floor area > 10,000 sf	Building height ≤ 20 stories	Building height > 20 stories
New Building	Renewable Energy	NA	✓	✓	✓
	Solar Readiness	✓	✓	✓	NA
Building Additions	Renewable Energy	NA	✓	✓	✓
	Solar Readiness	✓	✓	✓	NA
Change in Space Conditioning or Occupancy	Renewable Energy	NA	NA	NA	NA
	Solar Readiness	✓	✓	✓	NA
Existing Building Alterations	Renewable Energy	NA	NA	NA	NA
	Solar Readiness	NA	NA	NA	NA

There are also exemptions for small buildings and additions < 500 sf

# Thresholds when provisions apply

## **Gross conditioned floor area**

- ▶ Includes fully conditioned & semi-heated spaces
- ▶ Low energy spaces such as parking garages and unheated warehouses are not included in the gross conditioned floor area calculation

## **Building height**

- ▶ Applies only to stories above grade plane
- ▶ Does not apply to below grade spaces such as parking garage floors
- ▶ Provision thresholds based solely on building height do not include whether floors are conditioned



# Change in space conditioning or occupancy alterations


## ▶ Change of Space Conditioning

- Space converted from low energy to semi-heated or **conditioned** space
- Space converted from semi-heated to conditioned space

## ▶ Change of Occupancy

- Space converted from F, S or U occupancy to something other than F, S or U
- Space converted to Group R from another use or occupancy
- Group R dwelling unit converted to commercial use or occupancy if dwelling unit was permitted prior to July 1, 2002





# On-Site Renewable Energy Systems



# On-site Renewable Energy Systems

## What is required?

- ▶ Minimum energy generation capacity not less than **0.5 watt/SF or 1.7 Btu/SF** multiplied by the sum of all gross conditioned floor areas of the building or building additions
- ▶ Renewable energy generation system may be located on or within the building or located on or within another structure elsewhere on the project site
- ▶ There are exceptions for buildings with limited available roof area or where a substantial portion of the roof area is shaded

# On-Site Renewable Energy Systems Example

- ▶ 20,000 SF building, single story, Group S warehouse, fully conditioned
- ▶ Renewable energy systems requirement:
  - 20,000 SF x 0.5 watts/sf electric energy = **10,000 watts**, OR
  - 20,000 SF x 1.7 btu/sf thermal energy = **34,000 btu**
- ▶ Solar PV area - Assume 10 watts/SF of roof area
  - $10,000 \text{ watts} \div 10 \text{ watts/SF} = 1,000 \text{ SF}$  of roof area required for PV solar array installation

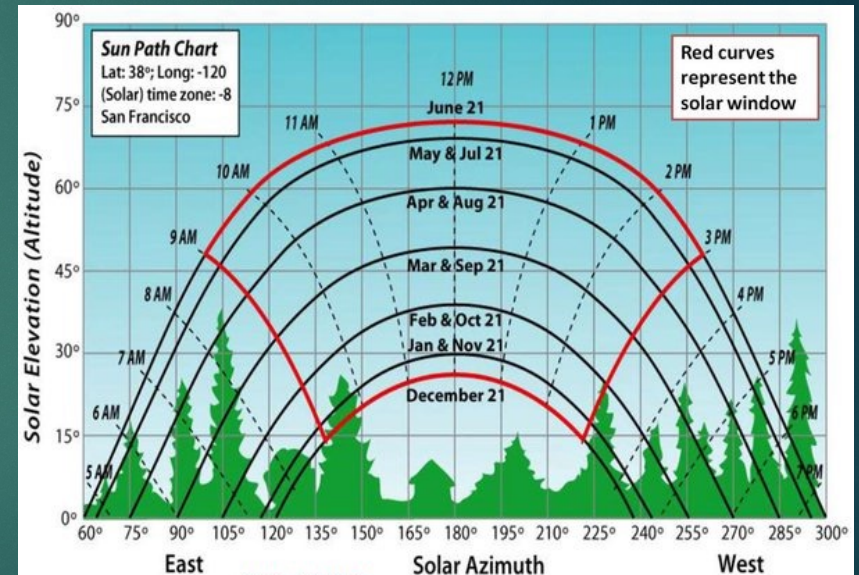


*Photo courtesy of Benton REA*



# On-site Renewable Energy Systems - Exception #1

- ▶ Buildings where >50% of the roof area is shaded from direct sunlight by natural objects or structures that are not part of the building for more than 2,500 hours per year between 8am and 4 pm
- ▶ Required documentation options
  - Solar shading modeling software
  - Solar site survey using a sun path chart
  - Include shading elements on site plan



