

ORDINANCE 572-AC

**AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEEDLES
AMENDING THE NEEDLES MUNICIPAL CODE (NMC)
SECTION 96.00 "USES PERMITTED", 96.01 "TABLE OF PERMISSIBLE
USES, ADDING SECTION 99.09.04 "RENEWABLE ENERGY
FACILITIES (REF)**

WHEREAS, Assembly Bill 2188 (Chapter 521, Statutes 2014) requires California cities to adopt an ordinance creating a streamlined permitting process for small residential rooftop solar energy systems; and

WHEREAS, the City of Needles wishes to advance the use of solar energy by all of its citizens, businesses and industries; and

WHEREAS, the City of Needles recognizes that rooftop solar energy provides reliable energy and pricing for its residents; large scale solar projects create local jobs and economic opportunity; and

WHEREAS, a public hearing notice for the Needles Planning Commission meeting was published in the Needles Desert Star on September 16, 2015; and

WHEREAS, on October 7, 2015, the Needles Planning Commission held a duly noticed and advertised public hearing to receive oral and written testimony relative to the amendment of the Needles Municipal Code (NMC), and following the conclusion adopted its Resolution No. 10-07-2015-1 PC, recommending that the City Council of the City of Needles make such amendment to the Needles Municipal Code (NMC); and

WHEREAS, a public hearing notice for the Needles City Council meeting was published in the Needles Desert Star on September 9, 2015; 10 days prior to said meeting; and

WHEREAS, on October 27, 2015, the Needles City Council held a duly noticed and advertised public hearing to receive oral and written testimony relative to the amendment to the Needles Municipal Code (NMC); and

WHEREAS, the Needles City Council has sufficiently considered all testimony and any documentary evidence presented to them in order to make the following determination:

SECTION 1. The City Council HEREBY FINDS AND DETERMINES that this activity is not subject to the California Environmental Quality Act ("CEQA") pursuant to CEQA Section §§ 15060 (c)(2), the activity will not result in a direct or reasonable foreseeable indirect physical change in the environment

SECTION 2. The City Council HEREBY FINDS AND DETERMINES that facts do exist to approve an amendment to the Needles Municipal Code (NMC).



CITY OF NEEDLES

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Mayor Edward Paget, M.D.
 Vice Mayor Jeff Williams
 Councilmember Tony Frazier
 Councilmember Tom Darcy
 Councilmember Shawn Gudmundson
 Councilmember Louise Evans
 Councilmember Robert Richardson, M.D.
 City Manager Rick Daniels

October 26, 2015

Re: Correction to Proposed Permissible Use Table as Reflected in Ordinance #572, page 2

The Permissible Use Table Section 24.20 “utility scale” REP utilizing any technology requiring a PPA should be Subsection “24.30”, not “24.20”.

(a) Energy Project (REP) as follows:

24.00	RENEWABLE ENERGY PROJECT (REP)	R1	R1	R2	R3	CR	C1	C2	C3	M1	M2	P
24.10	residential rooftop or ground mounted on-site use only less than 10 kw photovoltaic or 30 kw thermal	BP	BP	BP	BP	BP/Z	Z	Z	Z	Z	Z	Z
24.20	REP on-site only utilizing any technology no PPA required	S	S	S	S	S	S	S	S	S	S	S
24.20	utility scale REP utilizing any technology requiring a PPA					C*	C*	C*	C*	C*	C*	C*
30												
*	See Section “9(A)” Public Benefit Program											

Dan Williams
 Bldg. Official

SECTION 3. The City Council HEREBY APPROVES Ordinance 572-AC for an amendment to the Needles Municipal Code (NMC) as follows:

- (a) Amend Section 96.00 Uses Permitted, adding under the section “Symbol Meaning”, as follows:

“BP = Permitted Use with building permit for residential rooftop or ground mounted solar projects less than 10 kw solar voltaic or 30 kw thermal

- (b) Amend Section 96.01 Table of Permissible Uses, adding Subsection 24.00 “Renewable Energy Project (REP)” as follows:

24.00	RENEWABLE ENERGY PROJECT (REP)	R1	R1	R2	R3	CR	C1	C2	C3	M1	M2	P
24.10	residential rooftop or ground mounted on-site use only less than 10 kw photovoltaic or 30 kw thermal	BP	BP	BP	BP	BP/Z	Z	Z	Z	Z	Z	Z
24.20	REP on-site only utilizing any technology no PPA required	S	S	S	S	S	S	S	S	S	S	S
24.20	utility scale REP utilizing any technology requiring a PPA					C*	C*	C*	C*	C*	C*	C*
*	See Section “9(A)” Public Benefit Program											

- (c) Add Section 99.09.04 “Renewable Energy Projects (REP)”

(1) Permitted Uses

- a) Renewable Energy Projects (REP) shall be allowed in accordance with the City Code Section 96.01 “Permissible Use Table”, unless otherwise exempted by state or federal law.
- b) Other hybrid or emerging renewable energy technologies, which in the opinion of the review authority are of a similar and compatible nature to those uses described in this section.

(2) Definitions

- a) “Electronic submittal” means the utilization of one or more of the following:
 - 1) e-mail,
 - 2) the internet,
 - 3) Facsimile.
- b) “Small residential rooftop solar energy system” means all of the following:
 - 1) A solar energy system that is no larger than 10 kilowatts alternating current nameplate rating or 30 kilowatts thermal.
 - 2) A solar energy system that conforms to all applicable state fire, structural, electrical, and other building codes as adopted or

amended by the City and paragraph (iii) of subdivision (c) of Section 714 of the Civil Code, as such section or subdivision may be amended, renumbered, or redesignated from time to time.

- 3) A solar energy system that is installed on a single or duplex family dwelling.
 - 4) A solar panel or module array that does not exceed the maximum legal building height as defined by the authority having jurisdiction.
- c) "Applicant" is the Landowner, developer, facility owner, and/or operator with legal control of the project, including heirs, successors and assigns, who have filed an application for development of a Solar Energy Facility under this Ordinance.
 - d) "Parcel" means all land within a legally established parcel.
 - e) "Practicable" means it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.
 - f) "Landowner" means the persons or entities possessing legal title to the Parcel(s) upon which a REP is located.
 - g) "Protected Lands" means, for the purpose of this chapter only, lands containing resources that are protected or regulated by established regulatory standards of local, state, and federal agencies, conservation easements or other contractual instruments in such a way that prohibits or limits development of those lands.
 - h) "Review Authority" means applicable-city land use decision-making body as determined by local ordinance and appeal procedures.
 - i) "Solar Energy Project (SEP)" means a Solar Electric System that satisfies the parameters identified in the Ordinance...
 - j) "Solar Electric System (SES)" means the components and subsystems that, in combination, convert solar energy into electric or thermal energy suitable for use, and may include other appurtenant structures and facilities. The term includes, but is not limited to, photovoltaic power systems, solar thermal systems, and solar hot water systems.
 - k) "Uses Allowed" means one of the following:
 - (1) A REP designed primarily for serving on-site needs or a use that is related to the Primary Use of the property.
 - (2) A REP designed and installed to provide on-site energy demand for any legally established use of the property.
 - (3) A REP that uses over 50% of the Parcel(s) and is devoted to solar electric power generation primarily for use off-site.
 - (4) A REP that provides up to 125% of on-site electricity (or hot water) demand and generally less than 50% of the building site area, or 15-25% of the Parcel land area.
 - (5) A REP that is not the Primary Use of the property and uses less than 50% of the Parcel(s).

- (6) Other hybrid or emerging renewable energy technologies, which in the opinion of the review authority are of a similar and compatible nature to those uses described in this section.

(3) Permit Requirements

(a) Small residential rooftop energy system

1) Application package includes:

- a) Exhibit "A" - Checklist for Expedited Solar Residential Rooftop Project
- b) Exhibit "B-1" - Standard Plan-Simplified Central/String Inverter System
- c) Exhibit "B-2" - Standard Plan-Simplified Micro inverter and ACM System
- d) Exhibit "C" - Structural Criteria for Rooftop Solar Structural Requirements
- e) Exhibit "D" - building permit application with interconnection agreement application (Photovoltaic guidelines/ Needles Rebate Program)

2) Application Submittal for permit

Will be accepted by the City via email, internet, or facsimile

3) Review Process and permit issuance

- a) Building official to review and confirm application is complete and administratively approve the application and issue all required permits or authorizations. Incomplete applications will be returned with written notification from building official identifying application deficiencies.

Such approval does not authorize an applicant to connect the small residential rooftop energy system to the local utility provider's electricity grid. The applicant is responsible for obtaining such approval or permission from the local utility provider.

4) Inspection

Only one inspection shall be required, which shall be done in a timely manner. If a small residential rooftop solar energy system fails inspection, a subsequent inspection is authorized; however the subsequent inspection need not conform to the requirements of this subsection.

(b) All other REP Projects

1) Permits required

The type of land use permit required for REFs are shown in the Permissible Use Table under Section 24.00

2) Application Package includes:

- a) Conditional Use Permit Application
- b) CEQA Checklist
- c) Interconnection Agreement Application

3) Permits

- a) Nothing in this chapter modifies the minimum building standards required to construct a REP, consistent with applicable building and fire codes. The REP components and all accessory equipment shall comply with the most recently adopted Building Code as determined by the Building Official and Fire Code as determined by the Fire Official.
- b) The Permits shall include review by local permitting departments including, but not limited to, the local Fire Authority, for Health and Safety Requirements.

(4) General Requirements

(a) Setbacks.

The following setbacks from the Parcel line to the closest part of the REP shall be established as shown in the Table below. Fencing, roads and landscaping may occur within the setback.

Parcel Line Setback Table			
Zoning District			
	Front	Rear	Side
Commercial	30'	30'	30'
Industrial	30'	30'	30'
Residential*	Per Zoning for that District		
* Complies with required front yard setbacks, or otherwise does not impair sight distance for safe access to or from the property or other properties in the vicinity as determined by ministerial zoning clearance.			

(b) Grading, Access and Parking

- (1) Renewable energy projects shall be sited to maintain natural grades and use existing roads for access to the extent practical. Construction of new roads shall be avoided as much as possible. Natural grades shall be restored and re-vegetated for temporary access roads, construction staging areas, or field office sites used during construction. The operator shall maintain an all-weather access road for maintenance and emergency vehicles.

(c) Soil Stabilization, Erosion Control and Ground Water Management –

- (1) To the extent feasible and compatible with the climate and pre-project landscaping of the property the site shall be restored with native vegetation. The re-vegetation plans shall be reviewed and approved by the City. All areas occupied by the facility that are not utilized for access to operate and maintain the installation shall be covered with gravel or other soil stabilization or other methods approved by the City. Use of chemical soil stabilization will require ongoing maintenance as required by the City.
- (2) The renewable energy facility must have a storm water management plan/permit showing existing and proposed grading and drainage demonstrating no net increase in runoff.
- (3) Erosion and Sediment Control Plan, if applicable, approved prior to beginning grading or construction. The plan must include best management practices for erosion control during and after construction, and permanent drainage and erosion control measures to prevent damage to local roads or adjacent areas, and to minimize sediment and storm water run-off into waterways, agricultural lands and habitat areas.
- (4) Prior to issuing a final Building Permit, an as-built grading and drainage plan, prepared by a licensed professional surveyor or other approved qualified professional shall be submitted to the reviewing agency's engineer for review and approval. The plan shall show that the as-built conditions are substantially the same as those shown on the approved grading and drainage plan.
- (5) A maintenance plan shall be submitted for the continuing maintenance of the REP, which may include, but not be limited to, planned maintenance of soil stabilization, equipment maintenance, and plans for cleaning of solar panels if required.

(d) Aesthetics

The operator of the renewable energy facility shall maintain the facility including all required landscaping in compliance with the approved design plans, and shall keep the facility free from weeds, dust, trash and debris.

(e) Air Quality

During site preparation, grading and construction, the renewable energy facility operator must implement best management practices to minimize dust and wind erosion, including regularly watering roads and construction staging areas as necessary, and minimizing vehicle idling and number of vehicle trips. Paved roads shall be swept as needed to remove any soil that has been carried onto them from the facility site.

(f) Air Safety

Renewable energy facilities shall be sited and operated to avoid hazards to air navigation. The renewable energy facility shall comply with any conditions

imposed by Federal, State, County, and City agencies.

(g) Biological Resources

The protection of high value biological resources is an important consideration. REP projects shall not be located on lands which support listed, candidate or other fully protected species, species of special concern, or species protected under the Native Plant Protection Act; Environmentally Sensitive Habitat Areas without CEQA. Applicant shall be responsible for all costs associated with the preparation of all documentation, studies, etc., as well as the costs associated with the City's use of a third party reviewer to ensure application completeness. Applicants are encouraged to coordinate with permitting agencies such as Dept. of Fish and Game and U.S. Fish and Wildlife Service during design stages.

(h) Cultural Resources

Renewable energy facilities shall be sited to avoid or mitigate impacts to significant cultural and historic resources, as well as sacred landscapes. Facilities requiring a use permit that result in ground disturbance shall require a cultural resources records search and, if necessary, a cultural resources field survey at the time of facility application. Consultation with Native American tribes shall be conducted as part of the environmental review process.

Grading plans for all renewable energy facilities shall include notes that require the contractor to halt work within the vicinity of any archeological, historical or cultural resources or artifacts that may be discovered during construction or operation. If cultural resources are discovered during construction, the operator shall notify the local agency and a qualified professional shall be retained at the applicant's expense to evaluate the find and determine any measures to mitigate impacts including avoidance, removal, preservation or recordation in accordance with California law. The operator shall implement any feasible mitigation measures as determined by the local agency. If human remains are discovered, the County Coroner must also be notified and consultation with the Native American Heritage Commission may be required to determine the most likely descendants.

(i) Fire Protection

The renewable energy facility shall be subject to Fire Safety Standards. The operator must implement a Fire Prevention Plan for construction and ongoing operations approved by the County Fire Marshall and local fire protection district. The plan shall include, but not be limited to: emergency vehicle access and turn-around at the facility site(s), addressing, vegetation management and fire break maintenance around structures.

(j) Proximity to Transmission Lines and Utility Notification

Upgrades to distribution or transmission facilities shall be identified and addressed as part of the CEQA review process. No building permit for a renewable energy facility shall be issued until evidence has been provided that the proposed interconnection is acceptable to the affected utility.

If new distribution, transmission, or substation facilities are required and the utility is an investor-owned utility, the California Public Utilities Commission (CPUC) may need to approve a Permit to construct or a Certificate of Public Convenience and Necessity. Coordination with the CPUC is essential prior to renewable energy facility approval.

