PPCSIP Calculator User Guide

1. Guide Overview

This User Guide provides background on the Pacific Power California Solar Incentive Program (PPCSIP) EPBI Calculator. The Guide describes how the calculator determines the PPCSIP incentive for a proposed system and detailed step by step instructions on its use. The calculator is web-accessible at http://www.pacificpowercasolar.com/solar-calculator.html

The PPCSIP-EPBI calculator is a tool available to participants of the Pacific Power California Solar Incentive Program to determine the PPCSIP Rating and calculate an appropriate incentive level based on a reasonable expectation of performance for an individual system. The PPCSIP-EPBI Calculator has also been created for consumer's to educate themselves on the differences of solar system design and how changes to the PV system's specifications will produce different kilowatt hour results over the course of a year. Please be aware that actual performance of an installed PV system is based on numerous factors, including some factors that may not be considered in the PPCSIP-EPBI Calculator. While this calculator relies on industry-standard assumptions, and is driven by NREL's PV Watts, there may be other factors that affect the output of your PV System.

2. PVWatts Web Service

The PPCSIP-EPBI calculator utilizes NREL's PV Watts v2 to estimate the performance of proposed and optimal systems. Calculation of the Expected Annual Generation will be performed by the PVWatts v2 web service provided by the National Renewable Energy Laboratory (NREL). More information about this service can be found at http://www.nrel.gov/rredc/pvwatts/grid.html

The Tool will pass the following inputs to the PVWatts web service:

a. Latitude (user input)
b. Longitude (user input)
c. DCRating [(DC Rating for module in Equipment List) * (#modules)]
d. Derate
e. Tilt (user input)
f. Azimuth (user input)
g. NOCT (Nominal Operating Cell Temperature)

3. PPCSIP Eligibility

Eligible photovoltaic (PV) projects must be located within sites where the Host Customer is a Pacific Power retail electric customer. Systems between 1 kW and 5 MW are eligible to participate in PPCSIP, however incentives are paid on the first 250 kW of installed capacity. PPCSIP rebates are available to qualified residential, commercial, industrial, government and irrigation customers for solar PV systems on both new and existing buildings.

Program eligibility details can be found at: http://www.pacificpowercasolar.com/index.html

3. PPCSIP Calculator Overview

The PPCSIP calculator is an internet accessible tool (http://www.pacificpowercasolar.com/solar-calculator.html) used to determine the Design Factor and the resulting Expected Performance Based Incentive (EPBI) for eligible PPCSIP proposed systems.

For all projects, the expected performance of the system will determine the incentive amount. The calculator determines the PPCSIP incentive for a PV system by using required site and system information specified by the user. When first opened, the calculator has an input page, where the user enters the project name, zip code, location of the system, type of customer, and annual site demand. The system specifications of each array are also entered, including PV array name, the type and number of PV modules, mounting method, the type and number of inverters, shading, and the proposed system's tilt and azimuth. For the purposes of PPCSIP, an array is defined as a grouping of modules with a single type of PV panel, inverter, tilt and azimuth combination. The PPCSIP-EPBI calculator is designed to calculate incentives for systems either with a single array, or mixed systems that use different types of inverters, PV panels, or have varying tilts and/or azimuths. A mixed system will require the user to add additional array information for each combination by clicking the "Add Additional Array" button at the bottom of the input page.

Once all required data is entered, the user initiates the calculator by clicking the "Calculate" button. The calculator then calls NREL's PV Watts v2 performance calculator passing to it information on the proposed system and its location. The PV Watts model returns to the calculator the monthly electric energy production of the proposed PV system. The calculator then uses the PV Watts results to determine the resulting PPCSIP incentive for the proposed system.

The following incentive rates will be used for incentive calculations:

Step	Total kW Installed per Step	Residential kW 33%	Commercial / Tax Exempt kW 67%	Residential / Commercial Incentives $/Watt	Tax Exempt Incentive $/Watt
1	448	148	300	$2.00	$2.75
2	483	160	323	$1.50	$2.25
3	520	172	348	$1.13	$1.88
4	467	154	313	$0.84	$1.59
5	501	165	336	$0.63	$1.38
6	540	178	362	$0.47	$1.22
7	583	192	391	$0.36	$1.11

4. Required Calculator Inputs

The inputs for the PPCSIPEPBI calculator are described below.

Project Name: Title identifying the project.

ZIP Code: This is the zip code of the location of the proposed PV system. Note that this zip code must be located within the specified utility's service territory where the system is or will be located.

