CALIFORNIA SOLAR ENERGY INDUSTRIES ASSOCIATION
916-747-6987 info@calseia.org
P.O. Box 782, Rio Vista, CA 94571

DOCKET
07-SB-1
DATE OCT 01 2008
RECD. OCT 06 2008

**COMMENTS ON THE CEC PROPOSED SB1 ELIGIBILITY GUIDELINES**
Docket No. 07-SB-1X
**October 1, 2008**

CALSEIA appreciates the opportunity to provide comments and recommendations on the proposed SB1 Eligibility Guidelines.

A number of changes were made to the handbook that will provide additional flexibility. CALSEIA appreciates those modifications.

A number of concerns remain that CALSEIA would like addressed prior to the implementation of the Guidebook.

## 1. DIRECT INDUSTRY COSTS TO COMPLY AS A RESULT OF CHANGING CALCULATORS

CALSEIA strongly recommends that the Energy Commission staff prepare and publish an assessment of the cost to small business that would result from the changes that are proposed by the new draft guidelines. While the guidelines are not presented as a regulation, where these costs would have to be considered as part of the rulemaking proceeding, the guidelines do have the affect of a regulation because all solar installations use the rebate programs to justify the up-front cost of acquiring a solar system. Every solar business in California is affected by these changes and they will experience costs to implement the changes. For small businesses, this impact can create an undue hardship.

Direct testimony provided during the workshop on September 29 included a cost estimate of:

a. **Minimum additional time required** for an organization with 25 sales people running calculator 15 times/day per salesperson: **22 hours/day**
b. The calculator change would require us to hire approximately **3 additional sales people** to do the same amount of work **increasing the cost of sales by 12%.**
c. **Additional cost to the company due to increased time spent**: $210,000/year

These estimated costs are **<u>in addition</u>** to the costs that are incurred due to the difficulties outlined below that relate to the operational problems with the proposed calculator.

## 2. PROPOSED CHANGE IN CALCULATOR YIELDS NON-REPEATABLE RESULTS

Based on an analysis provided by a CALSEIA Member (attached) as well as verbal discussions with a number of other solar companies, CALSEIA found that the performance and rebate outputs from the CEC calculator do not provide repeatable results. The attached example shows that an identical system, using the CEC shading method will yield results that are in the range of 7,630 to 5,654 kWh per year and rebates that range from $10,995 to 8,143.

The variability of results will cause the following problems:

a) Customers comparing bids from more than one company will be confused or misled by the results.
b) Companies will be able to 'game' the results to optimize the rebates.
c) Companies will face loss of income if an inspection calculates a performance level that is different than the contractor's calculation. Contractors also will incur increased expenses for time spent trying to justify the original calculation.

## 3. ALGORITHMS DO NOT ACCURATELY ACCOUNT FOR SHADING

CALSEIA examined the effect of shading using a standard Drain/Waste/Vent pipe that is a typical protrusion from a residential home (also shown in the attached example). It typically consists of no more than a 2" pipe projecting vertically from the roof between 18" and 24" in height. The analysis compares the shading effect of the DWV pipe and a tree. The tree was assumed to be 10' taller than the array and 10' from the corner of the array. According to the CEC calculator results, a 2" vent pipe would have a greater shading effect than a tree.

## 4. CALCULATOR DOES NOT ADAPT TO NEW TECHNOLOGIES

As stated during the workshop, new technologies are the current nature of the solar industry. Several parties testified and CALSEIA concurs that the proposed calculator does not accurately reflect the performance characteristics of some of these new products, in particular micro-inverters. The performance attributes of micro inverters, such as those made by Enphase (http://www.enphaseenergy.com), a California-based business, are not reflected in the calculator proposed by the Energy Commission. Other new technologies (for example, the Solar Magic product now available from National Semiconductor, http://www.national.com/analog/solarmagic) are coming to market that will enhance the performance of solar modules in variable light conditions. It is no longer appropriate to estimate the output of a solar module based on physical shading characteristics alone. The presence of new technologies that optimize performance in variable light conditions needs to be represented in the calculator. The Energy Commission should not change to a calculator that will inhibit the use of these technologies as these new technologies can greatly improve the performance of solar output.

## 5. CALCULATOR CHANGES AFFECT CONTRACTS IN PLACE

The CSI program requires that the equipment in the reservation match the actual equipment installed. A rebate calculation is performed and submitted to reserve a rebate. Since equipment changes are common for companies (due to availability of particular modules or inverters at the time the installation is scheduled for installation), many companies must do the calculation again to claim the rebate. Changes in the rebate as a result of equipment changes will affect the rebate levels, even though the contractor cannot amend the purchase price with the customer.

If the Energy Commission changes the calculator this will impact projects that already have reservations and will cause significant market disruption when the incentive claim is made using a different calculator than was originally used to reserve the rebate.

In addition, both the CPUC and the Energy Commission have made unannounced changes to the calculator algorithms and data entry rules. These changes affect the contractors at the point when an incentive claim is made if the rebate amount changes between the time the reservation is made and when the rebate claim is filed.