(k) Security and Fencing

The site area for a renewable energy facility must be fenced or other appropriate measures to prevent unauthorized access and provide adequate signage. Wildlife friendly fencing shall be used **where required**. If needed, security lighting shall be operated by motion sensors. Access gates and equipment cabinets must be locked at all times.

(l) Signs

Temporary signs describing the facility, and providing contact information for the contractor and operator shall be placed during construction and must be removed prior to final inspection and operation. Signs for public or employee safety are required. No more than two signs relating the address and name of the operator/facility may be placed on-site, subject to design review. Outdoor displays, billboards or advertising signs of any kind either on- or off-site are prohibited.

(m) Off-Site Facilities

When the REP is located on more than one Parcel, there shall be proper easement agreements or other approved methods for the notification of all impacted parties.

(n) Septic System Avoidance – The REP shall not be located over a septic system, leach field area or identified reserve area unless approved by the Department of Environmental Health;

(o) Floodplain Avoidance – If located in a floodplain as designated by FEMA, or an area of known localized flooding, all panels, electrical wiring, automatic transfer switches, inverters, etc. shall be located above the base flood elevation; and, shall not otherwise create a fire or other safety hazard as determined by the Building Official.

(p) Visibility

- 1) If lighting is required, it shall be activated by motion sensors, fully shielded and downcast type where the light does not spill onto the adjacent Parcel or the night sky;
- 2) No display of advertising, except for reasonable identification of the panel, inverter or other equipment manufacturer, and the facility owner;

(q) Decommissioning and Restoration

- 1) A Decommissioning Plan shall be required and shall include the following:

An estimate prepared by a registered engineer describing the activities required to decommission the site and return it to its natural condition that existed before the installation along with an estimate to conduct the decommissioning activities.

The Owner/Applicant shall provide sufficient financial assurance to decommission the site. Allowable financial assurances include cash deposit, Letter of Credit or Performance Bond from an institution satisfactory to the City Manager.

- a) Removal of all aboveground and underground equipment, structures, fencing and foundations to a depth of three feet below grade. Underground equipment, structures and foundations located at least three feet below grade that do not constitute a hazard or interfere with the use of the land do not need to be removed.
- b) If applicable, removal of substations, overhead poles, above ground electricity transmission lines located on-site or within the public right of way if determined not to be usable to any other public or private utility.
- c) Removal of graveled areas and access roads.
- d) Regarding and placement of like-kind topsoil after removal of all structures and equipment.
- e) An Erosion Control Plan.
- f) Revegetation of disturbed areas with native seed mixes and plant species suitable to the area.
- g) The timeframe for completion of removal and decommissioning activities.
- h) An engineer's cost estimate for all aspects of the decommissioning plan, including use of prevailing wage rates, and credit for the salvage value of the panels and system materials.
- i) A statement signed by the owner or operator that they take full responsibility for reclaiming the site in accordance with the Decommissioning Plan and Use Permit approval upon cessation of use. See above. We want a financial assurance instrument.

The renewable energy facility operator is required to notify the City immediately upon termination or cessation of use or abandonment of the operation. The operator shall remove components of the facility when it becomes functionally obsolete or is no longer in use. The operator shall begin decommissioning and removal of all equipment, structures, footings/foundations, signs, fencing, and access roads within 90 days from the date the facility ceases operation, and shall return the site to an appropriate end-use within the timeframe specified in the Decommissioning Plan.

(r) Financial Assurance

At the time of issuance of the permit for the construction of the facility, the operator shall provide financial assurance in a form and amount acceptable to the local agency to secure the expense of decommissioning and removing all equipment, structures, fencing, and reclaiming the site and associated access or distribution lines in compliance with the approved reclamation plan.

(s) Workforce Development

The operator shall be encouraged to participate in the a regional occupational training program, or a similar program approved by the city, providing job training in renewable energy, and restoration and land stewardship, by providing an annual contribution to fund the program and providing access to the facility by teachers and students, for the term of the lease or facility use.

Submittal of a Local Hiring Plan is required prior to applying for a building permit for new construction valued at above \$TBD. The Plan shall set voluntary targets for local hiring, along with a protocol for sequencing local job recruitment activities prior to advertising outside the-City as determined by the City. The Plan shall also include annual monitoring and reporting requirements during construction

- (t) Abandonment – A REP that ceases to produce electricity on a continuous basis for twenty four (24) months shall be considered abandoned unless the Applicant or Landowner demonstrates by substantial evidence satisfactory to the City that there is no intent to abandon the facility. Applicants and/or Landowners are required to remove all equipment and facilities and restore the site to original condition upon abandonment.
- 1) Facilities deemed by the City to be unsafe and facilities erected in violation of this section shall also be subject to this Section. The code enforcement officer or any other employee of the City shall have the right to request documentation and/or affidavits from the Applicant regarding the system’s usage, and shall make a determination as to the date of abandonment or the date on which other violation(s) occurred.
 - 2) Upon a determination of abandonment or other violation(s), the City shall send a notice hereof to the Applicant and/or Landowner, indicating that the responsible party shall remove the REP and all associated facilities, and remediate the site to its approximate original condition within ninety (90) days of notice by the City, unless the City determines that the facilities must be removed in a shorter period to protect public safety. Alternatively, if the violation(s) can be addressed by means short of removing the REP and restoration of the site, the City may advise the Applicant and/or Landowner of such alternative means of resolving the violation(s).
 - 3) If the Applicant and/or Landowner do not comply, the City may remove the REP and restore the site and may thereafter (a) draw funds from any bond, security or financial assurance that may have been provided or (b) initiate judicial proceedings or take other steps authorized by law against the responsible parties to recover only those costs associated with the removal of structures deemed a public hazard.

(5) Misc.

Public Benefit Program

A streamlined permitting process utilizing a Special Use Permit in lieu of a Conditional Use Permit shall be used for any REF utility-scale sized project participating in the Public Benefit Program.

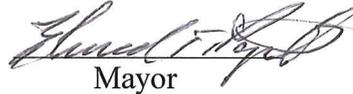
SECTION 4. This action shall become final and effective thirty (30) days after this decision by the City Council as provided by the Needles City Code.

SECTION 5. The City Clerk shall certify to the adoption of this Ordinance and shall transmit copies of the same to the applicant.

NOW, THEREFORE, BE IT ORDAINED that the City Council of the City of Needles, California, approve an amendment to the City Code.

INTRODUCED AND READ for the first time and ordered posted at a regular meeting of the City Council of the City of Needles, California, held on the 27th day of October, 2015, by the following roll call vote:

AYES: Councilmembers Gudmundson, Evans, Frazier, Williams, Darcy
NOES: None and Richardson
ABSENT: None
ABSTAIN: None



Mayor

Attest:



City Clerk

PASSED, APPROVED AND ADOPTED at a regular meeting of the City Council of the City of Needles, California, held on the 10th day of November, 2015.

AYES: Councilmembers Gudmundson, Evans, Frazier, Williams,
NOES: None Darcy and Richardson
ABSENT: None
ABSTAIN: None



Mayor

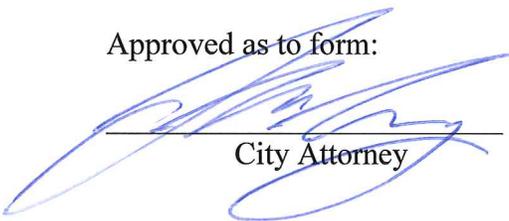
(Seal)

Attest:



City Clerk

Approved as to form:



City Attorney



Eligibility Checklist for Expedited Solar Photovoltaic Permitting for One- and Two-Family Dwellings

GENERAL REQUIREMENTS

- | | | |
|--|----------------------------|----------------------------|
| A. System size is 10 kW AC CEC rating or less | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| B. The solar array is roof-mounted on one- or two-family dwelling or accessory structure | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| C. The solar panel/module arrays will not exceed the maximum legal building height | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| D. Solar system is utility interactive and without battery storage | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| E. Permit application is completed and attached | <input type="checkbox"/> Y | <input type="checkbox"/> N |

ELECTRICAL REQUIREMENTS

- | | | |
|--|----------------------------|----------------------------|
| A. No more than four photovoltaic module strings are connected to each Maximum Power Point Tracking (MPPT) input where source circuit fusing is included in the inverter | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| 1) No more than two strings per MPPT input where source circuit fusing is not included | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| 2) Fuses (if needed) are rated to the series fuse rating of the PV module | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| 3) No more than one noninverter-integrated DC combiner is utilized per inverter | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| B. For central inverter systems: No more than two inverters are utilized | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| C. The PV system is interconnected to a single-phase AC service panel of nominal 120/220 Vac with a bus bar rating of 225 A or less | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| D. The PV system is connected to the load side of the utility distribution equipment | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| E. A Solar PV Standard Plan and supporting documentation is completed and attached | <input type="checkbox"/> Y | <input type="checkbox"/> N |

STRUCTURAL REQUIREMENTS

- | | | |
|---|----------------------------|----------------------------|
| A. A completed Structural Criteria and supporting documentation is attached (if required) | <input type="checkbox"/> Y | <input type="checkbox"/> N |
|---|----------------------------|----------------------------|

FIRE SAFETY REQUIREMENTS

- | | | |
|--|----------------------------|----------------------------|
| A. Clear access pathways provided | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| B. Fire classification solar system is provided | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| C. All required markings and labels are provided | <input type="checkbox"/> Y | <input type="checkbox"/> N |
| D. A diagram of the roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points is completed and attached | <input type="checkbox"/> Y | <input type="checkbox"/> N |

Notes:

1. These criteria are intended for expedited solar permitting process.
2. If any items are checked NO, revise design to fit within Eligibility Checklist, otherwise permit application may go through standard process.



**Solar PV Standard Plan — Simplified
Central/String Inverter Systems for
One- and Two-Family Dwellings**

SCOPE: Use this plan ONLY for utility-interactive central/string inverter systems not exceeding a system AC inverter output rating of 10KW on the roof of a one- or two-family dwelling or accessory structure. The photovoltaic system must interconnect to the load side of a single-phase AC service panel of nominal 120/240Vac with a bus bar rating of 225A or less. This plan is not intended for bipolar systems, hybrid systems or systems that utilize storage batteries, charge controllers, trackers, more than two inverters or more than one DC combiner (noninverter-integrated) per inverter. Systems must be in compliance with current California Building Standards Codes and local amendments of the authority having jurisdiction (AHJ). Other Articles of the California Electrical Code (CEC) shall apply as specified in 690.3.

MANUFACTURER'S SPECIFICATION SHEETS MUST BE PROVIDED for proposed inverter, modules, combiner/junction boxes and racking systems. Installation instructions for bonding and grounding equipment shall be provided, and local AHJs may require additional details. Listed and labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling (CEC 110.3). Equipment intended for use with PV system shall be identified and listed for the application (CEC 690.4[D]).

Job Address: _____ Permit #: _____

Contractor/ Engineer Name: _____ License # and Class: _____

Signature: _____ Date: _____ Phone Number: _____

Total # of Inverters installed: _____ (If more than one inverter, complete and attach the "Supplemental Calculation Sheets" and the "Load Center Calculations" if a new load center is to be used.)

Inverter 1 AC Output Power Rating: _____ Watts

Inverter 2 AC Output Power Rating (if applicable): _____ Watts

Combined Inverter Output Power Rating: _____ ≤ 10,000 Watts

Location Ambient Temperatures (Check box next to which lowest expected temperature is used):

<p>1) <input type="checkbox"/> Lowest expected ambient temperature for the location (T_L) = Between -1 to -5 °C</p> <p><input type="checkbox"/> Lowest expected ambient temperature for the location (T_L) = Between -6 to -10 °C</p> <p>Average ambient high temperature (T_H) = 47 °C</p> <p>Note: For a lower T_L or a higher T_H, use the Comprehensive Standard Plan</p>
--

DC Information:

Module Manufacturer: _____		Model: _____	
2) Module V_{oc} (from module nameplate): _____ Volts	3) Module I_{sc} (from module nameplate): _____ Amps		
4) Module DC output power under standard test conditions (STC) = _____ Watts (STC)			

5) DC Module Layout

Identify each source circuit (string) for inverter 1 shown on the roof plan with a Tag (e.g. A,B,C,...)	Number of modules per source circuit for inverter 1	Identify, by tag, which source circuits on the roof are to be paralleled (If none, put N/A)
		Combiner 1:
		Combiner 2:
Total number of source circuits for inverter 1:		

6) Are DC/DC Converters used? Yes No **If No, skip to Step 7. If Yes enter info below.**

DC/DC Converter Model #: _____	DC/DC Converter Max DC Input Voltage: _____ Volts
Max DC Output Current: _____ Amps	Max DC Output Current: _____ Volts
Max # of DC/DC Converters in an Input Circuit: _____	DC/DC Converter Max DC Input Power: _____ Watts

7) Maximum System DC Voltage — Use A1 or A2 for systems without DC/DC converters, and B1 or B2 with DC/DC Converters.

A1. Module V_{oc} (STEP 2) = _____ x # in series (STEP 5) _____ x 1.12 (If $-1 \leq T_L \leq -5^\circ\text{C}$, STEP 1) = _____ V

A2. Module V_{oc} (STEP 2) = _____ x # in series (STEP 5) _____ x 1.14 (If $-6 \leq T_L \leq -10^\circ\text{C}$, STEP 1) = _____ V

Max. Rated Module V_{oc} (*1.12) (Volts)	29.76	31.51	33.48	35.71	38.27	41.21	44.64	48.70	53.57	59.52	66.96	76.53	89.29
Max. Rated Module V_{oc} (*1.14) (Volts)	29.24	30.96	32.89	35.09	37.59	40.49	43.86	47.85	52.63	58.48	65.79	75.19	87.72
Max # of Modules for 600 Vdc	18	17	16	15	14	13	12	11	10	9	8	7	6

Use for DC/DC converters. The value calculated below must be less than DC/DC converter max DC Input voltage (STEP 6).

