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7 Photovoltaic, Community Shared Solar, Battery Storage, and Solar Ready Buildings

7.1 Overview

Chapter 7 describes the compliance requirements for photovoltaic (PV) systems, battery storage systems, and solar and battery ready for newly constructed single-family residential buildings. The prescriptive PV requirement sets the standard design budget for the performance compliance method. Installation of battery storage system is a compliance option, and this chapter describes the qualification requirement for this credit. The requirements for solar ready buildings are mandatory measures for newly constructed single-family residential buildings that do not have a PV system due to an exception in Section 150.1(c)14. The solar ready requirement is implemented when designing the building's rooftop and associated equipment. The intent is to reserve a penetration-free and shade-free portion of the roof for the potential future installation of a solar energy system. There are no requirements to install panels, conduit, piping, or mounting hardware.

For information about solar water heating system, please see Chapter 5.

7.1.1 What's new for 2022

7.1.1.1 Mandatory Measures

1. Energy Storage System (ESS) ready is now required for all single-family buildings with one or two dwelling units. See section 7.8 for details.

7.1.1.2 Prescriptive & Performance Compliance

1. Revised exceptions to the PV requirement for buildings with limited Solar Access Roof Area (SARA), enforcement-authority-approved roof designs in areas with high snow loads, designs approved by the local planning department prior to January 1, 2020 with mandatory conditions for approval, and some buildings with battery storage.
2. An additional control strategy was added to Joint Appendix JA12 for Separate Battery Storage Systems when battery systems are installed separate from on-site PV systems.

7.2 Prescriptive Requirements for Photovoltaic System

7.2.1 Photovoltaic System Size

§150.1(c)14

To comply with the prescriptive requirements, all single-family buildings are required to have a PV system installed unless the building qualifies for an exception. The minimum qualifying size of the PV system is based on the projected annual electrical usage as described by the Equation 7-1 below.

Equation 7-1

kW_{PV} required = (CFA x A)/1000 + (NDwell x B)

WHERE:

kW_{PV} = kW_{dc} size of the PV system

CFA = Conditioned floor area

NDwell = Number of dwelling units

A = Adjustment factor from Table 7-1

B = Dwelling adjustment factor from Table 7.1

Table 7-1 – CFA and Dwelling Adjustment Factors

Climate Zone	A - CFA	B - Dwelling Units
1	0.793	1.27
2	0.621	1.22
3	0.628	1.12
4	0.586	1.21
5	0.585	1.06
6	0.594	1.23
7	0.572	1.15
8	0.586	1.37
9	0.613	1.36
10	0.627	1.41
11	0.836	1.44
12	0.613	1.40
13	0.894	1.51
14	0.741	1.26
15	1.56	1.47
16	0.59	1.22

7.2.2 Exceptions to PV requirements

Annual Solar Access: The annual solar access is the ratio of solar insolation including shading to the solar insolation without shading. Refer to Exceptions for Reduced Solar Zone Due to Shade, in Section 7.6.2, for an example of how to calculate solar access.

Effective Annual Solar Access: The effective annual solar access shall be 70 percent or greater of the output of an unshaded PV array on an annual basis.

Effective Annual Solar Access Roof Areas: Are roof areas that meet the Effective Annual Solar Access requirements and are at least 80 contiguous square feet.

Solar Access Roof Area (SARA): The area of the building's roof, covered parking areas, carports, and all other newly constructed structures that are capable of structurally supporting a PV system per Title 24, Part 2, Section 1511.2. SARA does not include any roof area with less than 70 percent annual solar access.

There are five allowable exceptions to the prescriptive PV requirements as listed below.

Exception 1: may apply if there is limited unshaded roof space. For steep slope roofs, SARA shall not consider roof areas with a northerly azimuth that lies between 300 degrees and 90 degrees from true north. No PV system is required if the SARA is less than 80 contiguous square.

Exception 2: No PV system is required when the minimum PV system is less than 1.8 kWdc.

Exception 3: Buildings with enforcement-authority-approved roof designs, where the enforcement authority determines it isn't possible for the PV system, including panels, modules, components, supports, and attachments to the roof structure, to meet the snow load requirements of Ch. 7 in the American Society of Civil Engineers (ASCE) Standard 7-16.

Exception 4: For buildings that are approved by the local planning department prior to January 1, 2020 with mandatory conditions for approval:

1. Shading from roof designs and configurations for steep-sloped roofs, which are required by the mandatory conditions for approval, shall be considered for the annual solar access calculation.
2. Roof areas, that are not allowed by the mandatory conditions for approval to have PVs, shall not be considered in determining the SARA.

Exception 5: may apply to buildings with a battery storage system. PV system sizes determined using equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Join Appendix JA12 and have a minimum usable capacity of 7.5 kWh.

Example 7-1 Detached Building

Question:

Does a new detached building classified as occupancy U (like a pool house, rec room, art studio, etc.) on a residential lot need to meet the solar PV requirements in Energy Code Section 150.1?

Answer:

Yes. A conditioned, newly constructed building classified as U-building on a residential lot needs to meet the PV requirements in Section 150.1(c)14 of the Energy Code. Using the prescriptive method, the annual PV electrical output Equation 150.1-C allows for an input of zero for the number of dwelling units. Using the performance method, the PV calculation is automated to at least one dwelling unit.

Example 7-2

Question:

Answer:

7.2.3 Joint Appendix 11 (JA11) Requirements

The installed PV system must meet the applicable requirements specified in JA11.

7.2.3.1 System Orientation

For prescriptive path compliance, a PV system with module pitches greater than 2:12, or 10 degrees, must be oriented between 90 to 300 degrees from true north. Module pitches less than 10 degrees (low-slope) can be installed in any orientation since azimuth of low-slope modules has an insignificant impact on array performance.

When using the performance approach, the array may be oriented in any direction, including due north; however, the more the orientation deviates from the optimum orientation of southwest, the worse the system performs, resulting in a larger PV system size needed to achieve compliance. It is best to orient the panels as close to southwest as possible to maximize the system performance with the smallest array size.

To use the California Flexible Installation 1 (CFI1) simplified modeling option in the performance method, the PV array must be installed between 150 to 270 degrees from true north, with all modules at the same tilt as the roof for pitches up to 7:12.

When the CFI2 option is selected in the performance calculation, the PV array must be installed between 105 and 300 degrees from true north, with all modules at the same tilt as the roof for pitches up to 7:12. Note, when selecting CFI2, the performance of the proposed system is derated by approximately 10 percent.

If the PV array does not meet either CFI1 or CFI2, then the actual orientation and tilt of the PV array shall be described.

7.2.3.2 Shading

Shading from obstructions must be limited to meet the performance or prescriptive requirements. For prescriptive compliance, if the PV system does not qualify for Exception 1 described above, then the weighted average annual solar access by panel count shall be at least 98 percent. Any obstruction located north of the array does not need to be considered. Obstructions include the following:

(a) Any vent, chimney, architectural feature, mechanical equipment, or other obstruction that is on the roof or any other part of the building.