## 6. CALCULATOR OPERATION CHALLENGES THAT INCREASE COST OF USE

CALSEIA has found that there are a number of operational problems that create new problems for contractors. A few examples are:

a) If an error is made in data entry, there is no "go back" feature. This means that the contractor must start over from the beginning of the process to enter data.

b) The typical sales transaction begins with a sales person estimating shading and system layout. After a contract is signed (at this point a purchase price is settled upon), the contractor will schedule a technician to verify shading and system layout. Sales people do not carry the equipment to perform a detailed shading analysis (ladders and shading tools) nor do contractors' carry insurance to cover sales personnel on the roof. Tethering requirements required by Cal-OSHA would also apply to sales personnel.

   The sales person always performs an initial site visit before preparing a bid and signing a contract, however asking them to take an accurate shade reading from the ground, identify trees and calculate the height to distance ratio from the non-existent roof to the top of the obstruction in order to come up with an accurate estimate of the incentive amount is unrealistic. This means that the project administrator will have to do an additional visit, re-calculate the incentive, have the client sign the revised CF-IR-PV, and send the updated form with electronic files. The incentive will almost always be lower than estimated due to actual shading. In short, the Energy Commission calculator creates more work for installers and generates a number that is not very accurate and could mislead the host-customer by setting their expectations too high.

c) Because of the complicated nature of the calculator, generating a CF-1R-PV for large, multi-array affordable housing projects is time consuming and frustrating for sales people. It takes about an hour to complete the various calculations necessary for a system with multiple inverters, tilts, and azimuths. In comparison, a similar CSI EPBB calculation would take about 10 minutes.

d) Because of the HERS requirement there is the possibility that the project administrator will have to run the calculator a third time and have the client sign the form again, if the rater finds any discrepancies. More time wasted for the installer and the client.

e) Products that are commonly used by solar companies are not yet available for use in the calculator. Due to the extended time allowed for module manufacturers to list their products, many of the products that are commonly used by solar companies are not yet included in the calculator.

## 7. HANDBOOK COMMENTS

The following comments are specific to the Handbook.

a) Field Verification – The Handbook is ambiguous about who pays for HERS and other field inspections. CALSEIA recommends that the customer's utility provide this service as they receive a return on investment for energy efficiency improvements made by the site owner. CALSEIA recommends that this provision be clarified to specify that solar contractors are not obligated to pay this expense.

b) Shading tool – Shading tools do not provide consistent results at the same site. Causes for these inconsistency range from standing in a different location than where the original shading calculation was taken or if the shading tool is held at different angles. CALSEIA recommends add language that cautions that shading tools do not provide consistent results and that inspections should take this into consideration when determining whether a system is installed consistent with the rebate application. Inspectors should make all attempts to ensure that variances in shading results that could be caused by margin of error that results from the use of the shading tool are not used to change incentive levels. The Handbook should be clarified to ensure that varying results caused by the normal use of the shading tool should not be used to modify rebates paid to customers.

c) Shading simplification – the CPUC established a Shading Subcommittee in 2007. The recommendations from the subcommittee are attached. CALSEIA recommends that to the extent possible, all of the recommendations of the subcommittee be incorporated into the CEC's method of calculating shading.

d) Unplanted trees and unbuilt buildings – the Handbook would require that Contractors survey prospective customers and their neighbors to determine if someone might have plans to plant a tree or alter a neighboring site in a manner that might shade a solar array in the future. This is an unworkable provision. CALSEIA appreciates that the Handbook includes an exemption from this requirement. However, it should be removed altogether. It would have no force of law if a neighbor or customer changed their mind after this survey was conducted. There would be no consequence to the site owner if a new tree or building was placed in a manner that shades the array. CALSEIA strongly encourages that this requirement be removed.

e) Climate data anomalies – CALSEIA and others testified at the hearing that there are anomalies in the Climate data used in the calculator that yield inaccurate performance results. One example provided at the workshop described the lack of granularity in the calculator's climate data that results in a system that is located in a coastal climate is actually treated as an inland climate (Climate Zone 10). These anomalies have been described to the Energy Commission staff at the New Solar Homes Advisory Committee since early 2007. CALSEIA strongly encourages that this and other climate data anomalies be addressed.

## 8. ALLOW SYSTEM EXPANSION

The Guidelines do not currently address eligibility for customers who expand their existing solar electric systems. SB1 refers to new equipment for new installations but does not address the specific situation of an existing customer who is planning to expand the size of their current system. For example, a commercial customer who budgeted and constructed a system that provides less than 100% of their generation and who planned to expand the system in their next fiscal year may or may not be eligible for incentives. Program administrators have interpreted the current program rules to prohibit system expansion unless the existing inverter is replaced by a new inverter. However, a customer who planned ahead and purchased an inverter that is capable of the expanded system size and would now add new modules to expand total system output would be subjected to an unnecessary expense as a result of this interpretation. CALSEIA recommends that system expansions using new solar modules be eligible for incentives if the existing inverter is capable of handling the additional generation capacity. This issue is also important for some residential customers.

**RECOMMENDATIONS**

CALSEIA recommends that the SB1 Guideline be amended to retain the current calculation method and tool used in the CSI program.