B1. Module V_{oc} (STEP 2) = _____ x # of modules per converter (STEP 6) _____ x 1.12 (If $-1 \leq T_L \leq -5^\circ\text{C}$, STEP 1) = _____ V

B2. Module V_{oc} (STEP 2) = _____ x # of modules per converter (STEP 6) _____ x 1.14 (If $-6 \leq T_L \leq -10^\circ\text{C}$, STEP 1) = _____ V

Max. Rated Module V_{oc} (*1.12) (Volts)	30.4	33.0	35.7	38.4	41.1	43.8	46.4	49.1	51.8	54.5	57.1	59.8	62.5	65.2	67.9	70.5
Max. Rated Module V_{oc} (*1.14) (Volts)	29.8	32.5	35.1	37.7	40.4	43.0	45.6	48.2	50.9	53.5	56.1	58.8	61.4	64.0	66.7	69.3
DC/DC Converter Max DC Input (Step #6) (Volts)	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	79

8) Maximum System DC Voltage from DC/DC Converters to Inverter — Only required if Yes in Step 6
Maximum System DC Voltage = _____ Volts

9) Maximum Source Circuit Current
Is Module I_{sc} below 9.6 Amps (Step 3)? Yes No (If No, use Comprehensive Standard Plan)

10) Sizing Source Circuit Conductors
 Source Circuit Conductor Size = Min. #10 AWG copper conductor, 90°C wet (USE-2, PV Wire, XHHW-2, THWN-2, RHW-2)
 For up to 8 conductors in roof-mounted conduit exposed to sunlight at least ½" from the roof covering (CEC 310)
 Note: For over 8 conductors in the conduit or mounting height of lower than ½" from the roof, use Comprehensive Plan.

11) Are PV source circuits combined prior to the inverter? Yes No
 If No, use Single Line Diagram 1 and proceed to Step 13.
 If Yes, use Single Line Diagram 2 with Single Line Diagram 4 and proceed to Step 12.
 Is source circuit OCPD required? Yes No
 Source circuit OCPD size (if needed): 15 Amps

12) Sizing PV Output Circuit Conductors — If a combiner box will NOT be used (Step 11),
 Output Circuit Conductor Size = Min. #6 AWG copper conductor

13) Inverter DC Disconnect
 Does the inverter have an integrated DC disconnect? Yes No If Yes, proceed to step 14.
 If No, the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)

14) Inverter Information
 Manufacturer: _____ Model: _____
 Max. Continuous AC Output Current Rating: _____ Amps
 Integrated DC Arc-Fault Circuit Protection? Yes No (If No is selected, Comprehensive Standard Plan)
 Grounded or Ungrounded System? Grounded Ungrounded

AC Information:

15) Sizing Inverter Output Circuit Conductors and OCPD
 Inverter Output OCPD rating = _____ Amps (Table 3)
 Inverter Output Circuit Conductor Size = _____ AWG (Table 3)

Table 3. Minimum Inverter Output OCPD and Circuit Conductor Size									
Inverter Continuous Output Current Rating (Amps) (Step 14)	12	16	20	24	28	32	36	40	48
Minimum OCPD Size (Amps)	15	20	25	30	35	40	45	50	60
Minimum Conductor Size (AWG, 75°C, Copper)	14	12	10	10	8	8	6	6	6

Integrated DC Arc-Fault Circuit Protection? Yes No (If No is selected, Comprehensive Standard Plan)
 Grounded or Ungrounded System? Grounded Ungrounded

16) Point of Connection to Utility

Only load side connections are permitted with this plan. Otherwise, use Comprehensive Standard Plan.

Is the PV OCPD positioned at the opposite end from input feeder location or main OCPD location? Yes No
 If Yes, circle the Max Combined PV System OCPD(s) at 120% value as determined from Step 15 (or Step S20), bus bar Rating, and Main OCPD as shown in Table 4.

If No, circle the Max Combined PV System OCPD(s) at 100% value as determined from Step 15 (or Step S20), bus bar Rating, and Main OCPD as shown in Table 4.

Per 705.12(D)(2): [Inverter output OCPD size [Step #15 or S20] + Main OCPD Size] ≤ [bus size x (100% or 120%)]

Table 4. Maximum Combined Supply OCPDs Based on Bus Bar Rating (Amps) per CEC 705.12(D)(2)									
Bus Bar Rating	100	125	125	200	200	200	225	225	225
Main OCPD	100	100	125	150	175	200	175	200	225
Max Combined PV System OCPD(s) at 120% of Bus Bar Rating	20	50	25	60*	60*	40	60*	60*	45
Max Combined PV System OCPD(s) at 100% Bus Bar Rating	0	25	0	50	25	0	50	25	0

*This value has been lowered to 60 A from the calculated value to reflect 10 kW AC size maximum.

Reduction of the main breaker is not permitted with this plan. Otherwise, use Comprehensive Standard Plan.

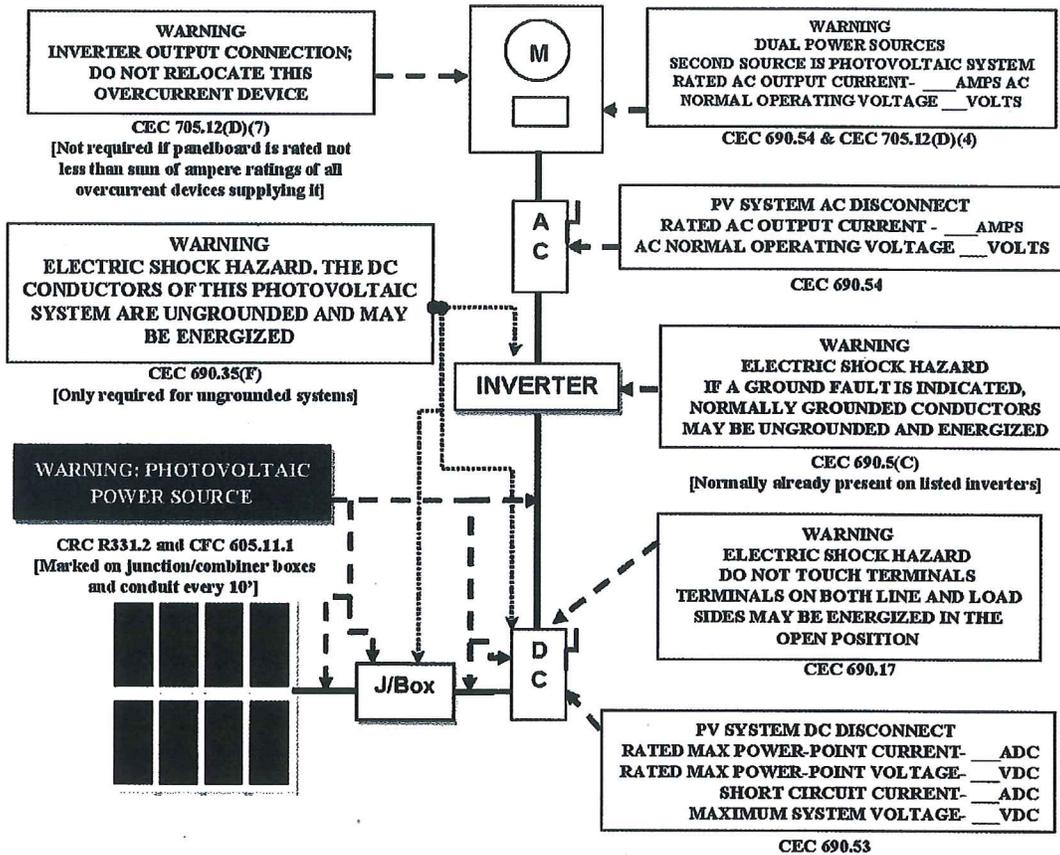
17 & 18 & 19) Labels and Grounding and Bonding

This content is covered by the labels on the next page and the Single Line Diagram(s). For background information, refer to the Comprehensive Standard Plan.

Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings

Markings

CEC Articles 690 and 705 and CRC Section R331 require the following labels or markings be installed at these components of the photovoltaic system:



Code Abbreviations:
 California Electrical Code (CEC)
 California Residential Code (CRC)
 California Fire Code (CFC)

Informational note: ANSI Z535.4 provides guidelines for the design of safety signs and labels for application to products. A phenolic plaque with contrasting colors between the text and background would meet the intent of the code for permanency. No type size is specified, but 20 point (3/8") should be considered the minimum.

CEC 705.12 requires a permanent plaque or directory denoting all electric power sources on or in the premises.

Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings

TABLE 1

NO.	DESCRIPTION
1	SOLAR PV MODULE / STRING
2	DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED)
3	SOURCE CIRCUIT JUNCTION BOX INSTALLED? YES / NO
4	SEPARATE DC DISCONNECT INSTALLED? YES / NO
5	INTERNAL INVERTER DC DISCONNECT? YES / NO
6	CENTRAL INVERTER
7	LOAD CENTER INSTALLED? YES / NO
8	PV PRODUCTION METER INSTALLED? YES / NO
9	*SEPARATE AC DISCONNECT INSTALLED? YES / NO
10	CONNECT TO INVERTER #2 (USE LINE DIAGRAM 2)

* Consult with your local AHJ and /or Utility

SINGLE-LINE DIAGRAM #1 — NO STRINGS COMBINED PRIOR TO INVERTER

CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED: GROUNDED (INCLUDE GEC) UNGROUNDED

FOR UNGROUNDED SYSTEMS:
 - DC DC/DI MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT
 - UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.

IF DC/DC CONVERTERS ARE USED, CHECK THE BOX BELOW THE CORRESPONDING CONFIGURATION

PARALLEL DC/DC CONVERTERS ON ONE SOURCE CIRCUIT (FIXED UNIT VOLTAGE DC/DC CONVERTERS)

DC/DC CONVERTERS ARE ALL RUN IN SERIES (FIXED SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE

TYPE	DESCRIPTION	CONDUIT		CABLE	
		SIZE	NUMBER OF CONDUCTORS	SIZE	NUMBER OF CONDUCTORS
A	DESCRIPTION				
B	DESCRIPTION				
C	DESCRIPTION				
D	DESCRIPTION				

Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings

SINGLE-LINE DIAGRAM #2 – COMBINING STRINGS PRIOR TO INVERTER

CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED: GROUNDED (INCLUDE GEC)
 UNGROUNDED

FOR UNGROUNDED SYSTEMS:
- DC CPD MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT
- UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C), WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.

A/TAG	DESCRIPTION	YES / NO	(IF YES, STEPS 2 & 8 REQUIRED)
1	SOLAR PV MODULE / STRING		
2	DC/DC CONVERTERS INSTALLED?		
3	SOURCE CIRCUIT LIGNON BOX INSTALLED?		
4	COMBINER BOX (STEPS 11 & 12 REQUIRED)		
5	SEPARATE DC DISCONNECT INSTALLED?		
6	INTERNAL INVERTER DC DISCONNECT		
7	CENTRAL INVERTER		
8	LOAD CENTER INSTALLED?		
9	PV PRODUCTION METER INSTALLED?		
10	SEPARATE AC DISCONNECT INSTALLED?		
11	CONNECT TO INVERTER #2 (USE LINE DIAGRAM 4)		

* Consult with your local AHJ and/or Utility

COMBINER BOXES / CONDUIT SCHEDULE			
TYPE	DESCRIPTION AND CONDUIT SCHEDULE	NUMBER OF CONDUCTORS	CONDUIT SIZE
A1			
A2			
B1			
B2			
C			
D			
E			
F			

NON-COMBINED STRINGS CONDUIT SCHEDULE (IF APPLICABLE)			
A2	DESCRIPTION AND CONDUIT SCHEDULE	NUMBER OF CONDUCTORS	CONDUIT SIZE

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE

IF DC/DC CONVERTERS ARE USED, THEY ARE RUN IN SERIES (PHED SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

**Solar PV Standard Plan — Simplified
 Central/String Inverter Systems for One- and Two-Family Dwellings
 Supplemental Calculation Sheets for Inverter #2
 (Only include if second inverter is used)**

DC Information:

Module Manufacturer: _____		Model: _____	
S2) Module V_{oc} (from module nameplate): _____ Volts		S3) Module I_{sc} (from module nameplate): _____ Amps	
S4) Module DC output power under standard test conditions (STC) = _____ Watts (STC)			
S5) DC Module Layout			
Identify each source circuit (string) for inverter 1 shown on the roof plan with a Tag (e.g. A,B,C,...)	Number of modules per source circuit for inverter 1	Identify, by tag, which source circuits on the roof are to be paralleled (if none, put N/A)	
		Combiner 1: Combiner 2:	
Total number of source circuits for inverter 1: _____			
S6) Are DC/DC Converters used? <input type="checkbox"/> Yes <input type="checkbox"/> No		If No, skip to Step S7. If Yes, enter info below.	
DC/DC Converter Model #: _____		DC/DC Converter Max DC Input Voltage: _____ Volts	
Max DC Output Current: _____ Amps		Max DC Output Current: _____ Volts	
Max # of DC/DC Converters in an Input Circuit: _____		DC/DC Converter Max DC Input Power: _____ Watts	

S7) Maximum System DC Voltage — Use A1 or A2 for systems without DC/DC converters, and B1 or B2 with DC/DC Converters.

A1. Module V_{oc} (STEP S2) = _____ x # in series (STEP S5) _____ x 1.12 (If $-1 \leq T_L \leq -5^\circ\text{C}$, STEP S1) = _____ V

A2. Module V_{oc} (STEP S2) = _____ x # in series (STEP S5) _____ x 1.14 (If $-6 \leq T_L \leq -10^\circ\text{C}$, STEP S1) = _____ V

Max. Rated Module V_{oc} (*1.12) (Volts)	29.76	31.51	33.48	35.71	38.27	41.21	44.64	48.70	53.57	59.52	66.96	76.53	89.29
Max. Rated Module V_{oc} (*1.14) (Volts)	29.24	30.96	32.89	35.09	37.59	40.49	43.86	47.85	52.63	58.48	65.79	75.19	87.72
Max # of Modules for 600 Vdc	18	17	16	15	14	13	12	11	10	9	8	7	6

Use for DC/DC converters. The value calculated below must be less than DC/DC converter max DC Input voltage (STEP S6).

B1. Module V_{oc} (STEP S2) = _____ x # of modules per converter (STEP S6) _____ x 1.12 (If $-1 \leq T_L \leq -5^\circ\text{C}$, STEP S1) = _____ V

B2. Module V_{oc} (STEP S2) = _____ x # of modules per converter (STEP S6) _____ x 1.14 (If $-6 \leq T_L \leq -10^\circ\text{C}$, STEP S1) = _____ V

Max. Rated Module V_{oc} (*1.12) (Volts)	30.4	33.0	35.7	38.4	41.1	43.8	46.4	49.1	51.8	54.5	57.1	59.8	62.5	65.2	67.9	70.5
Max. Rated Module V_{oc} (*1.14) (Volts)	29.8	32.5	35.1	37.7	40.4	43.0	45.6	48.2	50.9	53.5	56.1	58.8	61.4	64.0	66.7	69.3
DC/DC Converter Max DC Input (Step 6) (Volts)	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	79

S8) Maximum System DC Voltage from DC/DC Converters to Inverter — Only required if Yes in Step S6
 Maximum System DC Voltage = _____ Volts

S9) Maximum Source Circuit Current
 Is Module ISC below 9.6 Amps (Step S3)? Yes No (If No, use Comprehensive Standard Plan)

S10) Sizing Source Circuit Conductors
 Source Circuit Conductor Size = Min. #10 AWG copper conductor, 90°C wet (USE-2, PV Wire, XHHW-2, THWN-2, RHW-2)
 For up to 8 conductors in roof-mounted conduit exposed to sunlight at least ½" from the roof covering (CEC 310)
 Note: For over 8 conductors in the conduit or mounting height of lower than ½" from the roof, use Comprehensive Plan.