(b) Any part of the neighboring terrain.

(c) Any tree that is mature at the time of installation of the PV system.

(d) Any tree that is planted on the building lot or neighboring lots or planned to be planted as part of landscaping for the building. (The expected shading shall be based on the mature height of the tree.)

(e) Any existing neighboring building or structure.

(f) Any planned neighboring building or structure that is known to the applicant or building owner.

(g) Any telephone or other utility pole that is closer than 30 feet from the nearest point of the array.

Example 7-3 Shading

Question:

What would be the impact of shading on the PV sizing requirement?

Answer:

Prescriptively the PV array cannot have any shading and the weighted average annual solar access as measured by an approved solar assessment tool must be at least 98 percent by panel count. Under the performance path, there is no minimum requirement for annual solar access, however the increase in shading (lower annual solar access)will necessitate in a larger PV size to meet the same TDV budget as a smaller unshaded PV system.

7.2.3.3 Solar Access Verification

A solar assessment tool that is approved by the Executive Director must be used to demonstrate the shading conditions of the PV system or when claiming an exception based on limited amount of solar access.

The installer must provide documentation that demonstrates the actual shading condition of the installed PV system using an approved solar assessment tool. To be certified by the Executive Director, the solar assessment tool:

a. Must calculate the annual solar access percentage of each individual solar array and a weighted average of the PV system. The calculation must include all known obstructions, including any tree that is planted on the building lot or neighboring lots or planned to be planted as part of landscaping for the building.

b. Must not include horizon shading in the calculation by default,

c. Must produce a shade report with a summary of the PV system, including the address of the project, individual array panel count, orientation, annual solar access percentage, and a weighted average of the PV system as a whole.

d. Annual solar access percentage values must be comparable to on-site measurements, if the tool's model shading condition is based on satellite or aerial images. Documentation must be provided to the CEC as proof.

7.2.3.4 Remote Monitoring Capability

The PV system must have a web portal and a mobile device application that enables the building owner, manager, or occupants to monitor the performance of their PV system to identify, report, and correct performance issues with the panels, inverters, shading, or other issues that may adversely impact the performance of the PV system. At a minimum, the occupants must have access to the following information:

(a) The nominal kW rating the PV system.

(b) Number of PV modules and the nominal watt rating of each module.

(c) Hourly (or 15-minute interval), daily, monthly, and annual kWh production in numeric and graphic formats for the system.

(d) Running total of daily kWh production.

(e) Daily kW peak power production.

(f) Current kW production of the entire PV system.

7.2.3.5 Additional Requirements

In addition to the requirements above, the PV system must also meet the following requirements in JA11:

Interconnection Requirements: All inverters in the PV system must comply with the CPUC Electric Tariff Rule 21, which governs CPUC-jurisdictional interconnections for all net energy metering (NEM) customers. Rule 21 requires that inverters have certain capabilities to ensure proper operation of the electrical grid as more renewables are interconnected. The inverters must perform functions that can autonomously contribute grid support during excursions from normal operating voltage and frequency system conditions by providing dynamic reactive/real power support, voltage and frequency ride-through, ramp rate controls, communication systems with ability to accept external commands, and other functions.

Certificates and Availability: The PV installer shall certify on the Certificate of Installation that all provisions of JA11 are met and provide a solar assessment report meeting one of the following conditions:

(a) A satellite, drone, or other digital image used in the solar assessment report must be created and dated after the PV system is installed.

(b) If the satellite, drone, or other digital image used in the solar assessment report is dated before the PV is installed, additional on-site pictures must be attached to clearly show that the installed system matches the system modeled in the solar assessment report

The Certificate of Installation shall be available on the building site for inspections.

Enforcement Agency Responsibilities: The local enforcement agency shall verify that the Certificate of Installation is valid complete and correct, and uploaded into a Commission-approved registry.

Example 7-4 Remote Monitoring

Question:

How do I implement monitoring to meet section JA11.5.1 including the current reading?

Answer:

There are multiple options. Many inverters can connect to the homeowner's internet, via ethernet and/or wireless. Others use independent cellular connections. For cellular, the data should be updated to the monitoring portal periodically as allowed by the cellular plan.

7.3 Performance Approach Compliance for Photovoltaic System

7.3.1 Energy Budget Calculation

The computer performance approach allows for the modeling of the PV system performance by considering PV system size, climate, panel orientations, inverter efficiency, and shading characteristics. The standard design PV system size is determined by the modeled annual electrical consumption of the mixed-fuel proposed design building, regardless of the actual fuel type of the proposed design building. The performance method allows for modeling different PV sizes, solar thermal systems, more energy efficiency measures, battery storage system and other demand response measures.

7.3.2 Exceptions to PV requirements

The five allowable exceptions to the prescriptive PV requirements listed in 7.2.2. can also be used under the performance approach. User must select the appropriate exception in the software and provide documentation to the building department with the building permit application.

7.3.3 Additional Requirements

The installed PV system must meet the applicable requirements as specified in JA11.

Example 7-5 Efficiency Tradeoff

Question:

Does the performance path allow tradeoffs between PV systems and energy efficiency measures? How about tradeoffs between a PV system that is coupled with a battery storage system and energy efficiency measures? How about a standalone battery storage system?

Answer:

Beginning with the 2019 Standards, the performance path no longer allows installing a larger PV system in exchange for less energy efficiency measures; however, the software will allow installing more energy efficiency, demand responsive measures, battery and storage and thermal storage systems in exchange for a smaller PV system.

When the PV system is coupled with at least a 5 kWh battery storage system, the performance path will allow a portion of the available credit to be used for efficiency measure tradeoffs; this is a modest credit that can be used to achieve compliance in buildings that have marginal difficulty achieving compliance.

The Standards allow standalone battery storage systems that are not coupled with a PV system; however, they are only allowed for buildings that do not have an onsite PV system due to an exception or being part of a CEC approved community solar program

Example 7-6 Solar Thermal System

Question:

Does a solar thermal water heating system still qualify for compliance credit in the performance path?

Answer:

Yes, although a solar water heating system cannot serve as a substitution for the prescriptively required PV system, it can still be installed along with PV for optional compliance credit in the performance path. Solar water heating systems are modeled along with the remainder of the water heating and distribution systems as part of the efficiency EDR score, and can be used for efficiency measures tradeoff, or installing a

smaller PV system. The requirements for solar thermal water heating systems are described in Chapter 5, Water Heating Requirements.

Example 7-7 Precooling

Question:

Can you explain precooling strategy requirements and how to comply with them?

Answer:

Precooling is a strategy that allows cooling the house by two or three degrees below the setpoint in the hours preceding the onset of peak time-of-use (TOU) hours, when the electricity rates are relatively low, and then turning off the air conditioning during the TOU peak hours, resulting in significant cost savings for the building occupants.

To obtain this credit, a JA5 compliant communicating thermostat must be installed in the dwelling unit and indicated on both CF1R and CF2R forms.

The precooling credit may only be used to lower the EDR score towards a more stringent EDR goal set by a reach code such as a local ordinance; this credit cannot be used to tradeoff the energy efficiency features of the building.