Customer Type: Customer Type will be a dropdown menu with the following two choices:

- Residential
- Commercial

Annual Site Demand: Site demand must be greater than zero and less than $1x10^9$. This is the Host Customer's last 12 months of consumption data in kWh.

PV Array Name: Title identifying the array.

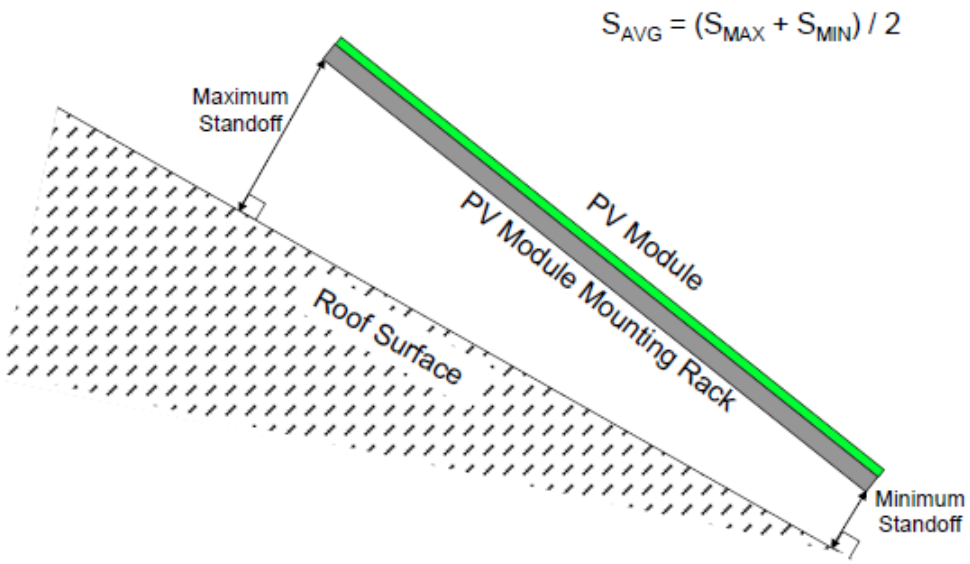
PV Module: Select the module that will be used in the proposed PV system. The options in this pull-down are based on the CEC's list of eligible photovoltaic modules, which can be found at http://www.gosolarcalifornia.org/equipment/.

Number of Modules: This is the total number of PV modules of the selected type that will be connected to the inverter(s) that are selected below.

Mounting Method: This is the "average standoff" between the mounting surface and bottom of the PV module frame or mounting rack, whichever is closest to the mounting surface. The selections are:

• *0" average standoff (flush mount or BIPV)* – Where the PV mounting rack is in direct contact with the mounting surface or the PV modules lack outdoor air ventilation.
• *> 0" to 1" average standoff* – The average standoff is 1" or less
• *> 1" to 3" average standoff* – The average standoff is 3" or less, but greater than 1"
• *> 3" to 6" average standoff* – The average standoff is 6" or less, but greater than 3"
• *> 6" average standoff* – The average standoff is greater than 6"

"Average standoff" (S_{AVG}) is the sum of the minimum and maximum standoff divided by two. Standoff is the distance perpendicular from the mounting surface to the bottom of the PV module frame. One minimum and maximum standoff distance must be established per array. See illustration below.



Inverter: This is the type of inverter that will be used with the proposed PV system. The options in this pull-down are based on the CEC's list of eligible inverters found at http://www.gosolarcalifornia.org/equipment/. If multiple inverter types are to be used, you must add additional arrays, and use only one inverter per array.

Number of Inverters: This is the total number of inverters of the selected type that will be installed for use with the PV modules selected above.

Minimal Shading: This criterion, if checked, indicates that no solar obstruction is closer than a distance twice the height it extends above the PV modules. If this criterion is met and Minimal Shading is checked, no derating due to shading is applied. Note that the reference optimal systems at the proposed and reference locations are always specified to meet the "Minimum Shading Criteria".

Shading Derate Factors (%): If the proposed system does not meet the "Minimum Shading Criteria", the user is required to input monthly non-shaded results from a shading study conducted at the proposed system site.

Array Tilt (degrees): This is the proposed system tilt from horizontal. Flat (horizontal) systems have a 0º tilt. Tilt must be greater or equal to zero and less than or equal to 90°.