S11) Are PV source circuits combined prior to the inverter? Yes No
 If No, use Single Line Diagram 1 and proceed to Step S13.
 If Yes, use Single Line Diagram 2 with Single Line Diagram 4 and proceed to Step S12.
 Is source circuit OCPD required? Yes No
 Source circuit OCPD size (if needed): 15 Amps

S12) Sizing PV Output Circuit Conductors — If a combiner box will NOT be used (Step S11),
 Output Circuit Conductor Size = Min. #6 AWG copper conductor

S13) Inverter DC Disconnect
 Does the inverter have an integrated DC disconnect? Yes No If Yes, proceed to Step S14.
 If No, the external DC disconnect to be installed is rated for _____ Amps (DC) and _____ Volts (DC)

S14) Inverter Information

Manufacturer: _____ Model: _____
Max. Continuous AC Output Current Rating: _____ Amps
Integrated DC Arc-Fault Circuit Protection? Yes No (If No is selected, Comprehensive Standard Plan)
Grounded or Ungrounded System? Grounded Ungrounded

AC Information:

S15) Sizing Inverter Output Circuit Conductors and OCPD

Inverter Output OCPD rating = _____ Amps (Table 3)
Inverter Output Circuit Conductor Size = _____ AWG (Table 3)

Inverter Continuous Output Current Rating (Amps) (Step 14)	12	16	20	24	28	32	36	40	48
Minimum OCPD Size (Amps)	15	20	25	30	35	40	45	50	60
Minimum Conductor Size (AWG, 75°C, Copper)	14	12	10	10	8	8	6	6	6

Load Center Calculations
(Omit if a load center will not be installed for PV OCPDs)

S20) Load Center Output:

Calculate the sum of the maximum AC outputs from each inverter.

Inverter #1 Max Continuous AC Output Current Rating [STEP S14] _____ × 1.25 = _____ Amps

Inverter #2 Max Continuous AC Output Current Rating [STEP S14] _____ × 1.25 = _____ Amps

Total inverter currents connected to load center (sum of above) = _____ Amps

Conductor Size: _____ AWG

Overcurrent Protection Device: _____ Amps

Load center bus bar rating: _____ Amps

The sum of the ampere ratings of overcurrent devices in circuits supplying power to a bus bar or conductor shall not exceed 120 percent of the rating of the bus bar or conductor.

Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings

△TAG DESCRIPTION

1 SOLAR PV MODULE / STRING

2 DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED)

3 SOURCE CIRCUIT JUNCTION BOX INSTALLED? YES / NO

4 SEPARATE DC DISCONNECT INSTALLED? YES / NO

5 INTERNAL INVERTER DC DISCONNECT? YES / NO

6 CENTRAL INVERTER

7 *SEPARATE AC DISCONNECT INSTALLED? YES / NO

8 TO LOAD CENTER ON LINE DIAGRAM 1

* Consult with your local AHJ and /or Utility

**SINGLE-LINE DIAGRAM #3 — ADDITIONAL INVERTER FOR DIAGRAM #1
INVERTER # 2**

CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:

GROUNDED (INCLUDE GEC)

UNGROUNDED

FOR UNGROUNDED SYSTEMS:

- DC/DC MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT

- UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 210.5(C). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE

CONDUIT/CABLE/CONDUIT SCHEDULE			
TYPE	DESCRIPTION AND CONDUIT/CABLE SIZE	NUMBER OF CONDUIT/CABLES	CONDUIT/CABLE TYPE
A	12-3/8" OR 14-3/8" R		
B	ECCLECC		
C	ECCLECC		
	14-3/8" R		

IF DC/DC CONVERTERS ARE USED, CHECK THE BOX BELOW THE CORRESPONDING CONFIGURATION

DC/DC CONVERTERS

PARALLEL DC/DC CONVERTERS ON ONE SOURCE CIRCUIT (PHASE UNIT VOLTAGE DC/DC CONVERTERS)

DC/DC CONVERTERS

DC/DC CONVERTERS ARE ALL RUN IN SERIES (PHASE SOURCE CIRCUIT VOLTAGE DC/DC CONVERTERS)

Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings

▲TAG DESCRIPTION

1 SOLAR PV MODULE / STRING

2 DC/DC CONVERTERS INSTALLED? YES / NO (IF YES, STEPS 6 & 8 REQUIRED)

3 SOURCE CIRCUIT JUNCTION BOX INSTALLED? YES / NO

4 COMBINER BOX (STEPS 11 & 12 REQUIRED)

5 SEPARATE DC DISCONNECT INSTALLED? YES / NO

6 INTERNAL INVERTER DC DISCONNECT? YES / NO

7 CENTRAL INVERTER

8 SEPARATE AC DISCONNECT INSTALLED? YES / NO

9 TO LOAD CENTER ON LINE DIAGRAM 3

* Consult with your local AHJ and/or utility

SINGLE-LINE DIAGRAM #4 – ADDITIONAL INVERTER FOR DIAGRAM #2

INVERTER # 2

CHECK A BOX FOR WHETHER SYSTEM IS GROUNDED OR UNGROUNDED:

GROUNDED (INCLUDE GEC)

UNGROUNDED

FOR UNGROUNDED SYSTEMS:

-DC/DC MUST DISCONNECT BOTH CONDUCTORS OF EACH SOURCE CIRCUIT

- UNGROUNDED CONDUCTORS MUST BE IDENTIFIED PER 220-51(4). WHITE-FINISHED CONDUCTORS ARE NOT PERMITTED.

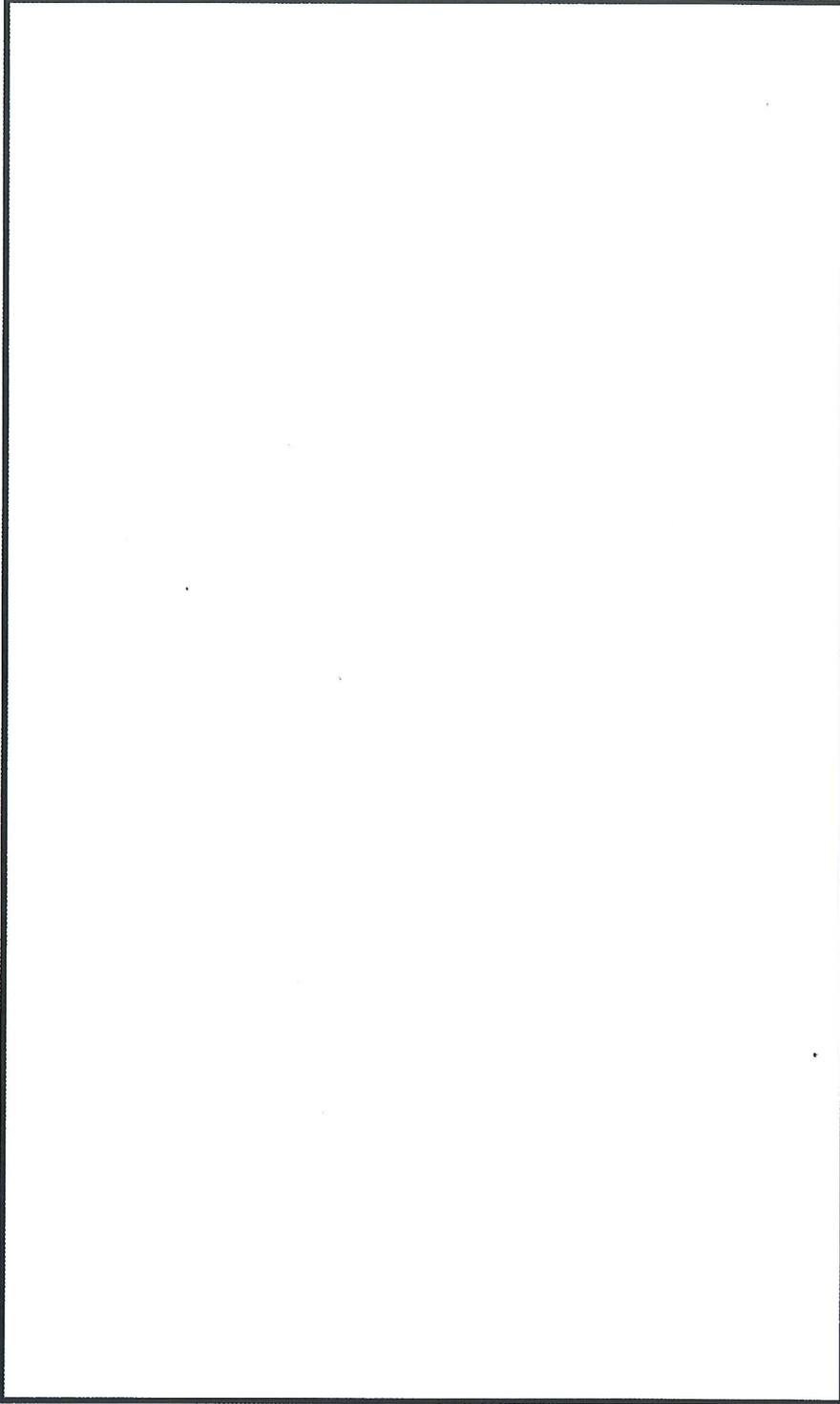
COMBINER BOX DISCONNECT SCHEDULE		CONDUIT SCHEDULE (UL-YELLOW)	
TYPE	DESCRIPTION AND CONDUCTOR SIZE	NUMBER OF CONDUCTORS	CONDUIT SIZE
<input type="checkbox"/> Y1	DC/DC OR INVERTER		
<input type="checkbox"/> B1	DC/DC OR INVERTER		
<input type="checkbox"/> C	DC/DC OR INVERTER		
<input type="checkbox"/> D	DC/DC OR INVERTER		
<input type="checkbox"/> E	DC/DC OR INVERTER		

ENTER "N/A" WHERE SUITABLE FOR WHEN NOT USING CONDUIT OR CABLE AS PERMITTED BY CODE

IF DC/DC CONVERTERS ARE USED, THEY MUST BE INSTALLED IN A SEPARATE JUNCTION BOX (CIRCUIT VOLTAGE DC/DC CONVERTERS)

SOLAR PV STANDARD PLAN

Roof Layout Diagram for One- and Two-Family Dwellings



Items required: roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points.



**Solar PV Standard Plan — Simplified
Microinverter and ACM Systems for
One- and Two-Family Dwellings**

SCOPE: Use this plan ONLY for systems using utility-interactive Microinverters or AC Modules (ACM) not exceeding a combined system AC inverter output rating of 10 kW, with a maximum of 3 branch circuits, one PV module per inverter and with PV module ISC maximum of 10-A DC, installed on a roof of a one- or two-family dwelling or accessory structure. The photovoltaic system must interconnect to a single-phase AC service panel of 120/240 Vac with service panel bus bar rating of 225 A or less. This plan is not intended for bipolar systems, hybrid systems or systems that utilize storage batteries, charge controllers or trackers. Systems must be in compliance with current California Building Standards Codes and local amendments of the authority having jurisdiction (AHJ). Other articles of the California Electrical Code (CEC) shall apply as specified in section 690.3.

MANUFACTURER'S SPECIFICATION SHEETS MUST BE PROVIDED for proposed inverters, modules, combiner/junction boxes and racking systems. Installation instructions for bonding and grounding equipment shall be provided and local AHJs may require additional details. Listed and labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling (CEC 110.3). Equipment intended for use with PV system shall be identified and listed for the application CEC 690.4(D).

Applicant and Site Information

Job Address: _____ Permit #: _____
 Contractor/ Engineer Name: _____ License # and Class: _____
 Signature: _____ Date: _____ Phone Number: _____

General Requirements and System Information

Microinverter
 Number of PV modules installed: _____
 Number of Microinverters installed: _____

AC Module (ACM)
 Number of ACMs installed: _____
Note: Listed Alternating-Current Module (ACM) is defined in CEC 690.2 and installed per CEC 690.6

Number of Branch Circuits, 1, 2 or 3: _____

Actual number of Microinverters or ACMs per branch circuit: 1 _____ 2 _____ 3 _____

Total AC system power rating = (Total Number of Microinverters or ACMs) * (AC inverter power output) = _____ Watts

Lowest expected ambient temperature for this plan in Table 1: For -1 to -5°C use 1.12 or for -6 to -10°C use 1.14 correction factors.

Average ambient high temperature for this plan: = +47 OC
 Note: For lower expected ambient or higher average ambient high temperatures, use Comprehensive Standard Plan.

Microinverter or ACM Information and Ratings

Microinverters with ungrounded DC inputs shall be installed in accordance with CEC 690.35.

Microinverter or ACM Manufacturer: _____

Model: _____

Rated (continuous) AC output power: _____ Watts

Nominal AC voltage rating: _____ Volts

Rated (continuous) AC output current: _____ Amps

If installing ACMs, skip [STEPS 0]

Maximum DC input voltage rating: _____ Volts (limited to 79 V, otherwise use the Comprehensive Standard Plan)

Maximum AC output overcurrent protection device (OCPD) _____ Amps

Maximum number of Microinverters or ACMs per branch circuit: _____

PV Module Information

(If installing ACMs, skip to [STEP 4])

PV Module Manufacturer: _____

Model: _____

Module DC output power under standard test conditions (STC) = _____ Watts

Module V_{oc} at STC (from module nameplate): _____ Volts

Module I_{sc} at STC (from module nameplate): _____ Amps

Adjusted PV Module DC voltage at minimum temperature = [Table 1] _____ [cannot exceed Step 0]

Table 1. Module V_{oc} at STC Based on Inverter Maximum DC Input Voltage Derived from NEC 690.7																
Microinverter Max. DC Input [STEP 0] (Volts)	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	79
Max. Module V_{oc} @ STC, 1.12 (-1 to -5°C) Correction Factor (Volts)	30.4	33.0	35.7	38.4	41.1	43.8	46.4	49.1	51.8	54.5	57.1	59.8	62.5	65.2	67.9	70.5
Max. Module V_{oc} @ STC, 1.14 (-6 to -10°C) Correction Factor (Volts)	29.8	32.5	35.1	37.7	40.4	43.0	45.6	48.2	50.9	53.5	56.1	58.8	61.4	64.0	66.7	69.3

Branch Circuit Output Information

Fill in [Table 3] to describe the branch circuit inverter output conductor and OCPD size. Use [Table 2] for determining the OCPD and Minimum Conductor size.