Finally, if the dwelling unit is already equipped with a battery storage system coupled with a PV system, the precooling strategy may have negligible impact on further lowering the EDR score.

7.4 Community Shared Solar Electric Generation and Storage Systems

7.4.1 Photovoltaic System Size

§150.1(c)14

The 2019 Building Energy Efficiency Standards allow the possibility for the Standards requirements for photovoltaics on the site of the residential building to be fully or partially offset by Community Shared Solar Electric Generation. Community Shared Solar Electric Generation means solar electric generation or other renewable technology electric generation that is installed at a different site. Also, the batteries that can be installed in combination with photovoltaics on the building site to gain performance standards compliance credit can be fully or partially offset by Community Shared Battery Storage Systems that are installed at a different site. Community Shared Solar Electric Generation Systems and Community Shared Battery Storage Systems could be installed in combination or separately. Such systems are hereinafter referred to just as Community Shared Solar Generation Systems.

For these offsets to become available, entities who wish to serve as administrators of a proposed Community Shared Solar Electric Generation System must apply to the Energy Commission for approval, demonstrating that several criteria specified in Section 10-115 of the Standards are met, to ensure that the Community Shared Solar Generation System

provides equivalent benefits to the residential building expected to occur if photovoltaics or batteries had been installed on the building site. The Energy Commission will carefully consider these applications to determine if they meet these criteria. If approved, Energy Commission approved compliance software will be modified to enable users to take compliance credit for buildings served by that Energy Commission approved Community Shared Solar Electric Generation System.

Any entity may apply to serve as administrator of a proposed Community Shared Solar Electric Generation System, including but not limited to utilities, builders, solar companies, or local governments. The entity will be responsible for ensuring that the criteria for approval are met throughout (at least) a twenty-year period for each building that uses shares of the Community Shared Solar Electric Generation System for partial or full offset of the onsite solar electric generation and batteries, which would otherwise be required for the building to comply with the Standards. Throughout that period the administrator will be accountable to builders, building owners, enforcement agencies, the Energy Commission, and other parties who relied on these systems for offset of full or partial compliance with the Standards. Records demonstrating compliance with the criteria must be maintained over that period, with access to those records provided to any entity approved by the Energy Commission.

Entities interested in applying to serve as administrator of a proposed Community Shared Solar Electric Generation System should become thoroughly familiar with the criteria for approval specified in Section 10-115 and contact the Energy Commission Building Standards Office for further discussion and explanation of the criteria as necessary.

In general, the Community Shared Solar Electric Generation System must meet the following:

7.4.2 Enforcement Agency

The Community Shared Solar Electric Generation System must exist and be available for enforcement agency review early in the permitting process, and shall not cause delay in the enforcement agency review and approval of the building that will be served by the Community Shared Solar Generation System. All documentation required to demonstrate compliance for the building and the compliance offset from the Community Shared Solar Electric Generation System shall be completed and submitted to the enforcement agency with the permit application. The enforcement agency must be provided facilitated access to the Community Shared Solar Generation System to verify the validity and accuracy of compliance documentation.

7.4.3 Energy Performance and Minimum Community Shared PV and Battery Storage Size

Energy Commission approved compliance software must be used to show that the energy performance of the building's share of the Community Shared Solar Electric Generation System is equal to or greater than the partial or full offset claimed for the solar electric generation and batteries, which would otherwise be required for the building to comply with the Standards.

The minimum community shared solar size dedicated to the building and the annual kWh equivalence may be measured in one of two ways: (1) Using the CBECC-Res Simplified approach for PVs and the CFI orientation option, or (2) by modeling the actual attributes of the system using the detailed approach. When the detailed approach is used, the compliance software will determine a minimum kW size that will represent the portion of the community solar resource dedicated to the building, based on PV system component performance characteristics, azimuth (orientation and tilt), inverter type, tracking versus fixed systems, climate zone and CEC weather files containing solar availability data.

7.4.4 Participating Building Energy Savings and Bill Reduction Benefits

A specific share of the Community Shared Solar Generation System, determined to comply with the Energy Performance requirement above, must be dedicated on an ongoing basis to the building. The energy savings benefits dedicated to the building shall be provided in one of the following ways:

1. Actual reductions in the energy consumption of the building
2. Utility energy reduction credits that will result in virtual reductions in the building's energy consumption, including but not limited to generation credit, solar charge, program charge, and power charge indifference adjustment (PCIA) charge
3. Payments to the building that will have an equivalent effect as energy bill reductions that would result from one of the other two options above

For all three options mentioned above, the reduction in energy bills resulting from the share of the Community Shared Solar Generation System dedicated to the building shall be greater than the cost that is charged to the building to obtain that share of the Community Shared Solar Generation System.

7.4.5 Durability, Participation, and Building Opt-Out

1. Durability. The benefits from the specific share of the Community Shared Solar Generation System must be provided to each dedicated building for a period not less than 20 years.
2. Participation. Buildings using community shared solar and/or battery storage systems to comply with Sections 140.0(c), 150.1(a)3, or 170.0(a)3, must participate for at least 20 years, regardless of who owns or occupies the building, unless the building owner fulfills the Opt-Out Requirements. The Energy Commission approved Administrator(s) shall require either of the following from the building owner as demonstration of participation compliance:
    a. Equitable Servitude. A recorded covenant, or other legally binding method that runs with the land shall obligate the owner/tenant to maintain the building's participation in the community shared solar and/or community shared battery storage system for the Participation Period or satisfy the Opt-Out Requirements.

b. Other system. Confirmation from another Energy Commission approved program or system used by the Administrator to ensure a participation period of at least 20 years, per Section 10-115(a)4B.

3. Compliance Documentation. The Administrator shall maintain record(s) of the compliance documentation that determined the requirements for the on-site solar electric generation system and/or battery storage system to comply with the standards in effect at the time the builder applied for the original building permit, and which establishes participants' obligations to meet the Opt-Out Requirements. The Administrator shall provide a copy of this compliance documentation upon a participating building owner's request to every new owner of a participating building when the Administrator is notified that the title has transferred, and to any participating building owner who requests to opt-out.
4. Building Opt-Out. During the Participation period, the participating building owner has the option to Opt-Out if the Opt-Out Requirements are met.
    a. Prior to Opt-Out, the building owner shall demonstrate that they have installed an on-site solar electric generation system and met the Opt-Out Requirements by providing documentation from the installer of the on-site solar system or an attestation of the building owner with supporting documentation. The building owner is responsible for all costs associated with documentation for Opt-Out requirements.
    b. The Administrator shall review Opt-Out documentation and determine if the installed solar system meets the Opt-Out requirements. Within 30 days the Administrator shall provide written confirmation whether the building meets the Opt-Out requirements.
    c. All costs and benefits associated with participation in the program shall cease and all outstanding balance shall be paid to that party.
    d. The Administrator (or other entity) shall not impose any penalty related to a participating building's Opt-Out, or charge participants for recuperation of unrealized revenue that would have been expected to accrue beyond the end of participation. If the Administrator plans to change any other fees at the time of building Opt-Out, the Application for commission Approval shall explain the purpose of those fees.