# On-site Renewable Energy Systems - Exception #2

- ▶ Buildings where >80% of the roof area is covered by equipment, planters, vegetated space, skylights, or occupied roof deck
- ▶ Required documentation
  - Roof plan with coverage calculation

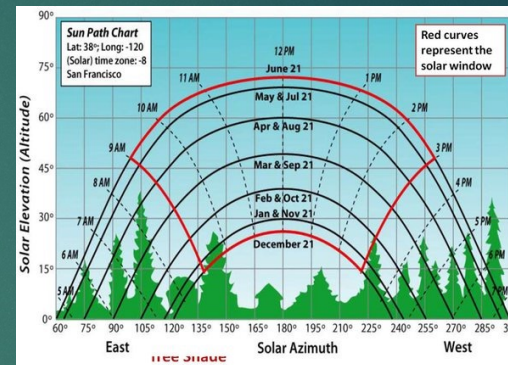




# On-site Renewable Energy Systems - Exception #1 & #2

Additional requirement for buildings that qualify under Exceptions #1 or #2 to omit installation of an on-site renewable energy system:

- ▶ Comply with **18 additional energy efficiency measure credits** from Table C406.2
- ▶ This is in addition to the minimum required number of additional energy efficiency credits for the project, based on building occupancy type



# Renewable Energy Systems Exception #3

- ▶ Buildings that do not have adequate roof area to install the minimum required on-site solar capacity may install a lesser SF area, but not zero
- ▶ Required documentation
  - Solar PV calculations for minimum required PV capacity and proposed capacity
  - Roof plan identifying available roof area for solar PV installation



# On-Site Renewable Energy Systems Example

- ▶ 23,000 SF building, 4-story, Group R-2 multi-family
- ▶ Renewable energy systems requirement:
  - 23,000 SF x 0.5 watts/sf electric energy = **11,500 watts**
- ▶ Solar PV area calculation
  - Assume 10 watts/SF of roof area
  - 11,500 watts ÷ 10 watts/SF = 1,150 SF of roof area required
  - Available roof area = 900 SF
  - 900 SF x 10 watts/SF = 9,000 watts



Image courtesy of Lewellen Associates


# On-site Renewable Energy Systems - Exception #3

Buildings that qualify under Exception #3 to have on-site renewable energy capacity that is lower than required capacity:

- ▶ Proposed capacity is counted **proportionately** toward the 18 additional energy efficiency measure credits required from Table C406.2
- ▶ Exception #3 example calculation
  - $9000 \text{ watts} / 11,500 \text{ watts required} = 78\%$  of required capacity
  - $18 \text{ credits} \times 78\% = 14 \text{ credits}$
  - **4 additional energy efficiency credits** are required to qualify for Exception #3







# Off-Site Renewable Energy



# Off-site Renewable Energy

Eligible off-site renewable energy sources that are delivered or credited to the building to demonstrate compliance with C411

- ▶ Self-generation via an off-site renewable energy system owned by the building project owner
- ▶ Community renewable energy facility systems
- ▶ Renewable power purchase agreement (PPA)



*Community solar system at Greenbank Farm, Whidbey Island - Image courtesy of Greenbank Farm*



# Renewable Energy Procurement

**TABLE C411.2.1  
MULTIPLIERS FOR RENEWABLE ENERGY PROCUREMENT METHODS**

Location	Renewable Energy Source	Renewable Energy Factor		
		In the state of Washington	Western Interconnected	In the states of Oregon or Idaho
On-site	On-site renewable energy system	1	NA	NA
Off-site	Directly owned off-site renewable energy system that begins operations after submission of the initial permit application	0.95	0.75	0.85
Off-site	Community renewable energy facility that begins operation after submission of the initial permit application	0.95	0.75	0.85
Off-site	Directly owned off-site renewable energy system that begins operations before submission of the initial permit application	0.75	0.55	0.65
Off-site	Community renewable energy facility that begins operation before submission of the initial permit application	0.75	0.55	0.65
Off-site	Renewable Power Purchase Agreement (PPA)	0.75	0.55	0.65