Table 2. Branch Circuit OCPD and Minimum Conductor Size*				
Circuit Current (Amps)	Circuit Power (Watts)	OCPD (Amps)	Minimum Conductor Size (AWG)	Minimum Metal Conduit Size for 6 Current Carrying Conductors
12	2880	15	12	¾"
16	3840	20	10	¾"
20	4800	25	8	1"
24	5760	30	8	1"

*NEC 690.8 and 210.19 (A)(1) Factored in Table 2, Conductors are copper, insulation must be 90°C wet-rated. Table 2 values are based on maximum ambient temperature of 69°C, which includes 22 OC adder, exposed to direct sunlight, mounted > 0.5 inches above rooftop, ≤ 6 current carrying conductors (3 circuits) in a circular raceway. Otherwise use Comprehensive Standard Plan.

Table 3. PV Array Configuration Summary			
	Branch 1	Branch 2	Branch 3
Number of Microinverters or ACMs [Step 0]			
Selected Conductor Size [Table 2] (AWG)			
Selected Branch and Inverter Output OCPD [Table 2]			

Solar Load Center (if used)

Solar Load Center is to have a bus bar rating not less than 100 Amps. Otherwise use Comprehensive Standard Plan.

Circuit Power see [STEP 0] = _____ Watts

Circuit Current = (Circuit Power) / (AC voltage) = _____ Amps

Table 4. Solar Load Center and Total Inverter Output OCPD and Conductor Size**				
Circuit Current (Amps)	Circuit Power (Watts)	OCPD (Amps)	Minimum Conductor Size (AWG)	Minimum Metal Conduit Size
24	5760	30	10	1/2"
28	6720	35	8	3/4"
32	7680	40	8	3/4"
36	8640	45	8	3/4"
40	9600	50	8	3/4"
41.6	≤ 10000	60	6	3/4"

**CEC 690.8 and 210.19 (A)(1) Factored in Table 4, Conductors are copper, Insulation must be 90°C wet-rated. Table 4 values are based on maximum ambient temperature of 47°C (no rooftop temperature added in this calculation), ≤ 3 current carrying conductors in a circular raceway. Otherwise use Comprehensive Standard Plan.

Point of Connection to Utility:

Load Side Connection only! Otherwise use the Comprehensive Standard Plan.

Is the PV OCPD positioned at the opposite end from input feeder location or main OCPD location?

Yes No (If No, then use 100% row in Table 5)

Per 705.12(D)(2): (Combined inverter output OCPD size + Main OCPD size) ≤ [bus bar size × (100% or 120%)]

Table 5. Maximum Combined Inverter Output Circuit OCPD										
Bus Bar Size (Amps)	100	125	125	200	200	200	225	225	225	
Main OCPD (Amps)	100	100	125	150	175	200	175	200	225	
Maximum Combined Inverter OCPD with 120% of bus bar rating (Amps)	20	50	25	60†	60†	40	60†	60†	45	
Maximum Combined Inverter OCPD with 100% of bus bar rating (Amps)	0	25	0	50	25	0	50	25	0	

†This plan limits the maximum system size to less than 10 kW, therefore the OCPD size is limited to 60 A. Reduction of Main Breaker is not permitted with this plan.

Grounding and Bonding

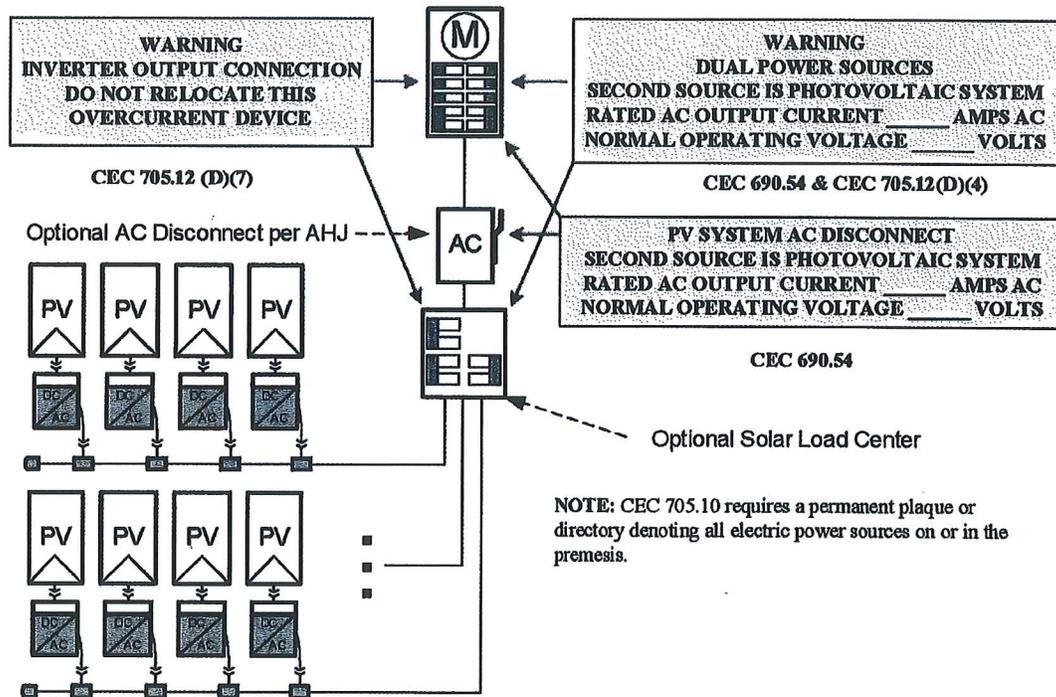
Check one of the boxes for whether system is grounded or ungrounded: Grounded Ungrounded

For Microinverters with a grounded DC input, systems must follow the requirements of GEC (CEC 690.47) and EGC (CEC 690.43).

For ACM systems and Microinverters with ungrounded a DC input follow the EGC requirements of (CEC 690.43).

Markings

Informational note: ANSI Z535.4 provides guidelines for the design of safety signs and labels for application to products. A phenolic plaque with contrasting colors between the text and background would meet the intent of the code for permanency. No type size is specified, but 20 point (3/8") should be considered the minimum.



Solar PV Standard Plan — Simplified Central/String Inverter Systems for One- and Two-Family Dwellings Single-Inverter Line Diagram

Equipment Schedule

TAG	DESCRIPTION: (Provide model # if provided)
1	Solar PV Module or ACM:
2	Microinverter (if not ACM):
3	Junction Box (es):
4	Solar Load Center, Yes / No:
5	Performance Meter, Yes / No:
6	*Utility External Disconnect Switch Yes / No:
7	Main Electrical Service Panel

Single-Line Diagram for Microinverters or ACMS

Check a box for dc system grounding: Grounded, Ungrounded
 For ungrounded dc power systems, EGC is required
 For grounded dc power systems, GEC & EGC are required
 Refer to CEC 250.120 for EGC Installation & Table 250.122 for sizing
 * Consult with your local AHJ and /or Utility

Conductor, Cable and Conduit Schedule

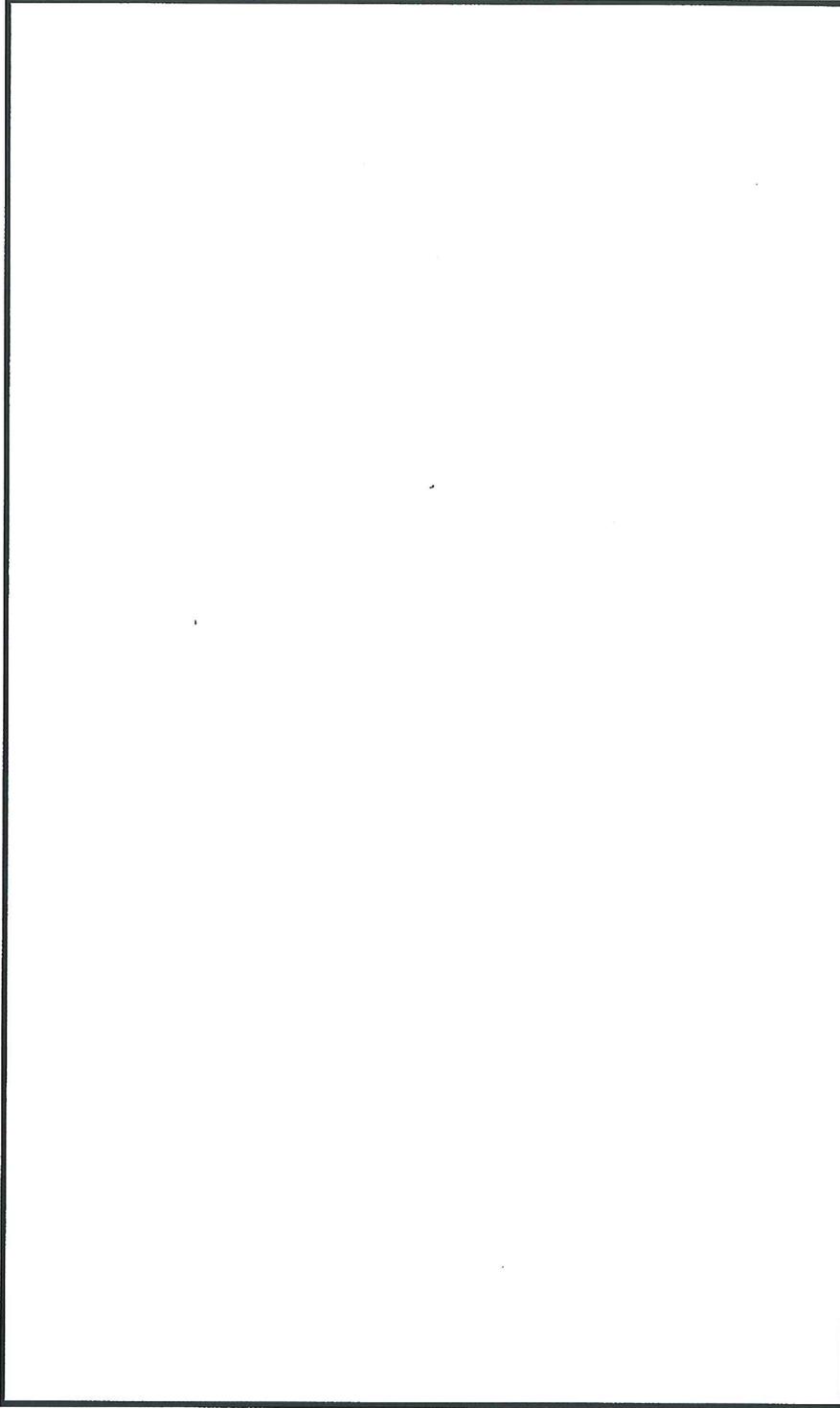
TAG	Description and Conductor Type: (Table 3)	Conductor Size	Number of Conductors	Conduit/Conductor/Cable Type	Conduit Size
A	Current-Carrying Conductors: (for each branch circuit) EGC:				
B	Current-Carrying Conductors: EGC: GEC (when required):				

The diagram illustrates the electrical flow from three PV modules (tag 1) through DC-to-AC inverters (tag 2) and junction boxes (tag 3). The system then passes through a solar load center (tag 4) and a branch circuit OCPD (tag 5) before reaching the main service panel (tag 7). A utility external disconnect switch (tag 6) is also shown. Notes specify DC GEC requirements for ungrounded systems and EGC requirements for grounded systems.

SOLAR PV STANDARD PLAN — SIMPLIFIED

Microinverter and ACM Systems for One- and Two-Family Dwellings

ROOF LAYOUT PLAN



Items required: roof layout of all panels, modules, clear access pathways and approximate locations of electrical disconnecting means and roof access points.



Structural Criteria for Residential Rooftop Solar Energy Installations

Use of this document

This toolkit document includes a one-page list of structural criteria for over-the-counter or online approval, as well as attached tables and figures that supplement the criteria and explain their use.

This document applies to flush-mounted solar arrays installed on the roofs of wood-framed one- and two-family dwellings. "Flush-mounted" means the modules are installed parallel to, and relatively close to, the roof surface (see the "Solar Array Check" section of the Structural Criteria for specific qualifying requirements). This list is intended to be a simple pre-installation check to gain reasonable assurance that the design of the solar array complies with the structural provisions of the 2013 California Building Code (CBC) and 2013 California Residential Code (CRC). It is not intended to provide post-installation inspection criteria.

Currently Used Expedited Solar Permitting Approaches

This document is intended for jurisdictions without an expedited process for residential solar structural permitting, and is not intended to replace or supplant procedures for jurisdictions with an expedited process already in place. Good examples from jurisdictions with provisions for expedited structural permitting include the City of Los Angeles, which exempts residential solar installations from structural permitting if five simple requirements are met, and the East Bay Green Corridor's streamlined solar permitting process, which uses structural criteria tailored to typical conditions for that consortium of nine cities.

Regional and Site Assumptions

This document is based on the following regional and site assumptions:

- The dwelling is located in a ZERO snow load area (see Map 1).
- The dwelling is not in Wind Exposure D (within 200 yards of the ocean or a large coastal bay).
- If in Wind Exposure B (urban, suburban or wooded areas), the dwelling may be located:
 - in a Special Wind Region (see Map 2) with design wind speeds between 110 and 130 mph, or
 - on a tall hill, provided average slope is no steeper than 15%.
- If in Wind Exposure C (within 500 yards of large open fields or grasslands), the dwelling is:
 - in a standard 110 mph design wind speed region, and
 - not on a hill with a grade steeper than 5%.

Additional Options

The Chief Building Official (CBO) may consider adding rows to the structural criteria, based on personal judgment and their jurisdiction's conditions and history. Possible additional questions include:

- Regional and Site Checks
 - If the jurisdiction is in a mixed snow load area, with zero snow load only at lower elevations, consider asking "is the dwelling lower than elevation ___ feet?"

(Introductory text provided for jurisdiction's reference only. Do not attach to Criteria that follow.)