7.4.6 Additionality

The specific share of the Community Shared Solar Generation System must provide the benefits to the participating building that are in no way made available or attributed to any other building or purpose. Renewable Energy Credits that are unbundled from the Community Shared Solar Electric Generation System do not meet this additionality requirement.

1. The participating building(s) shall be served primarily by renewable resources developed specifically for the community solar electric generation system.

2. Other renewable resources meeting the requirements of Section 10-115(a)4 may be used for each participating building if the building(s) is permitted before the renewable resources developed for the program start operating, or after they cease operating.
3. For each renewable resource developed to serve participating buildings, bundled Renewable Energy Credits (RECs), which satisfy the criteria of Portfolio Content Category 1, shall be retired and tracked in the Western Renewable Energy Generation Information System (WREGIS) on behalf of program participants to ensure they will not be allocated to or used for any other mandatory or voluntary renewable electricity program requirement or claim.
4. Excess generation from renewable resources may be used to serve other loads but must be isolated from the generation serving participating buildings. This is not considered a violation of Section 10-115(a)5C, the Additionality requirement above.

Example 7-8

Question:

To help entities that might want to apply to the Energy Commission for approval of a Community Shared Solar Energy Generation System, please provide examples of each of the three optional ways energy savings benefits could be provided to comply with Section 7.4.4.

Answer:

Examples would include:

Actual reductions in the energy consumption of the building: This could be accomplished by locating the PV systems for several houses on a carport on common land in a subdivision, and direct wiring the unique PV panels serving each house to an inverter that is located on the home's site. For homes served by utilities that are subject to compliance with Net Energy Metering requirements, the common land that is hosting the PVs on the carport would have to be adjacent to (could be directly across a street) the houses that are being served by the PV system. All other requirements of Section 10-115 would have to be met.

Utility energy reduction credits that will result in virtual reductions in the building's energy consumption that is subject to energy bill payments: This could be accomplished for qualifying multi-family dwellings by participation in an approved virtual net metering program, which has PVs installed on the multi-family project site, and energy bill credits that reduce each dwelling unit's monthly electricity bill consistent with Net Energy Metering requirements. Alternatively, this could be accomplished through a community shared solar program administered by a utility (like the Green Tariff Shared Renewables, or GTSR), for which a remote renewable resource is paid for through shares purchased for each home. In exchange, energy bill credits that reduce monthly electricity bills are allocated based on the homes' shares, including but not limited to generation credit, solar

charges, program charges, and nonparticipant charges. All other requirements of Section 10-115 would have to be met.

Payments to the building that will have an equivalent effect as energy bill reductions that would result from one of the two options above: This could be accomplished by builders installing PV systems on other properties they own to offset the compliance requirement for onsite PVs on homes they build. The homes would pay for a share of the PV systems on the other properties. The builders would be obligated to make an ongoing cash payment back to the homes for the home's share of the electricity generation achieved by the PV systems on the other properties. The share of the ownership of the PV systems on the other properties and the corresponding sharing of the electricity generation achieved by the PV systems on the other properties would not be accounted for through a utility system – the ownership share would not be paid to the utility and the payment for the share of the electricity generation achieved by the PV systems on the other properties would not be provided through a utility bill. The entire program would be administered by the builder for a 20-year period for each home. All other requirements of Section 10-115 would have to be met.

Example 7-9

Question

Could you also explain what the cost requirements are in the last sentence of Section 7.4.4.

Answer

Regardless of the three options chosen above, it must be cost effective for the home to participate in a community shared solar electric generation system program. The participating home will pay for its share of the community renewable resource and will receive either energy bill reductions, credits, or cash payments for the electricity that is generated by the community renewable resource. The value of the reductions, credits, or cash payments to the participating home must exceed its share value of the community renewable resource.

Let's take a hypothetical example of a Green Tariff Shared Renewables Program (GTSR) that is required by statute to be operated by investor-owned utilities. The following table shows the costs that the program charges a home to obtain shares of the program's

community solar resources, and the energy bill credit. The charges and credit are allocated per kWh generated by the home's share of the community renewable resource.

Example Green Tariff Shared Renewables Program Details	
Solar Charge	6.48 cents per kWh
Program Charge	2.956 cents per kWh
Power Charge Indifference Adjustment (PCIA) Charge	3.346 cents per kWh
Total Program Charges	12.782 cents per kWh
Generation Credit	-10.78 cents per kWh

The total cost that the home pays per kWh for its share of the community renewable resource is 12.8 cents per kWh and the energy bill credits for generation from the home's share of the community renewable resource is 10.8 cents per kWh. Since the value of the home's energy bill credit does not exceed the cost for the home to participate in the community solar program, the cost requirement of Section 7.4.4 is not met. Cost requirements can be brought into compliance through a combination of an increase in the generation credit and reductions in solar charge, program charge, and power charge indifference adjustment (PCIA) charge. In this example, if the generation credit raises by one cent, up to 11.8 cents, and total charges decrease by 1.1 cents, down to 11.7 cents, then the program meets the cost requirements.

7.5 Battery Storage System

The primary function of the battery storage system is to grid harmonize the onsite PV system with the grid, to bring maximum benefits to the grid, environment, and the occupants.

Grid Harmonization: For the purpose of Building Standards, grid harmonization is defined as strategies and measures that harmonize customer owned distributed energy resources assets with the grid to maximize self-utilization of PV array output, and limit grid exports to periods beneficial to the grid and the ratepayer. This is done by charging the battery from the PV system when there is limited electrical load at the building and the cost of electricity is low in midday, and discharging when the cost of electricity is high, usually in the late afternoon and early evening hours.

Battery storage system is available as a compliance credit in the performance compliance method, either coupled with an on-site PV system or as a standalone system if the building does not have on-site PV due to an exception or being part of a CEC approved community solar program. Battery storage is also a criterion of Exception 5 of the prescriptive PV requirements in section 150.1(c). In all cases, the battery storage system must meet all applicable requirements in Joint Appendix JA12 and be self-certified to CEC by the manufacturer as a qualified product.

A PV size can be specified with the performance approach based on a user-defined target energy design rating (EDR) and a coupled battery storage system with an appropriate battery control strategy. This is a cost-effective strategy for meeting lower target EDRs,

that may be required by reach codes, with a smaller, grid harmonized PV system. Various battery control strategies are described in Section 7.5.3 below.

The list of qualified JA12 products can be found here:

https://solarequipment.energy.ca.gov/Home/Index

7.5.1 Minimum System Performance Requirements

JA12 specifies that the battery storage system must meet or exceed the following specifications for both the prescriptive and performance approaches:

1. Usable capacity of at least 5 kWh
2. Energy capacity retention of 70 percent of nameplate capacity after 4,000 cycles covered by a warranty, or 70 percent of nameplate capacity under a 10-year warranty

In addition, if using the prescriptive approach, the single AC-to-AC charge-discharge cycle (round-trip) efficiency of the battery storage system must be at least 80 percent.