If the Commission does not agree to retain the current calculator, then the Commission should:

a) Prepare and publish an estimate of the cost to industry to implement the changes proposed by the Energy Commission.
b) Allow contractors to continue to use the current calculator for incentive claims made on reservations filed before the change.
c) Calculator changes should be announced 90 days prior to implementing the change.
d) Contractors should file incentive claims using the calculator in effect at the time the reservation was made.
e) Calculator changes should be made to reflect changes in performance characteristics as a result of new technology.
f) Address the climate data anomalies.

Specifically to the Handbook, CALSEIA recommends:

a) Clarify the party obligated to pay for field verification.
b) Add language to indicate that shading tools can yield different results, even when used properly.
c) Remove reference to assessments of unplanted trees or unbuilt buildings.

CALSEIA also recommends that the Energy Commission publish a list of the known problems with the calculator along with a schedule for addressing those problems.

CALSEIA strongly encourages the Energy Commission to convene user group meetings with industry (either in person or via webcast) to collect feedback on the calculator and to provide user training on the proper use of the calculator.

Last, CALSEIA recommends that the guideline specifically address the treatment of system expansions for incentive eligibility.

Respectfully submitted,

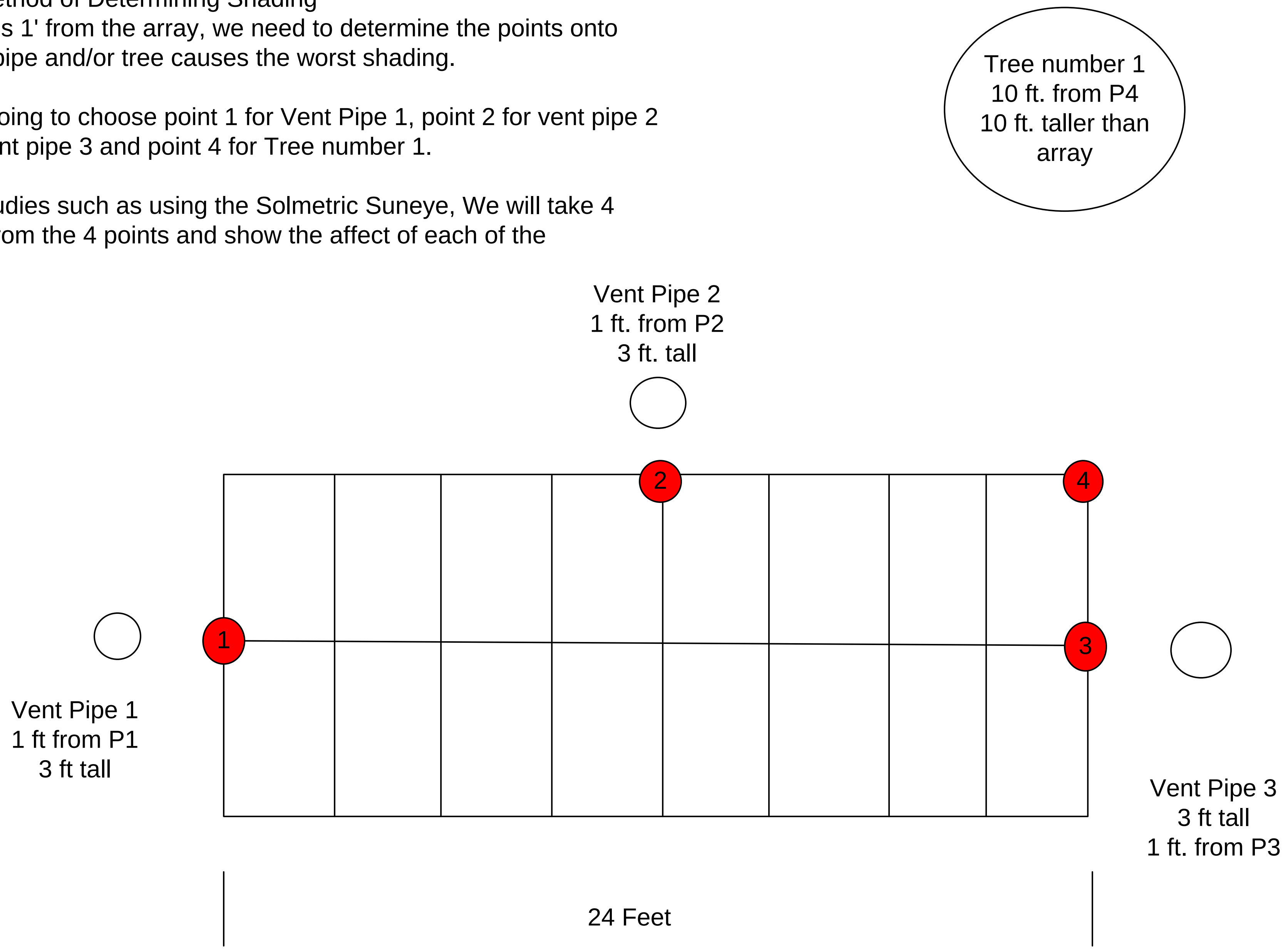
Sue Kateley

Sue Kateley
Executive Director

NSHP Manual Method of Determining Shading
If each vent pipe is 1' from the array, we need to determine the points onto which each vent pipe and/or tree causes the worst shading.

Therefore, I am going to choose point 1 for Vent Pipe 1, point 2 for vent pipe 2 and point 3 for vent pipe 3 and point 4 for Tree number 1.