- ▶ The proposed capacity of each source of renewable energy shall be multiplied by the factors in Table C411.2.1
- ▶ Off-site energy factors vary depending on when the energy facility or system begins operation, relative to date of the initial permit application

# Western Interconnection

- ▶ Qualifying off-site renewable energy systems shall be connected to the WECC
- ▶ WECC is a synchronous utility grid connecting all or portions of 14 states in the US, two Canadian provinces and a portion of Baja Mexico



Western Interconnection  
Image courtesy of the WECC



# Off-Site Renewable Energy Procurement Example

- ▶ **11,500 watts** of solar PV required per C411.1
- ▶ **9,000 watts** of PV installed on-site due to roof area limitations
- ▶ To make up the difference, procure **2,500 watts of off-site renewable energy capacity for 15 years**



# Off-Site Renewable Energy Procurement Example

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Off-site	Renewable Power Purchase Agreement (PPA)	0.75	0.55	0.65

**Target = 2,500 watts capacity**

→ Install 2,500 watts PV on-site

→ Watts: 2,632/3,333/2,941

→ Watts: 2,632/3,333/2,941

→ Watts: 3,333/4,545/3,846

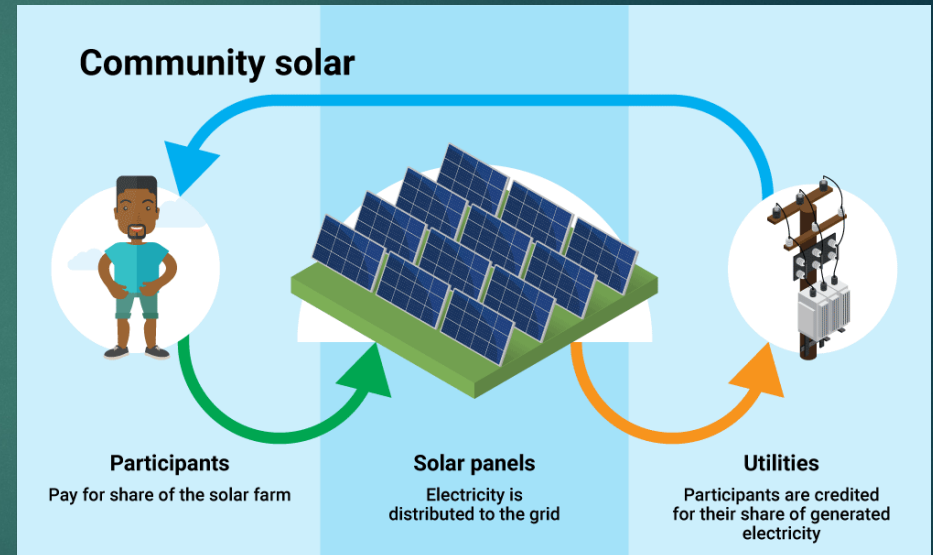
→ Watts: 3,333/4,545/3,846

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# Documentation For Off-site Renewable Energy Procurement

- ▶ Documentation shall be submitted to the code official
- ▶ The purchase agreement shall have a minimum duration of 15 years
- ▶ The purchase agreement shall be transferable in the event of partial or full transfer of building ownership
- ▶ Documentation of energy purchased from the off-site renewable energy producer shall be maintained by the building owner



# Multi-Tenant Buildings

- ▶ Applies when Renewable Energy Credits (RECs) are transferred to the tenants
- ▶ Owner shall develop a plan for tracking the quantity and vintage of the RECs on the tenant's behalf
- ▶ RECs are awarded and retired in proportion to the gross conditioned floor area that is leased or rented
- ▶ REC tracking system shall meet the requirements of Section V.B. of the Green-e framework







# Solar Readiness

When do the renewable energy systems & solar readiness provisions apply?