7.5.2 Controls Requirements for Prescriptive and Performance Compliance Paths

Battery storage systems that remain in backup mode indefinitely bring no grid benefits. The JA12 requirements are designed to ensure that the battery storage system remains in an active control mode and prevent the battery storage system from remaining in the backup mode indefinitely. These requirements also enable the battery storage system to receive the latest firmware, software, control strategy, and other important updates.

The following requirements apply to all control strategies, including Basic Control, Time-of-Use (TOU) Control, and Advanced Demand Flexibility Control, described in Section 7.5.3 below:

1. The battery storage system shall have the capability of being remotely programmed to change the charge and discharge periods.
2. During discharge, the battery storage system shall be programmed to first meet the electrical load of the dwelling unit(s). If during the discharge period the electrical load of the dwelling unit(s) is less than the maximum discharge rate, the battery storage system shall have the capability to discharge electricity into the grid upon receipt of a demand flexibility signal from the local utility or a third-party aggregator.
3. The battery storage system shall operate in one of the control strategies listed in Section 7.5.3 except during a power interruption, when it may switch to backup mode. If the battery system switches to backup power mode during a power interruption, upon restoration of power the battery system shall immediately revert to the previously programmed JA12 control strategy. The device must have the feature that would enable export to be built in at the time of installation. It can be in the off mode and be turned on later with a remote signal.

4. The battery storage system shall perform a system check on the following dates, to ensure the battery is operating in one of the control strategies listed section 7.5.3 below:

    a. Within 10 calendar days before the onset of summer TOU schedule, and

    b. Within 10 calendar days before the onset of winter TOU schedule

    If the local utility does not offer TOU rate schedule, the default system check dates should be 1 May and 1 November. At the time of inspection, the battery storage system shall be installed to meet one of the following control strategies. The battery storage system also shall have the capability to remotely switch to the other control strategies.

7.5.3 Controls Strategies

JA12 includes four control strategies that are designed to encourage charging the batteries when electricity prices are low, generally in the middle of the day when solar resources are plentiful and demand is low, and discharge the batteries later in the day when demand is high and solar resources are diminished:

Basic Control: Designed as a simple control that can be employed as the default control in the absence of TOU or Advanced Demand Flexibility Controls, or where communication between batteries and outside parties are not possible. When combined with an on-site solar PV system, to qualify for the Basic Control, the battery storage system shall be installed in the default operation mode to allow charging only from an on-site PV system when the PV system production is greater than the on-site electrical load. The battery storage system shall discharge only when the PV system production is less than the on-site electrical load.

Time-of-Use (TOU) Control: Designed to take advantage of TOU rates where they are available. This control strategy generally results in a greater Energy Design Rating (EDR) impact than the Basic Control. When combined with an on-site PV system, to qualify for the TOU Control, the battery storage system shall be installed in the default operation mode to allow charging only from an on-site PV system. The battery storage system shall discharge during the highest priced TOU hours of the day. The operation schedule shall be preprogrammed from factory, updated remotely, or programmed during the installation/commissioning of the system. At a minimum, the system shall be capable of programming three separate seasonal TOU schedules, such as spring, summer, and winter.

Advanced Demand Flexibility Control: Designed to bring the maximum value to the PV system generations by placing the charge/discharge functions of the battery storage system under the control of a utility or a third-party aggregator. This control strategy allows discharging into the gird upon receiving a demand response signal from a grid operator. This option requires robust communication capabilities between the battery storage system and the local utility or the third-party aggregator. When combined with an on-site solar PV system, to qualify for the Advanced Demand Flexibility Control, the battery storage system shall be programmed by default as Basic Control or TOU control

as described above. The battery storage control shall meet the demand flexibility control requirements specified in Section 110.12(a). Additionally, the battery storage system shall have the capability to change the charging and discharging periods in response to signals from the local utility or a third-party aggregator

Controls for Separate Battery Storage Systems: When installed separate from (not in combination with) an on-site solar photovoltaic system, including when the building is served by a community solar PV system, to qualify for the compliance credit, the battery storage system shall be programmed by default to:

1. Start Charging from the grid at the onset of lowest priced TOU hours of the day and start discharging at the onset of highest priced TOU hours of the day, or
2. Meet all the demand flexibility control requirements specified in Section 110.12(a) and shall have the capability to change the charging and discharging periods in response to signals from the local utility or a third-party aggregator.

Alternative Control Approved by the Executive Director: The Commission recognizes that there may be other control strategies that bring equal or greater benefits than the ones listed above, therefore, the Executive Director may approve alternative control strategies that demonstrate equal or greater benefits to those strategies listed in JA12. To qualify for Alternative Control, the battery storage system shall be operated in a manner that increases self-utilization of the PV array output, responds to utility rates, responds to demand response signals, minimizes greenhouse gas emissions from buildings, and/or implements other strategies that achieve equal or greater benefits than those specified in JA12.2.3. This alternative control option shall be accompanied with clear and easy to implement algorithms for incorporation into the compliance software for compliance credit calculations.

Other Requirements

In addition to the requirements above, the battery storage system must also meet the following requirements in JA12:

Safety Requirements: The battery storage system shall be tested in accordance with the applicable requirements given in UL 1973 and UL 9540. Inverters used with battery storage systems shall be tested in accordance with the applicable requirements in UL 1741 and UL 1741 Supplement A.

Interconnection and Net Energy Metering Requirements: The battery storage system and the associated components, including inverters, shall comply with all applicable requirements specified in Rule 21 and Net Energy Metering (NEM) rules as adopted by the California Public Utilities Commission (CPUC).

Enforcement Agency: The local enforcement agency shall verify that all Certificate of Installations are valid. The battery storage systems shall be verified as a model certified to the Energy Commission as qualified for credit as a battery storage system. In addition, the enforcement agency shall verify that the battery storage system is programmed and operational with one of the controls listed in Section 7.5.3 above. The programmed

control strategy at system final inspection and commissioning shall be the strategy that was used in the Certificate of Compliance.

Example 7-10 Battery Storage Credit

Question:

Can you explain the battery storage credit requirements and how to comply with them?

Answer:

The performance path allows a compliance credit for: a battery storage system with a capacity of at least 5 kWh, programmed for basic, time-of-use, or advanced demand flexibility control, and is coupled with a PV system; a standalone battery storage system separate from an on-site PV system with control requirements meeting JA12.2.3.4. The PV/storage credit may be used to lower the total EDR score towards a more stringent EDR goal set by a reach code such as a local ordinance. However, the software will only allow a portion of the available credit to be used for efficiency measures tradeoff. This is a modest credit that can be used to achieve compliance in buildings that are marginally out of compliance.

The manufacturers must self-certify to the Commission that the battery storage systems meet the requirements of JA12. These include minimum performance requirements, communication requirements, control requirements, safety requirements, and interconnection requirements, among others, that must be complied with and certified to the Commission. The self-certification form may be downloaded from the Commission's website:

Example 7-11 Battery Storage Credit

Question:

When batteries are used there is a loss of energy associated with round trip charging and discharging, resulting in fewer generated kWh. Why does the Commission provide a compliance credit for a battery storage system that is coupled with a PV system if there is a loss of energy?