For Automatic Studies such as using the Solmetric Suneye, We will take 4 shading studies from the 4 points and show the affect of each of the obstructions



| Shading Study Manual | Obstruction V1to P1 | Obstruction V2 to P2 | Obstruction V3 to P3 | Obstruction Tree to P4 | Result...Worst Case Shading for Each Azimuth | |
|---|---|---|---|---|---|---|
| ENE (Azimuth >55 to 78.75) | 0 | 0 | 0 | | 0 | All data in degrees to obstruction |
| E (Azimuth >78.75 to 101.25) | 72 | 0 | 0 | | 72 | |
| ESE (Azimuth >101.25 to 123.75) | 0 | 0 | 0 | | 0 | |
| SE (Azimuth >123.75 to 146.25) | 0 | 0 | 0 | | 0 | |
| S (Azimuth >168.75 to 191.25) | 0 | 72 | 0 | 45 | 72 | Note: In this case, the little South vent pipe shades the array |
| SSW (Azimuth >191.25 to 213.75) | 0 | 0 | 0 | | 0 | more than the tree to the south per NSHP methodolgy |
| SW (Azimuth >213.75 to 236.25) | 0 | 0 | 0 | | 0 | |
| WSW (Azimuth >236.25 to 258.75) | 0 | 0 | 0 | | 0 | |
| W (Azimuth >258.75 to 281.25) | 0 | 0 | 72 | | 72 | |
| WNW (Azimuth >281.25 to 305) | 0 | 0 | 0 | | 0 | |

| Shading Study Automatic from Point 1, 2, 3 and Manual from above | No Obstructions minimal shading | All Obstructions from P1 | All Obstructions from P2 | All Obstructions from P3 | All Obstructions from P4 | Manual from Table Above |
|---|---|---|---|---|---|---|
| ENE (Azimuth >55 to 78.75) | 0 | 0 | 0 | 0 | 0 | 0 |
| E (Azimuth >78.75 to 101.25) | 0 | 72 | 0 | 7 | 14 | 72 |
| ESE (Azimuth >101.25 to 123.75) | 0 | 0 | 0 | 13 | 0 | 0 |
| SE (Azimuth >123.75 to 146.25) | 0 | 0 | 0 | 0 | 0 | 0 |
| S (Azimuth >168.75 to 191.25) | 0 | 0 | 72 | 35 | 45 | 72 |
| SSW (Azimuth >191.25 to 213.75) | 0 | 0 | 0 | 0 | 0 | 0 |
| SW (Azimuth >213.75 to 236.25) | 0 | 0 | 33 | 0 | 0 | 0 |
| WSW (Azimuth >236.25 to 258.75) | 0 | 13 | 0 | 0 | 0 | 0 |
| W (Azimuth >258.75 to 281.25) | 0 | 7 | 0 | 72 | 0 | 72 |
| WNW (Azimuth >281.25 to 305) | 0 | 0 | 0 | 0 | 0 | 0 |
| **Calculator Runs see attached** | | | | | | |
| Rebate | $ 10,995.00 | $ 10,412.00 | $ 10,089.00 | $ 9,238.00 | $ 10,628.00 | $ 8,143.00 |
| Shading Cost | $ - | $ 583.00 | $ 906.00 | $ 1,757.00 | $ 367.00 | $ 2,852.00 |
| Annual kWh Production | 7630 | 7036 | 6783 | 6684 | 7243 | 5654 |

| | |
|---|---|
| Rebate Range Cost | $ 2,852.00 |
| Rebate Range kWh Production | 1976 |
| Summary | Manual is by far the most difficult shading study to accomplish and the most punative<br>Obstruction to P4 makes the most sense for worst shading because of the tree<br>Obstruction to P4 provides the best shading Rebate.<br><br>For actual field work, there is far to much variation due to the fact that the person doing the shading<br>Study has to determine which point has the worst shading |

NO SHADE



**New Subdivision** — **09/20/2008 3:13:48 PM**
Project Title — Date

**12 First St, 34 Second St, 56 Third St**
Project Address/Lot Number

**West Sacramento, CA 95691**
City/State/ZIP

**Irvine** — 8
City Used in Calculator Run — Climate Zone

**FOR OFFICIAL USE ONLY**

Reservation ______

PV ______

Date ______

Number of Systems in Reservation Application with Identical CF-1R-PV calculations: 1

Project Address List

**12 First St, 34 Second St, 56 Third St**
**78 Fourth St, 910 Fifth St, 1112 Sixth St**
**1314 Seventh St, 1516 Eight St, 1718 Ninth St**

Housing Type: **All Other Market Rate Housing**

## PV SYSTEM INFORMATION

Module Manufacturer and Model: **BP Solar BP175B**

Inverter Manufacturer and Model: Xantrex Technology, Inc. GT5.0-NA-240/208 (240V)

Series Modules in each String: 10 Parallel Strings: 3 Total Modules: 30

Mounting (BIPV or Rack Mounted): Rack Mounted

Standoff Height (if rack mounted): Roof Mounted (min 3.5 in. from roof)