## THRESHOLDS WHEN PROVISIONS APPLY

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Building Additions	Renewable Energy	NA	✓	✓	✓
	Solar Readiness	✓	✓	✓	NA
Change in Space Conditioning or Occupancy	Renewable Energy	NA	NA	NA	NA
	Solar Readiness	✓	✓	✓	NA
Existing Building Alterations	Renewable Energy	NA	NA	NA	NA
	Solar Readiness	NA	NA	NA	NA

There are also exemptions for small buildings and additions < 500 sf



# Solar Zone Minimum Area

## Solar zone areas shall be designated on the architectural plans

1. Minimum required solar zone area is either:
  - 40% of the roof area
  - 20% of the electrical service size – Area calculated using 10 peak watts of photovoltaic per SF
  - Roof area = Gross roof SF area minus skylights, occupied roof decks, mechanical equipment including clearances, and vegetated areas
2. Solar zone area does not have to be contiguous

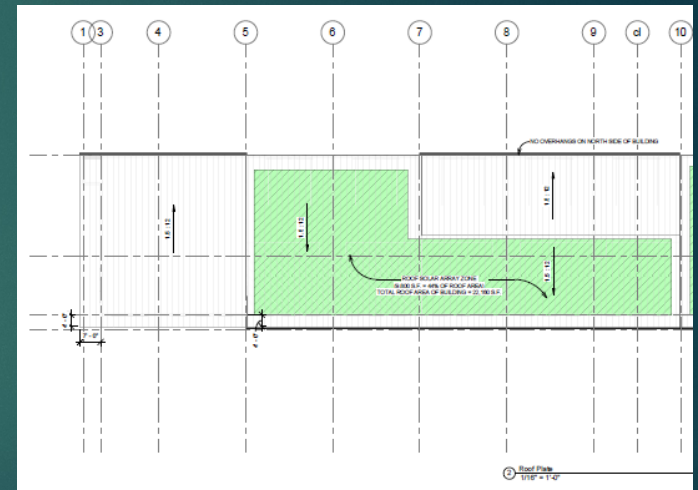


Image courtesy Lewellen Associates

C411.3.1  
C411.3.2

# Solar Zone Minimum Area

**Solar zone area will most often be based on 40% of the roof area because...**

- ▶ Due to IEC required load diversity, a typical electrical service is substantially over-sized relative to the actual measured peak load (up to 3 times)
- ▶ In most cases, 20% of the electrical service size will be much larger than 40% of the roof area
- ▶ 20% of the electrical service size threshold may be desirable for buildings such as a large single-story warehouse with low electrical load and large roof area





# Additional Solar Zone Area Criteria

3. May be located on the roof of the building or another structure elsewhere on-site
4. Cannot be located on a roof sloped greater than 2:12 that faces within 45 degrees of true north
5. Shall be setback from any existing or new object on the building or site that is located south, east or west of the solar zone area (parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings)
6. Shall be free of obstructions (pipes, vents, ducts, HVAC equipment), although may be installed above obstructions

**C411.3**  
**C411.3.3**  
**C411.3.4**

# Additional Solar Zone Area Criteria

## International Fire Code Requirements

- ▶ Designate access pathways for all solar zone areas on architectural plans
- ▶ Include accommodations for emergency smoke ventilation elements