Answer:

Battery storage systems store the PV generated power in the middle of the day when the solar resources are generally plentiful and electricity prices are low. The systems discharge the stored power later in the day, during the peak hours when solar resources are diminished, and electricity prices are high. Battery storage systems have a charge-discharge (round trip efficiency) loss of 5 to 15 percent, depending on the type of battery and the inverter efficiencies. A compliance credit is available because the electricity price differential between the mid-day rate and the peak-hours rate is greater than the battery charge-discharge losses. This means that even with the relatively small loss of energy, it

is still cost effective for a consumer to store power generated on-site around mid-day and use it later on, instead of purchasing additional electricity from the grid.

To calculate the compliance credit of a battery storage system coupled with a PV system, the Energy Commission's compliance software, on an hourly basis, accounts for the PV generation, losses, storage capacity remaining, charge and discharge rates, cost of electricity, house loads, and hourly exports. Similar calculations are also performed to calculate the benefits of storage for CO2 emissions.

Only battery storage systems complying with JA12 requirements are eligible for compliance credit. The requirements ensure the battery storage system remains in a dynamic mode allowing residents to take advantage of variable electricity costs associated with charge and discharge periods throughout the day. Static batteries that remain mostly in backup mode have little to no value to the homeowner, the grid, or the environment.

Example 7-12 Battery Storage TOU schedule

Question:

How will control requirement be enforced for customers that are not on a TOU schedule? How about customers on TOU rate but want to be in Basic Control?

Answer:

If the local utility does not have a TOU schedule, to comply with JA12.2.3, the battery storage system should perform a system check on 1 May and 1 November by default. A customer can set the control strategy to Basic Control, regardless of whether a TOU rate is available for the customer. However, this strategy will reduce the benefits of the battery storage for both the customer and the grid, and therefore is not recommended.

7.6 Solar Ready Overview

The solar-ready provisions are mandatory for single-family residential buildings that do not have a solar PV system, most commonly due to an exception to the prescriptive PV requirements in Section 150.1(c)14. There are also exceptions to the "solar zone" requirements. These are described in the corresponding sections of this chapter. These exceptions remove the need to reserve a portion of the roof area as a solar zone. However, the requirements relating to the main electrical service panel, reserved areas for inverters, metering equipment, and interconnection pathways to the electrical service will still apply. For this reason, CF2R-SRA-01-E compliance forms must be submitted with the building permit application, even when using an allowable solar zone exception.

Please note: In §110.10 of the *Energy Standards*, the solar zone, interconnection pathways, and design load requirements for low-rise multifamily buildings are located with the high-rise multifamily requirements in §110.10(b)1B. Refer to the multi-family buildings chapter in the "Nonresidential Compliance Manual" for more information.

7.6.1 Covered Occupancies

§110.10(a)

The solar-ready requirements apply to newly constructed single-family homes without a PV system located in a subdivision with 10 or more residences and where the tentative subdivision map application is complete and approved by the enforcement agency.

Note, even if homes within a subdivision of 10 or more residences use an approved community solar option for compliance, they must still meet the solar-ready requirements of Section 110.10, unless they qualify for an exception.

7.6.2 Solar Zone

§110.10(b)

The solar zone is a suitable place where solar panels can be installed at a future date - if the owner chooses to do so. A solar zone area is designed with no penetrations, obstructions, or significant shade. The solar zone must comply with the access, pathway, smoke ventilation, and spacing requirements in Title 24 Part 9. Requirements from the other parts of Title 24, and those adopted by a local jurisdiction, should also be incorporated in the solar zone design.

7.6.2.1 Solar Zone Minimum Area

§110.10(b)1

The total area of the solar zone may be composed of multiple subareas - if they meet minimum size specifications. No dimension of a subarea can be less than five feet. If the total roof area is equal to or less than 10,000 square feet, each subarea must be at least 80 square feet. If the total roof area is greater than 10,000 square feet, each subarea must be at least 160 square feet.

7.6.2.2 Solar Zone Area for Single-Family Residential Buildings

The solar zone must be located on the roof or overhang of the building. The "designated" solar zone's total area must be no less than 250 square feet (§110.10(b)1A). See Figure 7-6 for some acceptable solar zone placement techniques.

There are six allowable exceptions to the required solar zone area. Exceptions 1 and 6 allow alternate efficiency measures instead of an actual solar zone, so the requirements for zone shading, azimuth, design load, interconnection pathways, owner documentation, and electric service panel do not apply.

Submit a CF2R-SRA-01-E to the building department for all projects that do not include a solar PV system, even when using an exception to solar zone requirements. In addition, submit a CF2R-SRA-02-E solar zone worksheet for all projects with a solar zone, including exceptions that allow a reduced solar zone area.

7.6.2.3 Solar Zone Exceptions for Single-family Buildings:

Exception 1 may apply when a domestic solar water-heating (SWH) system is permanently installed at the time of construction. The SWH system must comply with the installation criteria in the Reference Residential Appendix RA4 and have a minimum solar savings fraction of 0.50. Note: These buildings are also exempt from the interconnection pathway, documentation, and electrical panel requirements because there is no solar zone.

Exception 2 may apply if the single-family home has three or more habitable stories and a total floor area ≤ 2,000 square feet. The designated solar zone may be reduced. The area must be ≥ 150 square feet.

Exception 3 may apply if the single-family home is in the Wildland-Urban Interface Fire Area (as defined in Title 24, Part 2). The solar zone area may be reduced to ≥ 150 square feet. In addition, a whole-house fan must be permanently installed at the time of construction. This exception is intended to accommodate attic- and roof-venting requirements in these fire areas.

Exception 4 reduces the solar zone area when the roof is shaded by objects that are not part of the building project, and therefore beyond the designer's control. The designated solar zone may be reduced to ≥ 50 percent of the potential solar zone area when solar access is limited as described below. When the "potential" solar zone is smaller than the 250 square feet minimum, the solar zone can be reduced to half the area of the potential solar zone. The reduced-size solar zone is called the "designated" solar zone.

Figure 7-2: Calculating Designated Solar Zone

Exceptions for Reduced Solar Zone Due to Shade

Step 1: Determine the Annual Solar Access: For the solar ready requirements, solar access is the ratio of solar insolation including shading to the solar insolation without shading. Annual solar access is most easily determined using specialized software.

$$\textbf{Solar Access} = \frac{\textbf{Solar Insolation Including Shading}}{\textbf{Solar Insolation Without Shading}}$$

Solar access does not consider shading from objects that are included in the building project because these are considered part of the building and the designer has control of these potential obstructions. These include the building itself, HVAC equipment, outdoor lights, landscape features and other similar objects. Objects that are not part of the building project cannot be moved or modified as part of the project and include existing buildings, telephone poles, communication towers, trees, or other objects.

Evaluate whether there are any objects outside the building project that will shade the rooftop (or other prospective solar zone areas such as overhangs or parking shade structures). If an existing object is located north of all potential solar zones, the object will not shade the solar zone.