Installation Option: **Detailed Input**

Azimuth: 180 degrees Tilt: 0 degrees Mounting Height Above Ground: Two-Story
**Shading Type: User-Defined**

### SHADING TABLE

| Orientation | Obstruction Type | Altitude Angle to Shading Obstruction | Distance To Height Ratio | Minimum Distance To Small Tree | Minimum Distance To Medium Tree | Minimum Distance To Large Tree |
|---|---|---|---|---|---|---|
| ENE (55-79) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| E (79-101) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| ESE (101-124) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SE (124-146) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSE (146-169) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| S (169-191) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSW (191-214) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SW (214-236) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WSW (236-259) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| W (259-281) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WNW (281-305) | N/A | Min Shading | 2 | N/A | 26 | 56 |

## CEC PV CALCULATOR RESULTS

Annual kWh production: **7,630**

Annual TDV (kWh) production: **111,287**

CEC Incentive: **$10,995**

P1



**New Subdivision** — Project Title

**09/20/2008 3:21:36 PM** — Date

**12 First St, 34 Second St, 56 Third St** — Project Address/Lot Number

**West Sacramento, CA 95691** — City/State/ZIP

**Irvine** — City Used in Calculator Run

8 — Climate Zone

**FOR OFFICIAL USE ONLY**

Reservation ______

PV ______

Date ______

Number of Systems in Reservation Application with Identical CF-1R-PV calculations: 1

Project Address List

**12 First St, 34 Second St, 56 Third St**
**78 Fourth St, 910 Fifth St, 1112 Sixth St**
**1314 Seventh St, 1516 Eight St, 1718 Ninth St**

Housing Type: **All Other Market Rate Housing**

## PV SYSTEM INFORMATION

Module Manufacturer and Model: **BP Solar BP175B**

Inverter Manufacturer and Model: Xantrex Technology, Inc. GT5.0-NA-240/208 (240V)

Series Modules in each String: 10 Parallel Strings: 3 Total Modules: 30

Mounting (BIPV or Rack Mounted): Rack Mounted

Standoff Height (if rack mounted): Roof Mounted (min 3.5 in. from roof)

Installation Option: **Detailed Input**

Azimuth: 180 degrees Tilt: 0 degrees Mounting Height Above Ground: Two-Story
**Shading Type: User-Defined**

### SHADING TABLE

| Orientation | Obstruction Type | Altitude Angle to Shading Obstruction | Distance To Height Ratio | Minimum Distance To Small Tree | Minimum Distance To Medium Tree | Minimum Distance To Large Tree |
|---|---|---|---|---|---|---|
| ENE (55-79) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| E (79-101) | On Roof Obstruction (Measured Angle) | 72 degrees | 0.33 | N/A | N/A | N/A |
| ESE (101-124) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SE (124-146) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSE (146-169) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| S (169-191) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSW (191-214) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SW (214-236) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WSW (236-259) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| W (259-281) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WNW (281-305) | N/A | Min Shading | 2 | N/A | 26 | 56 |

## CEC PV CALCULATOR RESULTS

Annual kWh production: **7,036**
Annual TDV (kWh) production: **105,385**
CEC Incentive: **$10,412**

P2



**New Subdivision**
Project Title

**09/20/2008 3:24:29 PM**
Date

**12 First St, 34 Second St, 56 Third St**
Project Address/Lot Number

**West Sacramento, CA 95691**
City/State/ZIP

**Irvine** 8
City Used in Calculator Run Climate Zone

**FOR OFFICIAL USE ONLY**

Reservation ______

PV ______

Date ______

Number of Systems in Reservation Application with Identical CF-1R-PV calculations: 1

Project Address List

**12 First St, 34 Second St, 56 Third St**
**78 Fourth St, 910 Fifth St, 1112 Sixth St**
**1314 Seventh St, 1516 Eight St, 1718 Ninth St**

Housing Type: **All Other Market Rate Housing**

## PV SYSTEM INFORMATION

Module Manufacturer and Model: **BP Solar BP175B**

Inverter Manufacturer and Model: Xantrex Technology, Inc. GT5.0-NA-240/208 (240V)

Series Modules in each String: 10 Parallel Strings: 3 Total Modules: 30

Mounting (BIPV or Rack Mounted): Rack Mounted

Standoff Height (if rack mounted): Roof Mounted (min 3.5 in. from roof)

Installation Option: **Detailed Input**

Azimuth: 180 degrees Tilt: 0 degrees Mounting Height Above Ground: Two-Story
**Shading Type: User-Defined**

### SHADING TABLE

| Orientation | Obstruction Type | Altitude Angle to Shading Obstruction | Distance To Height Ratio | Minimum Distance To Small Tree | Minimum Distance To Medium Tree | Minimum Distance To Large Tree |
|---|---|---|---|---|---|---|
| ENE (55-79) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| E (79-101) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| ESE (101-124) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SE (124-146) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSE (146-169) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| S (169-191) | On Roof Obstruction (Measured Angle) | 72 degrees | 0.33 | N/A | N/A | N/A |
| SSW (191-214) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SW (214-236) | On Roof Obstruction (Measured Angle) | 33 degrees | 1.56 | N/A | N/A | N/A |
| WSW (236-259) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| W (259-281) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WNW (281-305) | N/A | Min Shading | 2 | N/A | 26 | 56 |