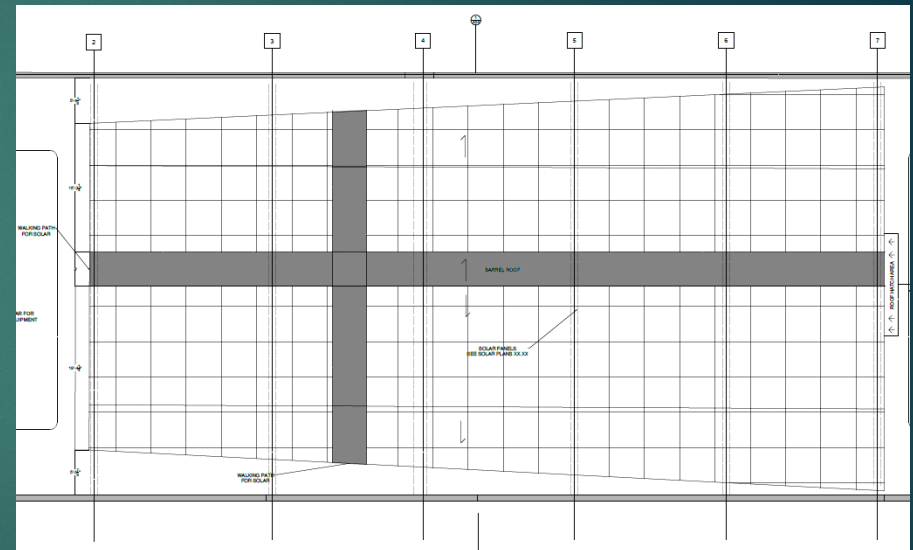


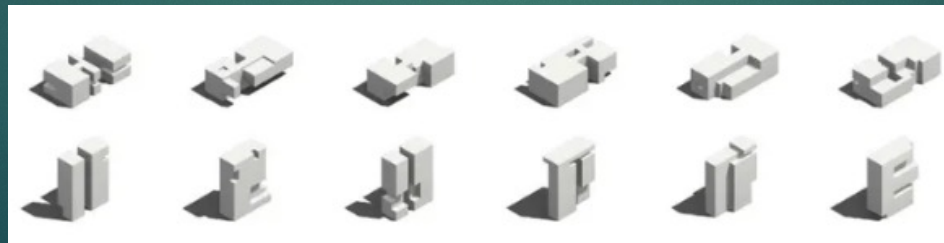
Image courtesy Lewellen Associates



# Solar Readiness Exception

Project is exempt from solar readiness provision when solar exposure of the overall roof area is less than 75% of that of unshaded areas as measured by one of the following criteria:

- ▶ Incident solar radiation expressed in kWh/SF/year using weather data
- ▶ Annual sunlight exposure expressed in cumulative hours per year
- ▶ Shadow studies indicating that the roof area is more than 25% in shadow on September 21<sup>st</sup> at 10 am, 11 am, 12 pm, 1 pm, 2 pm solar time