Array Azimuth (degrees): This is the horizontal direction ("true" north-south) the proposed system is pointing; due South is 180º azimuth and due North is 0º azimuth. The optimal reference system for proposed flat (horizontal) systems is assumed to have a 180º azimuth. Magnetic direction measured by a compass can be converted to "true" direction by adding the appropriate magnetic declination for the specific location. Magnetic declination can be determined at the NOAA website (http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp).

After the inputs are set, the user can click the "Calculate" button and the calculations will be executed.

5. Description of the Outputs

Once the calculator has completed its computations, it will display a results page containing inputs (Site Specifications and PV System Specifications) and outputs (Results) for the proposed and reference optimal system, as well as the Design Factor and calculated incentive. If the user wishes to apply to the PPCSIP program, they must include a copy of the EPBI Calculator results screen in their application materials.

All production estimates are obtained from running NREL's PV Watts v2 photovoltaic performance model using the proposed system parameters and weather data for the proposed and reference locations.

The outputs are described below.

Results

CEC-AC Rating: This is the product of the PV module PTC rating, module count and inverter efficiency.

Annual Expected Generation: This is the estimated annual energy output of the proposed system. This value is reported for the sole purpose of transparency of the calculator and is not a guarantee of future system performance.

kWh/kW: [Annual Expected Generation] / [CEC-AC Rating]

Eligible Generation: Eligible Generation is the lesser of "Eligible Demand" or "Annual Expected Generation" for systems > 5 kW. Eligible Generation equals "Annual Expected Generation" for systems ≤ 5kW.

Maximum Eligible System Size: [Eligible Generation] / [kWh/kW], capped at 250 kW.

Design Factor: The design factor is used to modify the maximum incentive rate based on the proposed system's estimated performance relative to an optimal system at the proposed location, an optimal system at a reference location and a well ventilated module installation. It is the product of the Design Correction, Geographic Correction, and Installation Correction for the proposed system.

PPCSIP Rating: The PPCSIP Rating is the system size rating that the PPCSIP incentive will be based upon. It is calculated as follows: [Design Factor] * [Maximum Eligible System Size]

Incentive Rate: This is the current PPCSIP incentive rate ($/W) and depends on the selected customer type.

Incentive Amount: This is the total incentive for the proposed system. The incentive amount for a system will be calculated as follows: [PPCSIP Rating] * [Incentive Rate] * 1000

Design Factor Details:

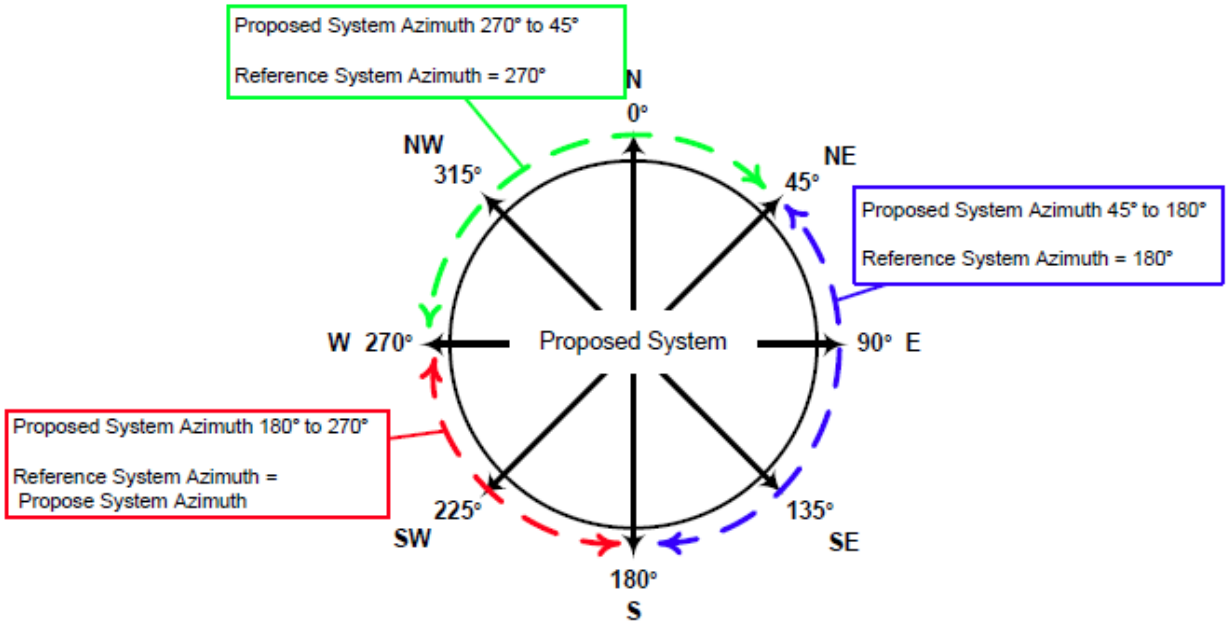
The “Design Factor Details” and notes provide additional information on all of the inputs used to calculate the Design Factor for the proposed system. When the “View Details” link to the right of the Design Factor is clicked, a new section titled “Design Factor Details” will dynamically appear below the “Results” section on the Calculation Results page. Clicking the “Hide Details” link will hide the “Design Factor Details” and the “Design Factor Notes” sections. The “Design Factor Details” and “Design Factor Notes” will not be displayed in the downloadable PDF version of the Calculation Results.