- If the jurisdiction is in a coastal region, consider asking "is the dwelling farther than 200 yards from the ocean or a large coastal bay?" to verify the dwelling is not in Wind Exposure D.
- If the jurisdiction is in a Special Wind Region with design wind speeds between 115 and 130 mph, consider verifying that the dwelling is in Wind Exposure B by asking "is the dwelling in an urban, suburban or wooded area, and *not* within 500 yards of open fields and grasslands?"
- If the jurisdiction is in a Special Wind Region with design wind speeds between 115 and 130 mph, consider verifying that there are no significant topographic wind speed-up effects by asking "is the dwelling in a relatively flat area (grade less than 5%) and not within 500 yards of the crest of a tall hill?"
- Roof Check
 - Based on the jurisdiction's one- and two-family housing stock and code compliance history, many CBOs will find it reasonable to assume that most dwellings' roof structures were designed to the building code in effect at the time the houses were built. If so, the roof structure code compliance check consists of the Contractor's visual roof audit, checking for unusual sagging or deterioration, without requiring additional measurements of existing rafters to check against span tables.
 - For CBOs of jurisdictions with evidence of structurally deficient one- and two-family housing stock or poor structural code compliance history, the CBO may elect to add the rafter span check option described in the criteria.

The Structural Toolkit and CRC Wind Speeds

The 2013 CRC contains an inconsistency related to wind speeds. Despite referencing ASCE 7-10 as its standard, the 2013 CRC's text and tables use outdated ASCE 7-05 wind speeds. Under the old ASCE 7-05 / CBC 2010, the basic design wind speed in most regions of the state was 85 mph (max. 3 second gust in 50 years). Under ASCE 7-10 / CBC 2013, the design wind speed has increased to 110 mph (max. 3 second gust in 700 years). Despite the different definitions of wind speed, design wind pressures remain essentially unchanged.

Because the Toolkit's structural document is intended to be forward looking, all wind speeds in the Toolkit document are based on the ASCE 7-10. This is clearly stated in the caption to the state wind speed map, and the Table 1 footnotes. This anticipates an obvious and expected correction to the CRC; otherwise the Toolkit would become immediately outdated when the CRC is amended to change the base design wind speed from mph to 110 mph.

2013 CRC text (ASCE 7-05) wind speeds equivalent to the 2013 CRC and CBC Reference Standard (ASCE 7-10) are shown below. See ASCE 7-10 Table C26.5-6 for additional information.

<u>2013 CRC text</u> <u>ASCE 7-05</u>	<u>2013 CRC and CBC Referenced Standard</u> <u>ASCE 7-10</u>
85 mph	110 mph
90 mph	115 mph
95 mph	120 mph
100 mph	126 mph
105 mph	133 mph

(Introductory text provided for jurisdiction's reference only. Do not attach to Criteria that follow.)

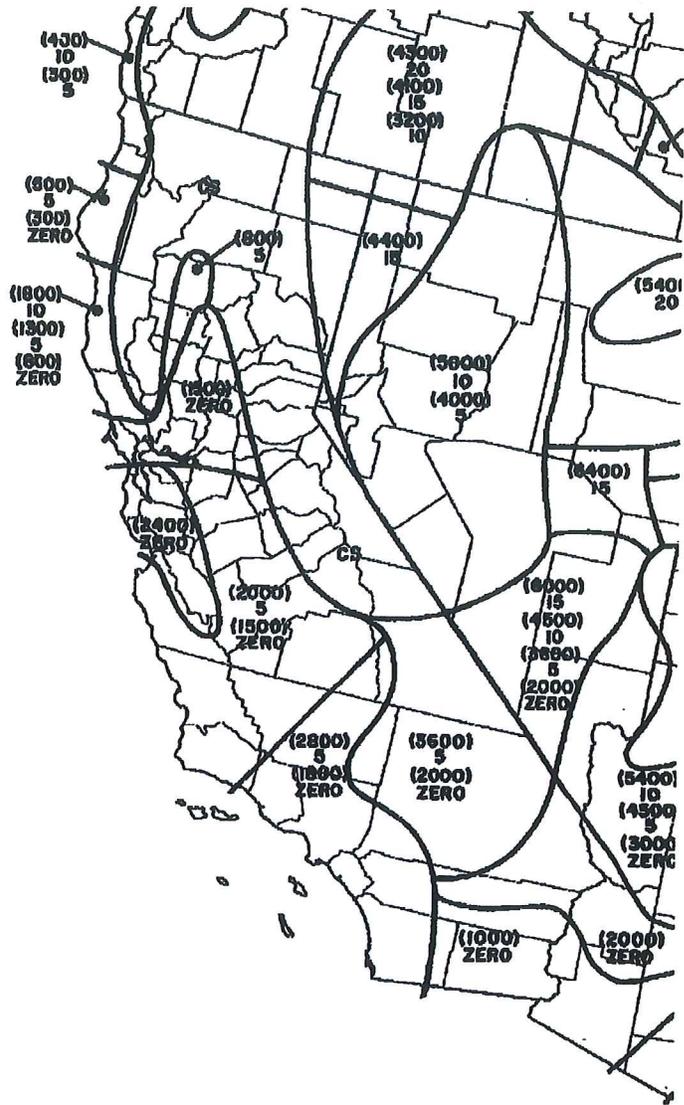
Structural Technical Appendix

This toolkit document is supported by a Structural Technical Appendix that describes the technical analysis behind these criteria, which are based on structural engineering principles and the California Building and Residential Codes. The Technical Appendix also provides some additional guidance to address non-conforming items, such as when an anchor layout is not based on a solar support component manufacturer's guidelines, or when a coastal site is located within 200 yards of the ocean (Exposure D). This document can be found online.

Probability of Code Compliance

The Structural Technical Appendix includes a section that examines the probabilities associated with the assumptions behind Table 1 that allows six feet cross-slope anchor spacing in some circumstances. That statistical analysis estimates that the probability of code noncompliance for six feet anchor spacing is only 2 in a thousand installations (0.2%). Note that probability of structural failure is orders of magnitude lower than the probability of code *noncompliance*.

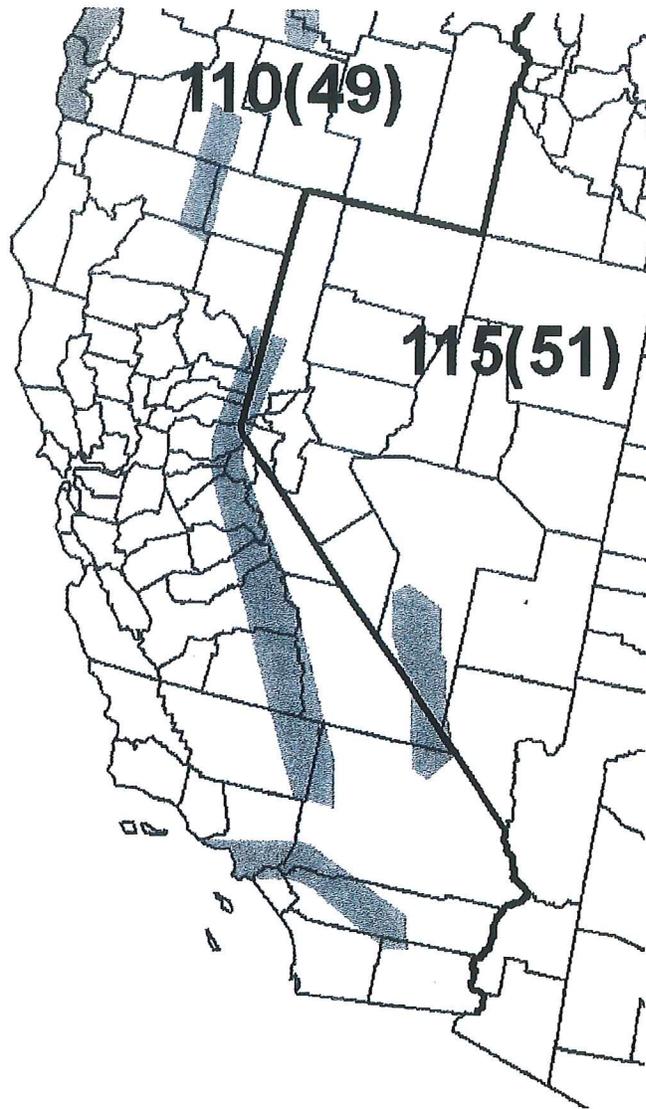
(Introductory text provided for jurisdiction's reference only. Do not attach to Criteria that follow.)



Map 1. California Ground Snow Load Map (Ref: ASCE 7-10).

The numbers in parentheses represent the upper elevation limits in feet for the ground snow load in psf listed below the elevation. Example: (2400) ZERO in the South San Francisco bay area indicates that zero ground snow loads occur from sea level up to an elevation of 2400 feet. CS indicates "Case Studies" where extreme local variations in ground snow loads occur. Non-zero snow load areas and Case Study (CS) areas are excluded from the use of this structural toolkit document. See the Technical Appendix for additional information.

(Map provided for jurisdiction's reference only. Do not attach to Criteria that follow.)



Map 2. California Design Wind Speed Map (Ref: ASCE 7-10).

The number outside the parentheses represents the design wind speed in mph. Typical design wind speed is 110 mph. The grey shaded areas on the map indicate "special wind regions" where higher wind speeds may apply. When the project is in a grey shaded area, contact the local building department for the design wind speed.

(Map provided for jurisdiction's reference only. Do not attach to Criteria that follow.)

STRUCTURAL CRITERIA FOR RESIDENTIAL FLUSH-MOUNTED SOLAR ARRAYS

1. ROOF CHECKS

A. Visual Review/Contractor's Site Audit of Existing Conditions:

- 1) Is the roof a single roof without a reroof overlay? Y N
- 2) Does the roof structure appear structurally sound, without signs of alterations or significant structural deterioration or sagging, as illustrated in Figure 1? Y N

B. Roof Structure Data:

- 1) Measured roof slope (e.g. 6:12): _____:12
- 2) Measured rafter spacing (center-to-center): _____ inch
- 3) Type of roof framing (rafter or manufactured truss): Rafter Truss

2. SOLAR ARRAY CHECKS

A. Flush-mounted Solar Array:

- 1) Is the plane of the modules (panels) parallel to the plane of the roof? Y N
- 2) Is there a 2" to 10" gap between underside of module and the roof surface? Y N
- 3) Modules do not overhang any roof edges (ridges, hips, gable ends, eaves)? Y N

B. Do the modules plus support components weigh no more than:

- 4 psf for photovoltaic arrays or 5 psf for solar thermal arrays? Y N

C. Does the array cover no more than half of the total roof area (all roof planes)?

Y N

D. Are solar support component manufacturer's project-specific completed worksheets, tables with relevant cells circled, or web-based calculator results attached?

Y N

E. Is a roof plan of the module and anchor layout attached? (see Figure 2)

Y N

F. Downward Load Check (Anchor Layout Check):

- 1) Proposed anchor horizontal spacing (see Figure 2): _____' - _____"ft-in

- 2) Horizontal anchor spacing per Table 1: _____' - _____"ft-in

- 3) Is proposed anchor horizontal spacing less than Table 1 spacing? Y N

G. Wind Uplift Check (Anchor Fastener Check):

- 1) Anchor fastener data (see Figure 3):

- a. Diameter of lag screw, hanger bolt or self-drilling screw: _____ inch

- b. Embedment depth of rafter: _____ inch

- c. Number of screws per anchor (typically one): _____

- d. Are 5/16" diameter lag screws with 2.5" embedment into the rafter

used, OR does the anchor fastener meet the manufacturer's guidelines? Y N

3. SUMMARY

A. All items above are checked YES. No additional calculations are required.

B. One or more items are checked NO. Attach project-specific drawings and calculations stamped and signed by a California-licensed Civil or Structural Engineer.

Job Address: _____

Permit #: _____

Contractor/Installer: _____

License # & Class: _____

Signature: _____ Date: _____

Phone #: _____

Optional Additional Rafter Span Check Criteria

[At option of CBO, insert rows (4) to (7) below into table above after row 1.B.(3)]

1. ROOF CHECKS

B. Roof Structure Data:

- 4) Measured rafter size (e.g. 13/4 x 33/4, not 2x4): _____ x _____ inch

- 5) Measured rafter horizontal span (see Figure 4): _____' - _____"ft-in

- 6) Horizontal rafter span per Table 2: _____' - _____"ft-in

- 7) Is measured horizontal rafter span less than Table 2 span? Y N Truss

(Jurisdictions may delete "Optional Additional Rafter Span Check" at bottom of this page, or incorporate into main list of Structural Criteria above)

Table 1. Maximum Horizontal Anchor Spacing				
Roof Slope		Rafter Spacing		
		16" o.c.	24" o.c.	32" o.c.
Photovoltaic Arrays (4 psf max)				
Flat to 6:12	0° to 26°	5'-4"	6'-0"	5'-4"
7:12 to 12:12	27° to 45°	1'-4"	2'-0"	2'-8"
13:12 to 24:12	46° to 63°	1'-4"	2'-0"	2'-8"
Solar Thermal Arrays (5 psf max)				
Flat to 6:12	0° to 26°	4'-0"	4'-0"	5'-4"
7:12 to 12:12	27° to 45°	1'-4"	2'-0"	2'-8"
13:12 to 24:12	46° to 63°	Calc. Req'd	Calc. Req'd	Calc. Req'd

Solar support component manufacturer's guidelines may be relied upon to ensure the array above the roof is properly designed, but manufacturer's guidelines typically do NOT check to ensure that the roof itself can support the concentrated loads from the solar array. Table 1 assumes that the roof complied with the building code in effect at the time of construction, and places limits on anchor horizontal spacing to ensure that a roof structure is not overloaded under either downward loads or wind uplift loads. Note 4 below lists the basic assumptions upon which this table is based.

Table 1 Notes:

1. Anchors are also known as "stand-offs", "feet", "mounts" or "points of attachment". Horizontal anchor spacing is also known as "cross-slope" or "east-west" anchor spacing (see Figure 2).
2. If anchors are staggered from row-to-row going up the roof, the anchor spacing may be twice that shown above, but no greater than 6'-0".
3. For manufactured plated wood trusses at slopes of flat to 6:12, the horizontal anchor spacing shall not exceed 4'-0" and anchors in adjacent rows shall be staggered.
4. This table is based on the following assumptions:
 - The roof structure conformed to building code requirements at the time it was built.
 - The attached list of criteria are met.
 - Mean roof height is not greater than 40 feet.
 - Roof sheathing is at least 7/16" thick oriented strand board or plywood. 1x skip sheathing is acceptable.
 - If the dwelling is in Wind Exposure B (typical urban, suburban or wooded areas farther than 500 yards from large open fields), no more than one of the following conditions apply:
 - The dwelling is located in a special wind region with design wind speed between 115 and 130 mph per ASCE 7-10, or
 - The dwelling is located on the top half of a tall hill, provided average slope steeper is less than 15%.
 - If the dwelling is In Wind Exposure C (within 500 yards of large open fields or grasslands), all of the following conditions apply:
 - Design wind speed is 110 mph or less (not in a Special Wind Region), and
 - The dwelling is not located on the top half of a tall hill.
 - The solar array displaces roof live loads (temporary construction loads) that the roof was originally designed to carry.
 - The Structural Technical Appendix provides additional information about analysis assumptions.