## CEC PV CALCULATOR RESULTS

Annual kWh production: **6,783**
Annual TDV (kWh) production: **102,112**
CEC Incentive: **$10,089**

P3



**New Subdivision**
Project Title

**09/20/2008 3:43:54 PM**
Date

**12 First St, 34 Second St, 56 Third St**
Project Address/Lot Number

**West Sacramento, CA 95691**
City/State/ZIP

**Irvine** 8
City Used in Calculator Run Climate Zone

**FOR OFFICIAL USE ONLY**

Reservation ______

PV ______

Date ______

Number of Systems in Reservation Application with Identical CF-1R-PV calculations: 1

Project Address List

**12 First St, 34 Second St, 56 Third St**
**78 Fourth St, 910 Fifth St, 1112 Sixth St**
**1314 Seventh St, 1516 Eight St, 1718 Ninth St**

Housing Type: **All Other Market Rate Housing**

## PV SYSTEM INFORMATION

Module Manufacturer and Model: **BP Solar BP175B**

Inverter Manufacturer and Model: Xantrex Technology, Inc. GT5.0-NA-240/208 (240V)

Series Modules in each String: 10 Parallel Strings: 3 Total Modules: 30

Mounting (BIPV or Rack Mounted): Rack Mounted

Standoff Height (if rack mounted): Roof Mounted (min 3.5 in. from roof)

Installation Option: **Detailed Input**

Azimuth: 180 degrees Tilt: 0 degrees Mounting Height Above Ground: Two-Story
**Shading Type: User-Defined**

### SHADING TABLE

| Orientation | Obstruction Type | Altitude Angle to Shading Obstruction | Distance To Height Ratio | Minimum Distance To Small Tree | Minimum Distance To Medium Tree | Minimum Distance To Large Tree |
|---|---|---|---|---|---|---|
| ENE (55-79) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| E (79-101) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| ESE (101-124) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SE (124-146) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSE (146-169) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| S (169-191) | On Roof Obstruction (Measured Angle) | 35 degrees | 1.43 | N/A | N/A | N/A |
| SSW (191-214) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SW (214-236) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WSW (236-259) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| W (259-281) | On Roof Obstruction (Measured Angle) | 72 degrees | 0.33 | N/A | N/A | N/A |
| WNW (281-305) | N/A | Min Shading | 2 | N/A | 26 | 56 |

## CEC PV CALCULATOR RESULTS

Annual kWh production: **6,684**

Annual TDV (kWh) production: **93,507**

CEC Incentive: **$9,238**

P4



**New Subdivision** — Project Title

**09/20/2008 3:32:48 PM** — Date

**12 First St, 34 Second St, 56 Third St** — Project Address/Lot Number

**West Sacramento, CA 95691** — City/State/ZIP

**Irvine** — City Used in Calculator Run

8 — Climate Zone

FOR OFFICIAL USE ONLY

Reservation ____________

PV ____________

Date ____________

Number of Systems in Reservation Application with Identical CF-1R-PV calculations: 1

Project Address List

**12 First St, 34 Second St, 56 Third St**
**78 Fourth St, 910 Fifth St, 1112 Sixth St**
**1314 Seventh St, 1516 Eight St, 1718 Ninth St**

Housing Type: **All Other Market Rate Housing**

## PV SYSTEM INFORMATION

Module Manufacturer and Model: **BP Solar BP175B**

Inverter Manufacturer and Model: Xantrex Technology, Inc. GT5.0-NA-240/208 (240V)

Series Modules in each String: 10 Parallel Strings: 3 Total Modules: 30

Mounting (BIPV or Rack Mounted): Rack Mounted

Standoff Height (if rack mounted): Roof Mounted (min 3.5 in. from roof)

Installation Option: **Detailed Input**

Azimuth: 180 degrees Tilt: 0 degrees Mounting Height Above Ground: Two-Story

**Shading Type: User-Defined**

### SHADING TABLE

| Orientation | Obstruction Type | Altitude Angle to Shading Obstruction | Distance To Height Ratio | Minimum Distance To Small Tree | Minimum Distance To Medium Tree | Minimum Distance To Large Tree |
|---|---|---|---|---|---|---|
| ENE (55-79) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| E (79-101) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| ESE (101-124) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SE (124-146) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSE (146-169) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| S (169-191) | On Roof Obstruction (Measured Angle) | 45 degrees | 1 | N/A | N/A | N/A |
| SSW (191-214) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SW (214-236) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WSW (236-259) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| W (259-281) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WNW (281-305) | N/A | Min Shading | 2 | N/A | 26 | 56 |

## CEC PV CALCULATOR RESULTS

Annual kWh production: **7,243**

Annual TDV (kWh) production: **107,572**

CEC Incentive: **$10,628**

MANUAL



**New Subdivision** — Project Title

**09/20/2008 3:19:02 PM** — Date

**12 First St, 34 Second St, 56 Third St** — Project Address/Lot Number

**West Sacramento, CA 95691** — City/State/ZIP

**Irvine** — City Used in Calculator Run

8 — Climate Zone

FOR OFFICIAL USE ONLY

Reservation ____________

PV ____________

Date ____________

Number of Systems in Reservation Application with Identical CF-1R-PV calculations: 1