Step 2: Determine the Potential Solar Zone Area: On low-sloped roofs, the potential solar zone is the area where annual solar access is ≥ 70 percent.

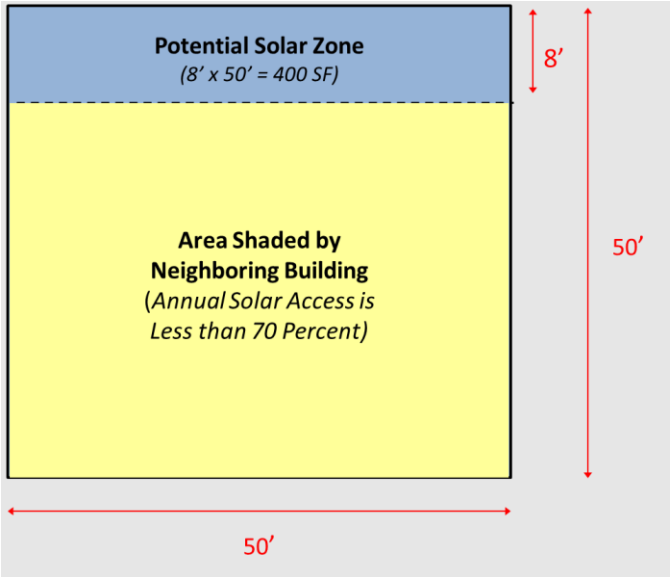
On steep-sloped roofs the potential solar zone is the area where the annual solar access is ≥ 70 percent on the portion oriented between 90 and 300 degrees of true north.

Step 3: Determine the size of the designated solar zone. The designated solar zone must be ≥ 50 percent of the potential solar zone area. If the roof is shaded such that there is no potential solar zone area, then no solar zone is required. See Figure 7.1. Document the method/tools used to demonstrate that the solar access is less than 70 percent in the compliance form CF1R-SRA-02-E (Minimum Solar Zone Area Worksheet).

Example 7-13

Question:

A house has a total roof area of 2,500 SF. The neighbor's house and trees shade the roof, so 2,100 SF of the roof has less than 70 percent annual solar access. How big does the solar zone have to be?



Answer:

If the entire roof were to have an annual solar access of 70 percent or greater, the minimum solar zone would have been 250 SF. Since the potential solar zone is only 2,500 – 2,100 = 400 SF, however, the minimum solar zone can be reduced to 50 percent of the potential solar zone, or 200 SF.

Exception 5 allows a reduced solar zone of ≥ 150 square feet if all thermostats have demand responsive controls. See Appendix H of this compliance manual for guidance on compliance with the demand responsive control requirements.

Exception 6 allows no solar zone when the following energy efficiency features are met:

1. All thermostats have demand responsive controls that comply with Section 110.12(a) and Joint Appendix JA5 (please see Exception 5, above, for more details), AND
2. Compliance with one of the following:
    a. Install a:
        i. a dishwasher that meets or exceeds the ENERGY STAR® program requirements WITH a refrigerator that meets or exceeds the ENERGY STAR program requirements; or
        ii. a whole-house fan driven by an electronically commutated motor; or
        iii. an SAE J1772 Level 2 Electric Vehicle Supply Equipment (EVSE or EV Charger) with a minimum of 40 amperes. SAE J1772 is the SAE

International document titled "SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler" (SAE J1772_201710)

b. Install a home automation system that is capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or

c. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation system in compliance with the *California Plumbing Code*; or

d. Install a rainwater catchment system designed to comply with the *California Plumbing Code* and uses rainwater flowing from at least 65% of the available roof area.

Example 7-14 Solar Ready Zone

Question:

What are the examples of how the solar-ready zone requirements can be avoided using Exception 6?

Answer:

Exception 6 provides three options for avoiding the solar-ready zone requirements altogether:

1. Install only demand responsive capable (DRC) thermostats with ENERGY STAR® dishwasher and refrigerator, or

2. Install only DRC thermostat(s) and a whole-house fan driven by an electronically commutated motor, or

3. Install only DRC thermostat(s) and a level 2 EV charger with a minimum of 40 amperes.

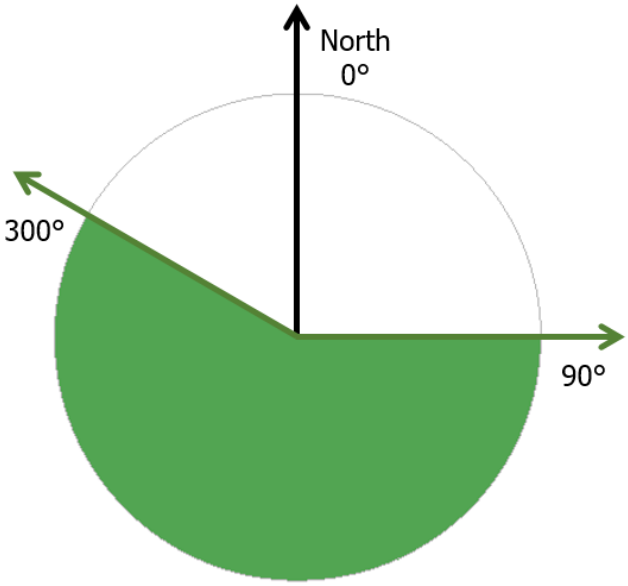
Any of these three options can be used to avoid the solar ready zone requirements.

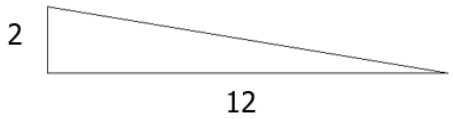
7.6.3 Azimuth (Solar Zone)

§110.10(b)2

All sections of the solar zone on steep-sloped roofs (rise-to-run ratio greater than 2:12, or 10 degrees) must be oriented between 90 degrees and 300 degrees of true north. The orientation ensures a reasonable solar exposure if a solar energy system is installed in the future. On a low-sloped roof (rise-to-run ratio equal to or less than 2:12, or 10 degrees), the azimuth requirement does not apply.

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 greater than 2:12 (see above), then the roof must face between 90° and 300°

7.6.4 Shading (Solar Zone)

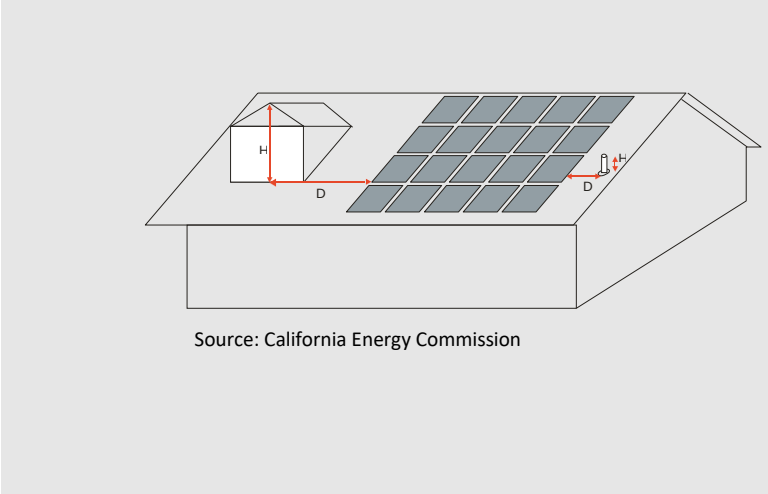
§110.10(b)3

The solar zone must be free from roof penetrations and shall not have any obstructions such as vents, chimneys, architectural features, or roof-mounted equipment located in the solar zone. This requirement ensures that the solar zone remains clear and open for the future installation of a solar energy system.