Table 2. Roof Rafter Maximum Horizontal Span (feet - inches) ¹								
Assumed Vintage	Nominal Size	Actual Size	Non-Tile Roof ²			Tile Roof ³		
			Rafter Spacing					
			16" o.c.	24" o.c.	32" o.c.	16" o.c.	24" o.c.	32" o.c.
Post-1960	2x4	1½"x3¾"	9'-10"	8'-0"	6'-6"	8'-6"	6'-11"	5'-6"
	2x6	1½"x5½"	14'-4"	11'-9"	9'-6"	12'-5"	10'-2"	8'-0"
	2x8	1½"x7¾"	18'-2"	14'-10"	12'-0"	15'-9"	12'-10"	10'-3"
Pre-1960	2x4	1¾"x3¾"	11'-3"	9'-9"	7'-9"	10'-3"	8'-6"	6'-9"
	2x6	1¾"x5¾"	17'-0"	14'-0"	11'-3"	14'-9"	12'-0"	9'-9"
	2x8	1¾"x7¾"	22'-3"	18'-0"	14'-6"	19'-0"	15'-6"	12'-6"

Beyond a visual review by the Contractor checking for unusual sagging or deterioration, some CBOs may want additional assurance that the roof structure complies with structural building code requirements. Table 2 is an optional table some CBOs may elect to use to provide additional assurance by requiring a check of existing roof rafter spans, and supports optional criteria 1.B.5 and 1.B.6. For post-1960 construction, these span tables match the rafter span tables found in the 2013 California Building and Residential codes. For pre-1960 construction, the rafter span tables are based on structural calculations with lumber sizes and wood species & grade appropriate for older construction. Note 5 below lists the basic assumptions upon which this table is based.

Table 2 Notes:

1. See Figure 4 for definition of roof rafter maximum horizontal span.
2. "Non-tile Roof" = asphalt shingle, wood shingle & wood shake, with an assumed roof assembly weight of 10 psf.
3. "Tile Roof" = clay tile or cement tile, with an assumed roof assembly weight of 20psf
4. Unaltered manufactured plated-wood trusses may be assumed to be code compliant and meet intent of Table 2.
5. This table is based on the following assumptions:
 - Span/deflection ratio is equal to or greater than 180.
 - For post-1960 construction, wood species and grade is Douglas Fir-Larch No. 2.
 - For pre-1960 construction, wood species and grade is Douglas Fir-Larch No. 1.
 - Other wood species and/or grade are also acceptable if allowable bending stress is equal or greater to that listed above.

(Attach Table 2 ONLY if the Optional Additional Rafter Span Check is added to the list of Structural Criteria)

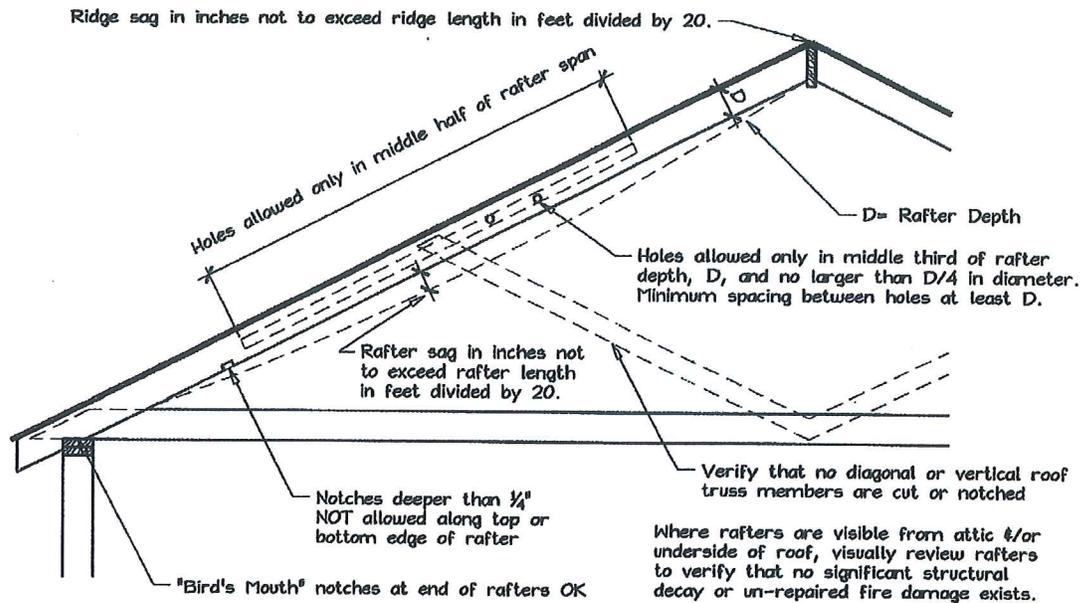


Figure 1. Roof Visual Structural Review (Contractor's Site Audit) of Existing Conditions.

The site auditor should verify the following:

1. No visually apparent disallowed rafter holes, notches and truss modifications as shown above.
2. No visually apparent structural decay or un-repaired fire damage.
3. Roof sag, measured in inches, is not more than the rafter or ridge beam length in feet divided by 20.

Rafters that fail the above criteria should not be used to support solar arrays unless they are first strengthened.

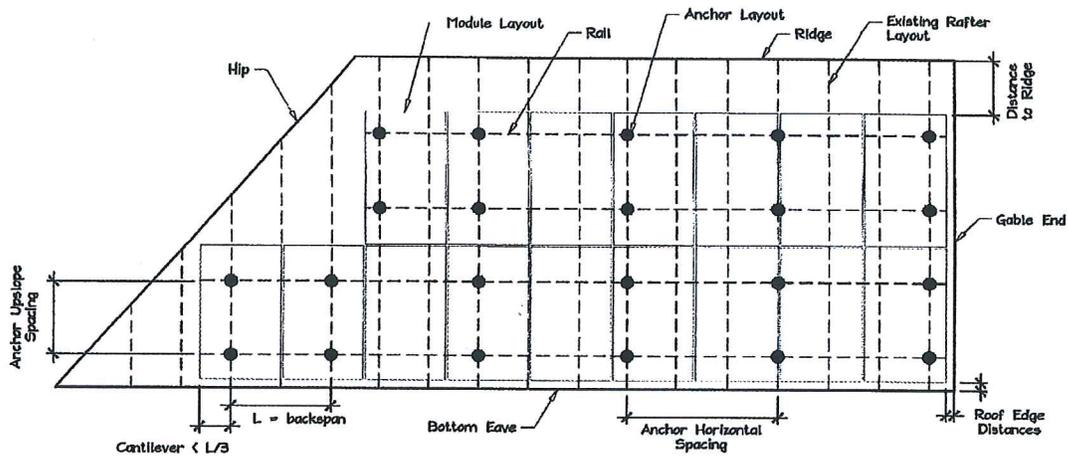


Figure 2. Sample Solar Panel Array and Anchor Layout Diagram (Roof Plan).

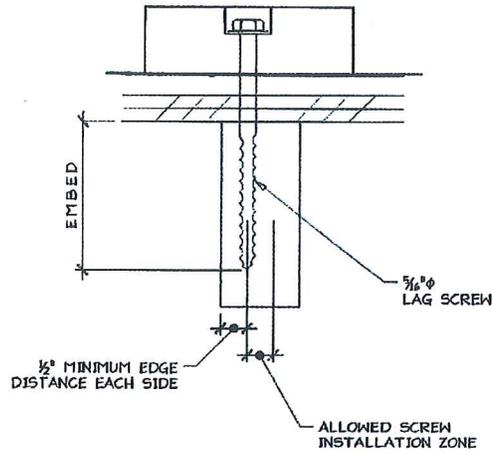


Figure 3. Typical Anchor with Lag Screw Attachment.

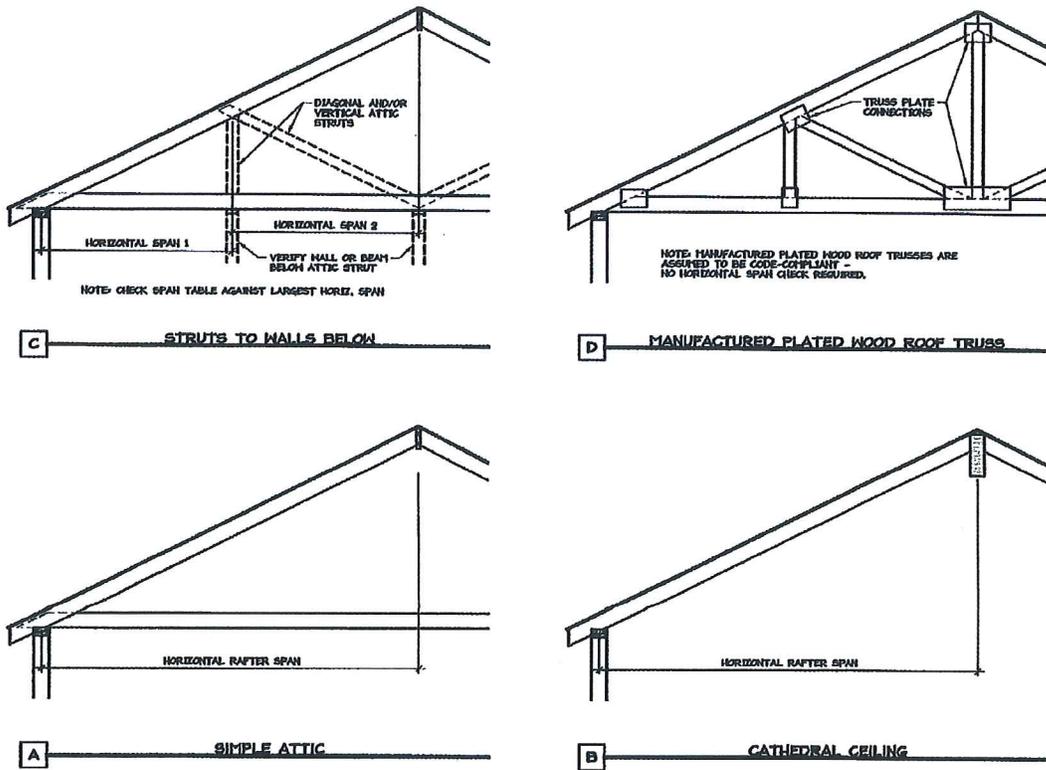


Figure 4. Definition of Rafter Horizontal Span.

(Attach Figure 4 ONLY if the Optional Additional Rafter Span Check is added to the list of Structural Criteria)



CITY OF NEEDLES

817 Third Street • Needles, California 92363
 (760) 326-2113 • FAX (760) 326-6765

*Mayor Jeff Williams
 Vice Mayor Steve Thomas
 Councilmember Don McCone
 Councilmember Rebecca Valentine
 Councilmember Richard Pletcher
 Councilmember Roy Mills
 Councilman Robert Smith
 City Manager Richard D. Rowe*

Photovoltaic Guidelines

• Program Description:

This program is designed to provide monetary incentives for the purchase and installation of photovoltaic (**PV**) or solar powered systems usually installed on the rooftops of homes and businesses. They operate using sunlight and create no noise or pollution.

A complete system usually consists of one or more modules connected to an inverter that changes direct current (DC) to alternating current (AC). The approximate cost per kilowatt of an installed PV system can range from \$7,500 to \$12,000 before the rebate payment. This can include the module, inverter, wiring, and interconnection equipment. Included in the above dollar amount is the cost of installation which ranges from \$6,000.00 to \$8,000.00, as well as sales tax and shipping charges (if applicable).

The incentive is available for qualifying PV systems. California Senate Bill 1 sets the recommended level of incentive for 2008 is \$2.80 per watt, per electric account (measured in AC output). The City of Needles has a maximum of 7,500 watts eligible for rebate. The rebate will be offered on the 7.5kW system for both residential and commercial projects. The rebate amount is decreased 7% so that the rebate is phased out by year 14 (the final year of the program)

Program Guidelines:

- This program is available to the City of Needles residential and commercial electric customers.
- Applicant must be a City of Needles electric customer. If applicant is a tenant or leases space, the property owner must sign the rebate application prior to its submission.
- Program participation requires systems to be installed at the service address.
- Project costs include the photovoltaic cells, modules, mounting or tracking structures, wiring, inverters, and utility interconnection equipment.
- The applicant must complete installation, or a California licensed contractor with the proper specialty code. The applicant is responsible for checking with appropriate state, county, city agencies, as well as the property owner regarding local conditions, restrictions, codes, ordinances, rules and regulations prior to installation.

- Contractors must have one of the following licenses:
 1. C-10 Electrical Contractor
 2. General Engineering "A" Contractor
 3. C-46 Solar Contractor
- To verify whether a contractor meets any of the above requirements, call the California Contractor's State License Board at 800-321-2752
- The City of Needles does **NOT** pay for electricity produced in excess of the customer's demand.
- Only California Energy Commission certified PV modules and inverters qualify for this program and are subject to approval by the City of Needles. The list of eligible equipment to determine eligibility for the Solar Support Program for PV modules (panels) and PV Inverters can be found on the CEC web site at: www.consumerenergycenter.org/erprebate/equipment.htm#1
- The CEC also provides a list of retailers and vendors of solar photovoltaic equipment at: www.consumerenergycenter.org/erprebate/databasetindex.html
- Applicant must complete an Interconnection Agreement for Net Energy Metering (NEM) with the City of Needles Electric Department prior to final connection to the grid and before any incentive can be paid.
- If there is a discrepancy between the guidelines and NEM Agreement, the **NEM** will supersede the guidelines.
- Applicant must comply with all Planning, Building and Safety, and Electric plan- check procedures.
- Systems will be inspected before rebate is issued, and must be interconnected to the City's electric meter.
- IT is recommended that you first hire a solar designer, consultant or contractor. After you and your contractor have selected the PV system and know the brand, model and number of panels you plan to install, you should call the City of Needles Electric Department at (760) 326-5700 for an update on the Solar Support Program's funding status. All rebates will be paid on a first come, first served basis until funding is exhausted. The City of Needles does not reserve funds for proposed PV projects. In addition you must submit plans and sign a City of Needles interconnection and NET Metering Agreement, and submit to an inspection by the utility **BEFORE** you connect the PV system to the utility grid. You or your contractor must also submit plans and secure both a building permit and electrical permit from the City of Needles Community Development Department. You can reach them at (760) 326-2115 extension #327.
- **A copy of the original dated and signed invoice or sale agreement and a copy of the signed off permit must be provided, and is subject to verification. The**

documentation must note the contractor name, address, manufacture's name, PV module number and inverter, total system capacity and purchase price.