Project Address List

**12 First St, 34 Second St, 56 Third St**
**78 Fourth St, 910 Fifth St, 1112 Sixth St**
**1314 Seventh St, 1516 Eight St, 1718 Ninth St**

Housing Type: **All Other Market Rate Housing**

## PV SYSTEM INFORMATION

Module Manufacturer and Model: **BP Solar BP175B**

Inverter Manufacturer and Model: Xantrex Technology, Inc. GT5.0-NA-240/208 (240V)

Series Modules in each String: 10 Parallel Strings: 3 Total Modules: 30

Mounting (BIPV or Rack Mounted): Rack Mounted

Standoff Height (if rack mounted): Roof Mounted (min 3.5 in. from roof)

Installation Option: **Detailed Input**

Azimuth: 180 degrees Tilt: 0 degrees Mounting Height Above Ground: Two-Story
**Shading Type: User-Defined**

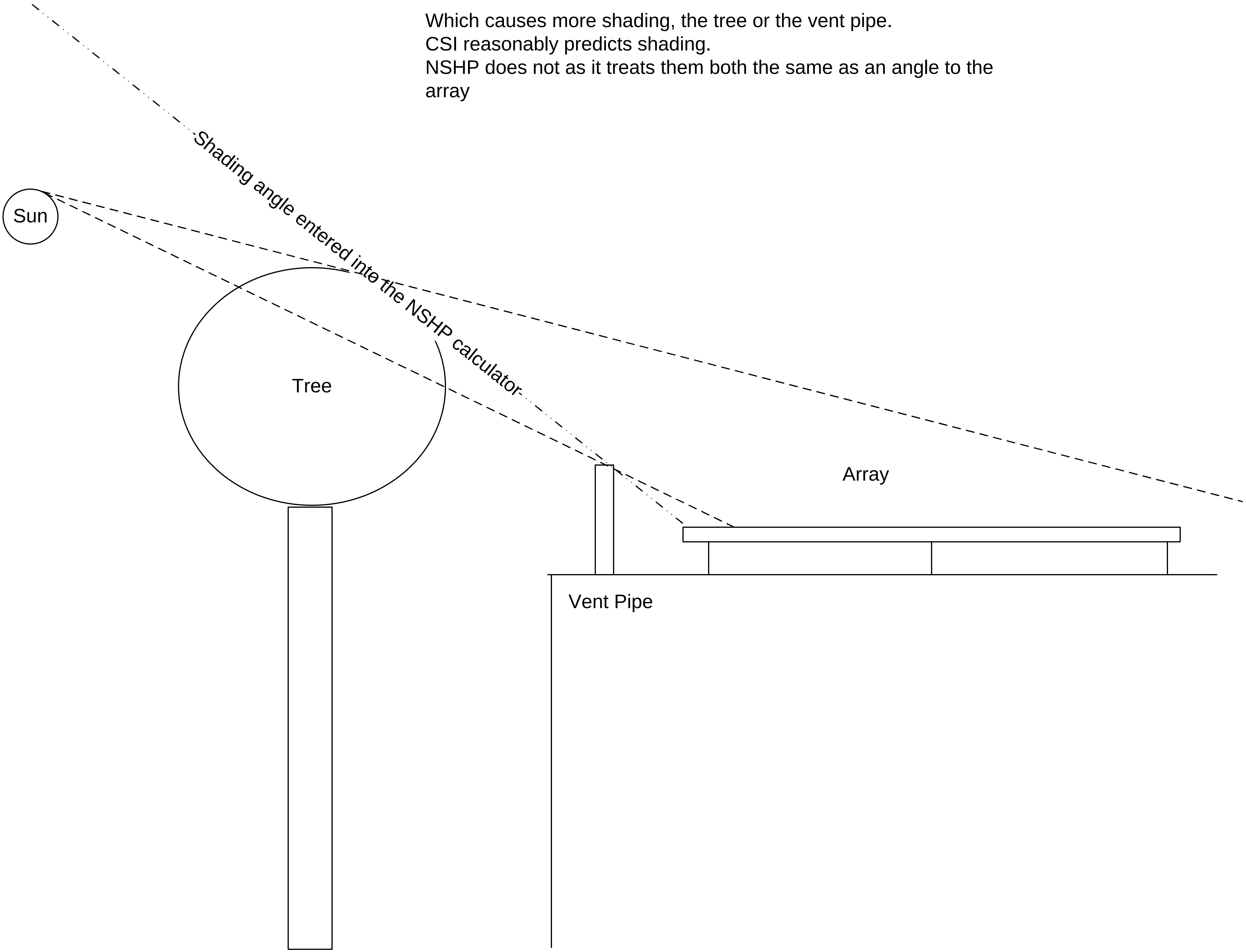
### SHADING TABLE

| Orientation | Obstruction Type | Altitude Angle to Shading Obstruction | Distance To Height Ratio | Minimum Distance To Small Tree | Minimum Distance To Medium Tree | Minimum Distance To Large Tree |
|---|---|---|---|---|---|---|
| ENE (55-79) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| E (79-101) | On Roof Obstruction (Measured Angle) | 72 degrees | 0.33 | N/A | N/A | N/A |
| ESE (101-124) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SE (124-146) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SSE (146-169) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| S (169-191) | On Roof Obstruction (Measured Angle) | 72 degrees | 0.33 | N/A | N/A | N/A |
| SSW (191-214) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| SW (214-236) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| WSW (236-259) | N/A | Min Shading | 2 | N/A | 26 | 56 |
| W (259-281) | On Roof Obstruction (Measured Angle) | 72 degrees | 0.33 | N/A | N/A | N/A |
| WNW (281-305) | N/A | Min Shading | 2 | N/A | 26 | 56 |