Design Correction: Design Correction is calculated as the ratio of the summer production of the proposed system, with proposed tilt and azimuth, and the optimal system estimated production at the proposed location, with optimal tilt and azimuth. It indicates how well optimized the proposed system is configured.

Geographic Correction: Geographic Correction is calculated as the ratio of the annual production of the summer optimal south facing system at the proposed location, and the annual production of the summer optimal south facing system at the reference location.

Installation Correction: Installation Correction is calculated as the ratio of the adjusted PTC rating and the unadjusted PTC rating of the proposed system. The adjusted PTC rating is dependent on the mounting method, NOCT and power temperature coefficient for a specific module.

Optimal Tilt (proposed azimuth): This is the system’s optimal tilt, maximizing summer output, at the proposed location. The optimal tilt also depends on the azimuth of the optimal reference system. The following illustrates how the reference system azimuth is set to treat south and west facing systems equally. If the azimuth of the proposed system is oriented between 180° and 270° it is compared to a reference system with an equal azimuth. Consequently, systems oriented this way have a greater potential to achieve a higher design factor when all other site and design specifications are equal. Systems oriented between 270° and 45° are compared to a reference system with a 270° azimuth, while system oriented between 45° and 180° are compared to a reference system with a 180° azimuth.



Optimal Tilt (facing south): This is the tilt of summer optimal south facing systems at the proposed and reference locations.

Annual kWh: This is the estimated annual energy output of the proposed system. This value is reported for the sole purpose of transparency of the calculator and is not a guarantee of future system performance.

at optimal tilt: This is the estimated annual energy output of the summer optimized system at the proposed location. This value is reported for the sole purpose of transparency of the calculator.

facing south at optimal tilt: This is the estimated annual energy output of south facing summer optimized systems at the proposed and reference locations. These values are used to determine the Geographic Correction.

Summer Months: These are the months that define the summer period. The proposed and reference optimal system output for these months is used to determine the "Summer kWh".

Summer kWh: This is the estimated summer energy output of the proposed system.

at optimal tilt: This is the estimated summer energy output of the proposed system, optimized to maximize summer output.

facing south at optimal tilt: This is the estimated summer energy output of the proposed and reference location systems, both optimized to maximize summer output.

6. Shading Input Requirements

Proposed systems meet the "Minimum Shading Criteria" if any surrounding object is no closer than a distance twice the height it extends above the PV modules. If this criterion is met and Minimal Shading is checked, no derating due to shading is applied.

For systems that do not meet the "Minimum Shading Criteria", the user is required to input monthly shade impact results from a shading study conducted at the proposed system site. The study must use a shade analysis tool (and accompanying software) such as the Solar Pathfinder (http://www.solarpathfinder.com) or the Solmetric SunEye™ (http://www.solmetric.com). These inputs are used as monthly derate factors (100% = no shading, 0% = total shading) to adjust the PV Watts output for shading. The shade analysis tool must be specific to the location, azimuth and tilt of the system being measured and must correct for magnetic declination. Do not use a shade analysis tool that is only applicable to south facing systems if your system's azimuth is different than 180º. Please reference the shade analysis tool documentation for more instructions on its use and interpretation.

The shading study must consist of shading measurements taken at the system array's major corners with no adjacent measurement being more than 40 feet apart, and the average monthly derate factors input into the calculator. Additional measurements must be taken along any edge that is longer than 40 feet and the points of measurement shall be distributed evenly between two major corners.

8. Getting Help & Providing Comments

Questions and comments regarding the PPCSIP-EPBI Calculator or this User Guide should be emailed to PPCSIP@energycenter.org.