*Shadow study example courtesy of Cove.Tool*

# Shaded Roof Area Example

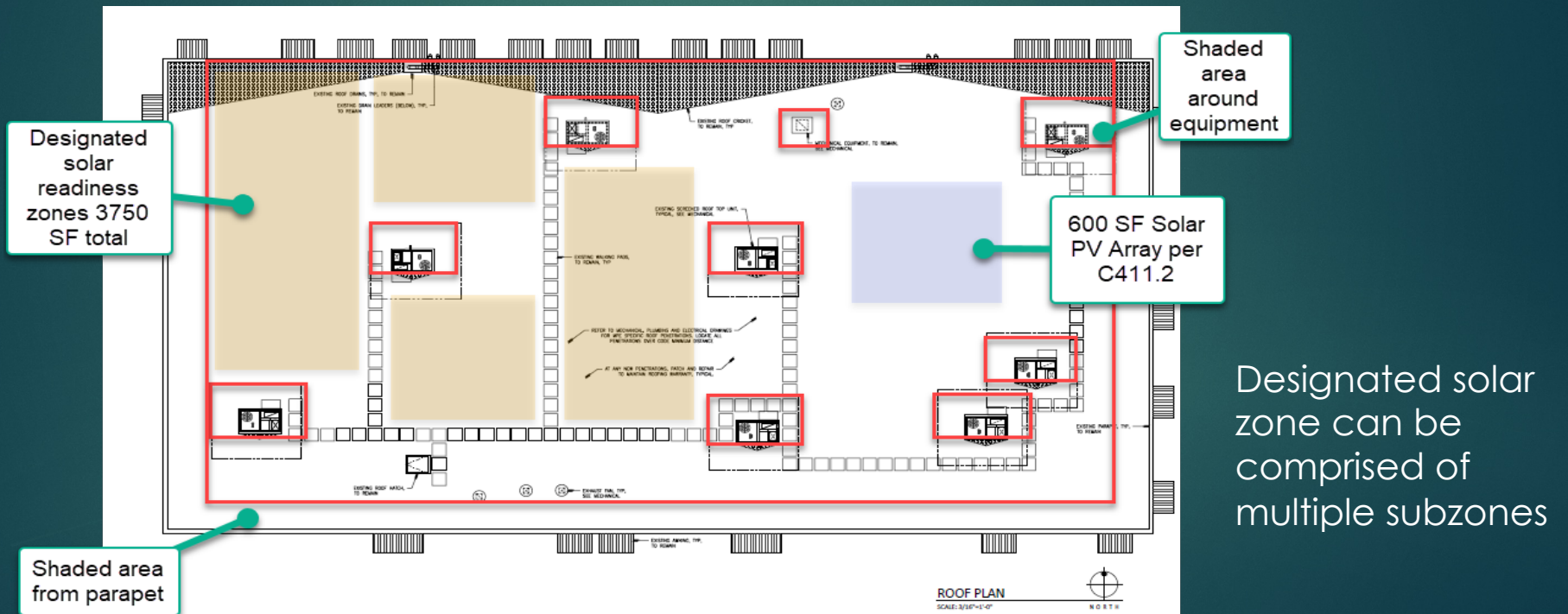


Image courtesy Lewellen Associates

C411.3.4



# Electrical Requirements

## Accommodations for future solar system shall be included in electrical plans

- ▶ Include solar zone boundaries, access pathways and proposed locations for future inverters and metering equipment on electrical plans
- ▶ Include information in one-line diagram for future connection to solar array (must be built into the switch board during initial construction)
- ▶ Designate future wiring pathway(s) from switchboards to inverter and to future solar array areas
- ▶ Identify future conduit penetrations through rated assemblies



# Solar PV Inverters

## Future inverter location coordination

- ▶ Solar panels output DC power, which is converted by the inverter to AC power to efficiently transmit it over distance to the main electrical service panel
- ▶ Location for future inverters shall be identified in electrical and structural plans – **Can be located either within or adjacent to the solar zone**
- ▶ Common locations include:
  - Designated area within the electrical room on the top floor of the building
  - Adjacent to the panels within the solar zone area (requires outdoor rated inverters and future structural upgrade at eventual inverter location)
  - Micro-inverters that are integral to each solar panel



C411.3.6  
C411.3.7



# Structural Requirements

## Future loads shall be included in the structural design

- ▶ Structural design accounts for dead loads (gravity) and live loads (lateral loads due to wind and seismic forces)
- ▶ Per IBC Section 1603.1.8.1, rooftop-mounted photovoltaic panel systems (including rack support systems) shall be accounted for in the structural analysis as Special Loads
- ▶ Structural analysis for the roof shall include a minimum additional **4 lbs/sf dead load** for the designated solar zone areas, in addition to all other loads
- ▶ If a photovoltaic system is included in project, use actual dead load values in the structural analysis versus energy code defaults

# Training Topics Review

- ▶ Renewable energy systems are required for new buildings and additions with >10,000 SF conditioned floor area (does not apply to alterations)
- ▶ Solar readiness provisions apply to buildings less than 20 stories
- ▶ Solar readiness provisions apply to new buildings, additions and change in space conditioning or occupancy alterations
- ▶ A designated solar zone for solar readiness may still be required even if a renewable energy system is not required
- ▶ Renewable energy system requirements can be met using both on-site and off-site renewable energy sources
- ▶ Renewable energy required minimum capacity is 0.5 watts/SF or 1.7 Btu/SF based on total conditioned floor area



# Training Topics Review

- ▶ Projects utilizing an exemption for the renewable energy requirement shall achieve 18 additional energy efficiency measures credits per C406.1
- ▶ Number of additional credits required for projects taking an exemption may be offset by installing a smaller than required renewable energy system
- ▶ Off-site renewable energy sources shall be connected to the Western Interconnection
- ▶ If a Renewable Power Purchase Agreement is utilized to comply with the renewable energy requirement, contract shall have a duration of at least 15 years
- ▶ Documentation for off-site renewable energy procurement shall be submitted to the code official

# Thank you!

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