- The City will conduct a final inspection to make sure that the applicable system were properly installed and interconnected in accordance with Electric Utility guidelines.
- Complete and return the application and supporting documentation to: **City of Needles, Electric Department, 817 Third Street, Needles, California 92363.**
- The application and supporting documentation must be submitted within 180 days of purchasing or installation of the PV system in order to qualify for a rebate.
- Rebates will be paid to the electric customer only. The name on the invoice must match the name on the electric customer account.
- Rebates will be issued within 4 to 6 weeks after verification of submitted paperwork, and completion of follow up inspection.
- A home or on-site audit will be conducted within 12 months after the application has been processed. Disparities discovered during the audit may result in rebate reversal.
- The cost of the bi-directional meter will be deducted from the rebate.
- This program will be continuous provided funds are available. **Other related solar web links:**

California Solar Center
www.californiasolarcenter.org/index.html

U.S. Department of Energy- Energy Efficiency and Renewable Energy
www.eere.energy.gov/solar/

National Center for Photovoltaics
www.nrel.gov/ncpv/pvmenu.cgi

National Renewable Energy
Laboratory www.nrel.gov/solar

Solar Electric Power Association
www.solarelectricpower.org/

**PHOTOVOLTAIC INTERCONNECTION AGREEMENT
FOR
NET ENERGY METERING
FROM
RESIDENTIAL SOLAR ELECTRIC GENERATING FACILITIES
OF 10 KILOWATTS OR LESS**

_____ ("Customer-Generator"), and
Needles Public Utility Authority ("NPUA") referred to collectively as "Parties" and
individually as "Party", agree
as follows:

1. SOLAR-ELECTRIC GENERATING FACILITY:

1.1 PVID Number: _____

1.2 PV Array Rating: _____ kW.

1.3 Address:

1.4 Facility will be ready for operation on or about _____
(date)

1.5 Location of NPUA Substation and Circuit:

1.6 Operating Option

Customer-Generator has elected to operate its solar-electric generating facility in parallel with NPUA's facilities. The solar-electric generating facility is intended primarily to offset part or all of the Customer-Generator's own electrical requirements.

2. PAYMENT FOR NET ENERGY

2.1 NPUA will determine for each billing period the energy generated and the energy used. In any billing period where the energy used exceeds the energy generated on the Customer-Generator's premise, the Customer-Generator will be billed for the net energy used. In the event energy generated by the facility exceeds the energy used on the Customer-Generator's premise during any billing period, the amount of the net excess energy will be credited against the Customer-Generator's energy usage in the next billing period. Accounts shall zero out at the end of the twelve (12) month period following the date of final interconnection of the Customer-Generator's eligible Solar Photovoltaic system. NPUA does not pay for electricity produced in excess of Customer's demand.

2.2 Customer-Generator shall pay any amount owing for electric service provided by NPUA in accordance with applicable rate schedules.

3. INTERRUPTION OR REDUCTION OF DELIVERIES

3.1 NPUA shall not be obligated to accept or pay for, and may require Customer-Generator to interrupt or reduce, deliveries of as-available energy:

(a) When necessary in order to construct, install, maintain, repair, replace, remove, Investigate, or inspect any of its equipment or any part of its system; or

(b) If NPUA determines that curtailment, interruption, or reduction is necessary because of emergencies, forced outages, force majeure, or compliance with prudent electrical practices.

3.2 Whenever possible, NPUA shall give Customer-Generator reasonable notice of the possibility that interruption or reduction of deliveries may be required.

3.3 Notwithstanding any other provisions of this Agreement, if at any time NPUA determines that either

(a) the facility may endanger NPUA personnel, or

(b) the continued operation of Customer-Generator's facility may endanger the integrity of NPUA's 's electric system, NPUA shall have the right to disconnect Customer-Generator's facility from NPUA 's electric system. Customer-Generator's facility shall remain disconnected until such time as NPUA is satisfied that the conditions(s) referenced in (a) or (b) of this Section 3.3 have been corrected.

4. INTERCONNECTION

4.1 Customer-Generator shall deliver the as-available energy to NPUA at the utility's meter.

4.2 Customer-Generator shall pay for designing, installing, operating, and maintaining the solar-electric generating facility in accordance with all applicable laws and regulations and shall comply with NPUA's Appendix A, which is attached hereto.

4.3 Customer-Generator shall not commence parallel operation of the generator facility until written approval of the interconnection facilities has been given by NPUA. Such approval shall not be unreasonably withheld. NPUA shall have the right to have representatives present at the initial testing of Customer-Generator's protective apparatus

5. MAINTENANCE AND PERMITS

Customer-Generator shall obtain any governmental authorizations and permits required for the construction and operation of the solar-electric generating facility and interconnection facilities and shall maintain all facilities in a safe and prudent manner and in conformance with all applicable laws and regulations including, but not limited to, NPUA's Appendix A.

Customer-Generator shall reimburse NPUA for any and all losses, damages, claims, penalties, or liability it incurs as a result of Customer-Generator's failure to obtain or maintain any governmental authorizations and permits required for construction and operation of Customer-Generator's generating facility.

6. ACCESS TO PREMISES

NPUA may enter Customer-Generator's premises:

(a) to inspect, at all reasonable hours, Customer-Generator's protective devices and read or test meter, and

(b) to disconnect, without notice the interconnection facilities if, in NPUA's opinion, a hazardous condition exists and such immediate action is necessary to protect persons, or NPUA's facilities, or property of others from damage or interference caused by Customer-Generator's solar-electric facilities, or lack of properly operating protective devices.

7. INDEMNITY AND LIABILITY

7.1 Each party as indemnitor shall defend, hold harmless, and indemnify the other Party and the directors, officers, employees, and agents of such other Party against and from any and all loss, liability, damage, claim, cost, charge, demand, or expense (including any direct, indirect, or consequential loss, liability, damage, claim, cost, charge, demand, or expense, including attorney's fees) for injury or death to persons including employees of either Party and damage to property including property of either Party arising out of or in connection with (a) the engineering, design, construction, maintenance, repair, operation, supervision, inspection, testing, protection or ownership of, or (b) the making of replacements, additions, betterments to, or reconstruction of, the indemnitor's facilities; provided, however, Customer-Generator's duty to indemnify NPUA hereunder shall not extend to loss, liability, damage, claim, cost, charge, demand, or expense resulting from interruptions in electrical service to NPUA's customers other than Customer-Generator. This indemnity shall apply notwithstanding the active or passive negligence of the indemnitee. However, neither Party shall be indemnified hereunder for its loss, liability, damage, claim, cost, charge, demand, or expense resulting from its sole negligence or willful misconduct.

7.2 Notwithstanding the indemnity of Section 7.1, and except for a Party's willful misconduct or sole negligence, each Party shall be responsible for damage to its facilities resulting from electrical disturbances or faults.

7.3 The provisions of this Section 7 shall not be construed to relieve any insurer of its obligations to pay any insurance claims in accordance with provisions of any valid insurance policy.

7.4 Except as otherwise provided in Section 7.1, neither Party shall be liable to the other Party for consequential damages incurred by that Party.

7.5 If Customer-Generator fails to comply with the insurance provisions of this Agreement, if any, Customer-Generator shall, at its own cost, defend, hold harmless and indemnify NPUA, its directors, officers, employees, agents, assignees, and successors in interest from and against any and all loss, liability, damage, claim, cost, charge, demand, or expense of any kind or nature (including attorneys' fee and other costs of litigation) resulting from the death or injury to any person or damage to any property, including the personnel and property of NPUA, to the extent that NPUA would have been protected had Customer-Generator complied with all such insurance provisions. The inclusion of this Section 7.5 is not intended to create any express or implied right in Customer-Generator to elect not to provide any such required insurance.

8. INSURANCE *(Optional)*

8.1 Customer-Generator shall maintain, during the term of this Agreement Comprehensive Personal Liability Insurance with a combined single limit of not less than one hundred thousand dollars (\$100,000) for each occurrence.

8.2 Such insurance required in Section 8.1 shall, by endorsement to the policy or policies, provide for thirty (30) calendar days written notice to NPUA prior to cancellation, termination, alterations, or material change of such insurance.

8.3 NPUA shall have the right to inspect or obtain a copy of the original policy or policies of insurance.

8.4 Customer-Generator shall furnish the required certificates and endorsements to NPUA prior to commencing operation.

8.5 All insurance certificates, endorsements, cancellations, terminations, alterations, and material changes of such insurance shall be issued and submitted to the following:

NPUA - 817 Third Street
Needles, California 92363

9. GOVERNING LAW

This Agreement shall be interpreted, governed, and construed under the laws of the State of California as if executed and to be performed wholly within the State of California.

10. AMENDMENT MODIFICATION OR WAIVER

Any amendments or modifications to this Agreement shall be in writing and agreed to by both Parties, The failure of any Party at any time or times to require performance of any provision hereof shall in no manner affect the right at a later time to enforce the same.

No waiver by any Party of the breach of any term of covenant contained in this Agreement, whether by conduct or otherwise, shall be deemed to be construed as a further or continuing waiver of any such breach or waiver of the breach of any other term or convent unless such waiver is in writing.

11. APPENDIX

The Agreement includes the following appendix, which is attached and incorporated by reference:

Appendix A: NPUA's Photovoltaic Interconnection Standards for Residential Solar Electric Generating Facilities of 10 kW or Less

12. NOTICES All written Notices shall be

directed as follows:

NPUA- 817 Third Street
Needles, California 92363

CUSTOMER-GENERATOR:

Name
Address
City

Customer-Generator's notices to NPUA pursuant to this Section 12 shall reference the PVID Number set forth in Section 1.1

13. TERM OF AGREEMENT

This Agreement shall be in effect when signed by the Customer-Generator and NPUA and shall remain in effect thereafter month-to-month unless terminated by either Party on thirty (30) days' prior written notice in accordance with Section 12.

**Guidelines for the Public Benefit Program
for Use with Solar Power Plants in Needles, California**

The City Council of the City of Needles approves the following Public Benefit Program guidelines for negotiating specific agreements with developers of utility-scale solar projects.

Community Benefit

The City of Needles should receive a community benefit in order to provide for a concerted and coordinated effort to maximize the benefits of the solar project to the City and its residents. Such benefits might include, but are not limited to, infrastructure improvement, job creation, economic development and enhancement to the quality of life in Needles and neighboring communities. Guidelines for the annual payments should be as follows:

1. Annual Payment Amount:
 - a. Years 1-10: \$150 per project acre
 - b. Years 11 through end of project: \$200 per project acre plus applicable CPI.
2. Incentives and credits may be provided, as negotiated, for local hire, veteran hire, permanent hire or early start.

Sales Tax Benefit

It is the goal of the City of Needles to maximize the sales tax revenue received during the construction of solar plant projects. This revenue may be used to provide for a concerted and coordinated effort to maximize the benefits of the project to the City of Needles and its residents. Such benefits may include, but are not limited to, infrastructure improvement, job creation, community services, economic development and enhancement to the quality of life in Needles and neighboring communities. The following should be implemented to meet this goal;

1. Developer, to the extent permissible by law, will require that the developer and all qualifying contractors and subcontractors obtain the appropriate Board of Equalization permit that allows allocation of all eligible use tax payments to the City of Needles.
2. Developer, to the extent permissible by law, will guarantee that the City of Needles will receive a specified amount of the expected sales tax revenue.

Other Benefits

If the project proposes to provide additional benefits to the community, such benefits should be considered.

Voluntary Agreement

It is optional for each Developer to enter into a public benefit agreement. If a Developer chooses to enter into a public benefit agreement, such agreement shall be set forth in a legally acceptable form approved by the City's Counsel such as a development agreement. Each project must be looked at individually.

RESOLUTION NO. _____

**A RESOLUTION OF THE CITY OF NEEDLES ESTABLISHING
GUIDELINES FOR THE PUBLIC BENEFIT PROGRAM FOR USE WITH SOLAR
POWER PLANTS IN NEEDLES**

WHEREAS, the State of California has mandated that 33 percent of the total electricity sold to retail customers by December 31, 2020 come from renewable energy resources and 75 percent of all such renewable energy resources must be from in-state sources by 2017; and,

WHEREAS, solar energy projects may not create the economic advantages or permanent employment opportunities that other development could offer; and,

WHEREAS, while the City of Needles wishes to do its part in assisting the State of California and RETI in meeting their renewable energy goals, it does not want this accomplished at the expense of its residents, since solar power plants that commit vast areas of Imperial County to energy production may preclude all other potential uses, including, agricultural and open space uses; and

WHEREAS, the City of Needles supports the development of renewable energy projects, provided that all environmental and economic negative effects and community concerns related to those projects are fully addressed; and,

WHEREAS, on _____, the City of Needles is committed to developing solar energy projects while addressing all environmental and economic negative effects and community concerns related to solar projects. Such commitment is referred to generally as the "Public Benefit Program;" and

WHEREAS, the City of Needles Public Benefit Program is designed to address concerns expressed by the local community and others related to negative effects of these projects; and

WHEREAS, in order to properly address the concerns of the community, the City of Needles encourages and recommends that developers participate in the Public Benefit Program, on all utility-scale solar projects.

NOW, THEREFORE, BE IT RESOLVED THAT the City Council of the City of Needles approves the attached Public Benefit Program guidelines for negotiating specific agreements with developers of utility-scale solar projects.

PASSED AND ADOPTED by City Council of the City of Needles, on this ____ day of _____ by the following vote:



CITY OF NEEDLES

817 Third Street • Needles, California 92363
(760) 326-2113 • FAX (760) 326-6765

*Mayor Edward T. Paget
Vice Mayor Jeff Williams
Councilmember Tony Frazier
Councilmember Jim Lopez
Councilmember Robert A. Richardson
Councilmember Louise Evans
Councilmember Tom Darcy
City Manager Rick Daniels*

CERTIFICATION

I, Dale Jones, City Clerk of the City of Needles, California, do hereby certify that the foregoing is a true and correct copy of Ordinance Number 572-AC

Dale Jones, CMC, City Clerk
(SEAL)

Date: November 19, 2015