Any obstruction located on the roof or any other part of the building that projects above the solar zone must be located at a sufficient horizontal distance away from the solar zone in order to reduce the resulting shading of the solar zone. For each obstruction, the horizontal distance ("D") from the obstruction to the solar zone shall be at least two times the height difference ("H") between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone.

Shading Equation: $D \geq 2 \times H$

Figure 7-5: Schematic of Allowable Setback of Rooftop Obstructions



Source: California Energy Commission

Any obstruction that is not located on the roof or another part of the building, such as landscaping or neighboring building, or is oriented north of all points of the solar zone is not subject to the shading requirement.

7.6.5 Structural Design Loads (Solar Zone)

The structural design loads for roof dead load and roof live load must be clearly indicated on the construction documents for the designated solar zone areas. The structural load information will be easily available if the building owner considers a solar energy system installation in the future. It is not necessary to estimate the collateral loads for future solar energy systems.

7.6.6 Interconnection Pathways

§110.10(c)

All buildings that comply by designating a solar zone must also include a plan for connecting a future PV and SWH system to the building's electrical or plumbing system. The construction documents must indicate:

1. A reserved location for inverters and metering equipment for solar electric systems.
2. A reserved conduit route from the solar zone to the point of interconnection with the electrical service. There is no requirement to install any conduit.
3. For homes with a central water heating system, a reserved plumbing pathway from the solar zone to the water-heating system connection. There is no requirement to install any plumbing.

7.6.7 Documentation

§110.10(d)

A copy of the construction documents or a document containing the required solar-ready information must be provided to the occupant. The building occupant must also receive a

copy of the associated installation forms CF2R-SRA-01-E and CF2R-SRA-02-E. Providing this information to the building occupant is required so the information is available if the owner decides to install a solar energy system in the future. Construction documents must include information about the as-designed structural loads, solar zone location, and the reserved interconnection pathways.

7.6.8 Main Electrical Service Panel

§110.10(e)

The main electrical service panel must have a minimum busbar rating of 200 amps. The panel must also include space for a future install of a double-pole circuit breaker, if one is not installed during construction, and must be permanently marked "For future solar electric". These items are required to simplify the possible future installation of a solar electric system.

7.7 California Fire Code Solar Access Requirements

Under regulations established by the Office of the State Fire Marshal, the 2022 version of Parts 2, 2.5, and 9 of Title 24 include requirements for the installation of rooftop solar photovoltaic systems. These regulations cover the marking, location of DC conductors, and access and pathways for photovoltaic systems. They apply to residential and nonresidential buildings regulated by Title 24 of the California Building Standards Codes. Provided below is a brief summary of the fire code requirements for residential buildings.

PV arrays shall not have dimensions in either axis greater than 150 feet. Residential buildings with hip, ridge/valley roof features shall provide a 3-foot access pathway away from applicable eave to hip/ridge/valley features. To provide adequate smoke ventilation, PV arrays shall not be located higher than 3 feet below the ridge. Builders shall refer directly to the relevant sections of Title 24 (most currently Part 2.5 Section R324.3, and Part 2.5 Section 324.6) for detailed requirements.

In addition to the requirements in the fire code, the California Department of Forestry and Fire Protection – Office of the State Fire Marshal (CAL FIRE-OSFM), local fire departments (FD), and the solar photovoltaic industry previously developed a *Solar Photovoltaic Installation Guideline* to increase public safety for all structures equipped with solar photovoltaic systems. The intent of this guideline is to provide the solar PV industry with information that will aid in the designing, building, and installation of solar PV systems in a manner that should meet the objectives of both the PV industry and the requirements set forth in the California Fire Code.

The entire Solar Photovoltaic Installation Guideline can be accessed at http://opr.ca.gov/docs/20190226-Solar_Permitting_Guidebook_4th_Edition.pdf

7.8 Battery Ready Overview

All single-family homes with one or two dwelling units must be Energy Storage System (ESS) ready to facilitate the future installation of a battery system. The following requirements must be met. There are no exceptions.

1. At least one of the following shall be provided:
    a. ESS ready interconnection equipment with a minimum backed up capacity of 60 amps and a minimum of four ESS supplied branch circuits. or
    b. A dedicated 1" minimum raceway from the main service to a subpanel that supplies the branch circuits described in #2 below. The subpanel must be labeled "Subpanel shall include all backed-up load circuits." All branch circuits are permitted to be supplied by the main service panel prior to the installation of an ESS.
2. A minimum of four branch circuits shall be identified and have their source of supply collocated at the subpanel referenced in #1b above to be supplied by the ESS. At least one circuit must supply the refrigerator, one lighting circuit near the primary egress, and at least one circuit shall supply a sleeping room receptacle outlet. There is no requirement for what is supplied by the fourth circuit.
3. The main panelboard shall have a minimum busbar rating of 225 amps.
4. Sufficient space shall be reserved to allow future installation of a system isolation equipment/transfer switch within 3 feet of the main panelboard. Raceways shall be installed between the panelboard and the system isolation equipment transfer switch location to allow the connection of backup power source.

7.9 Compliance and Enforcement

When a building permit application is submitted to the enforcement agency, the applicant also submits plans and energy compliance documentation. This section describes the forms and procedures for documenting compliance with the solar ready requirements of the Energy Standards. The following discussion is addressed to the designer preparing construction and compliance documents, and to the enforcement agency plan checkers who are examining those documents for compliance with the standards.

There are three forms associated with the low-rise residential solar-ready requirements. Each form is briefly described below.

CF2R-SRA-01-E: Certificate of Installation: Solar Ready Areas

This form is required for newly constructed single-family residential and low-rise multifamily projects that do not include solar PV systems. This form documents what was installed to comply with the solar-ready requirements, including any equipment installed to qualify for one of the solar zone exceptions.

CF2R-SRA-02-E: Certificate of Installation: Minimum Solar Zone Area Worksheet

This form is required when buildings comply with the solar-ready requirement by including a solar zone. That is, an appropriately sized solar PV system is not installed, an appropriately sized solar water heating system is not installed, the building does not comply with all the DRC requirements, or the roof is not designed for vehicle traffic or a heliport.

CF2R-STH-01-E: Certificate of Installation: Solar Water Heating System

Single-Family Residential Only: This form is required when a compliant solar water-heating system has been installed on the home to meet solar zone Exception 1.