## CEC PV CALCULATOR RESULTS

Annual kWh production: **5,654**
Annual TDV (kWh) production: **82,416**
CEC Incentive: **$8,143**

Which causes more shading, the tree or the vent pipe.
CSI reasonably predicts shading.
NSHP does not as it treats them both the same as an angle to the array



# CSI Shading Subcommittee Recommendations

## Introduction

During the CSI Working Group meeting dated June 2007, CCSE agreed to chair a committee of CSI stakeholders to make recommendations regarding the current CSI shade policy. The participants include experts on shade methodology and impacts including the designers of our current system, shade tool manufacturers, industry interest groups, solar sales and installation contractors, CSI inspectors, and other interested parties. The participants list is included at end of proposal. We reached our goal of making major recommendations by August 2007.

## Background

The CPUC requires the CSI program to include the impact of shade when determining the incentive amount. Therefore, AESC was contracted to design an incentive calculator (EPBB tool) incorporating the shade component as well as other design elements. The User Guide for the EPBB tool is located at the www.csi-epbb.com website. This User Guide contains the definition of the "minimal shading criteria" information necessary to accurately identify shade, as well as how to enter the shade impacts into the EPBB tool. Previous to the CSI program, the major PV incentive programs in California – ERP, SGIP, Re-Build a Greener San Diego, LADWP, and other solar programs – used system capacity, not system performance, to determine incentive amount. Thus, the inclusion of shade impact in calculating the applicable incentive is a massive shift in methodology from the previous nine years of incentive programs.

Over the course of the first seven months of the CSI program, the Program Administrators (PA's) observed inconsistencies between the shade reported to them during the Reservation Request and Incentive Claim stages versus what was being observed during system inspections. Concurrently, comments regarding the shading methodology surfaced during CSI trainings, public forums, as well as informal discussions with the stakeholders.

During the July CSI Public Forum, the Program Administrators agreed to form a group of interested parties to evaluate the current methodology and make recommendations. CCSE agreed to coordinate and oversee the contributions by the subcommittee and submit recommendations to the CPUC. The invitation to participate was given first at the Public Forum and followed with emailed invitations from the PA's to over 100 different parties. The invitation suggested forwarding it to other parties who may have interest in participating. At the same Public Forum, in response to and in recognition of the need to act quickly, we announced a final proposal date of August 2007.

The timeline for actions follows:

July 12 – Invitations emailed
July 20 – Participants submitted brief interest/qualification information
July 24 – Conference call - Understanding Current Methodology
Aug 1 – Conference call - Propose new solutions and/or clarifications
Aug 7 – Conference call - Evaluate suggestions
Aug 14 – conference call - Debate final recommendation(s)
Aug 16 – update PA's on subcommittee activities during Aug WG
Aug 17 – Conference Call – Final clarifications
Aug 21 – Conference Call – Review Final Proposal
Sept 18 – Submit final Proposal

In addition to our formal conference calls, participants conducted extensive email conversations, wrote supporting evidence, and submitted data for the suggestions. Their contributions deserve immense recognition.

Problems Identified with Current Methodology

1) "Minimal shading" definition problematic
   - Not easily estimable
   - Does not always reward highest performing systems
   - The influence of geographic location and orientation results in systems with similar shading receiving inconsistent incentive levels.
2) Multiple and costly shade impact studies now are required pre-sale before a rebate level and final customer cost can be determined.
   - More roof work for more people, requiring more tools, higher insurance
3) Degree of uncertainty with inspection accuracy
4) Increased administrative costs due to very small rebate fluctuations
   - Small changes in system layout can result in a change in incentive level requiring additional paperwork and customer coordination.
5) Documentation for showing shading is currently undefined

Solutions

1) Redefine "minimal shading"
   - Allow better chance to estimate
   - Eliminate discontinuity between minimal and non-minimal shading values
2) Provide estimation capability pre-sale in many cases for systems without significant shading
   - A full shading analysis still is required but it could be completed after contract signing in cases where the system is estimated to meet the minimal shading requirements.
3) Publish inspection tolerance levels
4) Define documents that may be requested for shading audit

Current Methodology

- Though 12-months of shade impact are input into the EPBB calculator, only shade impacts occurring between the months of May through October affect EPBB incentive.
  - Shade impact is expressed as a percentage of solar access during a given month.
    - If a site meets the “minimal shading criteria”, no shade measurements are required and applicant selects “minimal shading” on EPBB calculator.
    - If a site does not meet the “minimal shading criteria,” the specific monthly solar availability numbers must be entered into EPBB calculator.
  - Shade measurements are taken at the level of the PV panels and thus must be taken from atop the customer’s roof.
  - Shade impact can be determined using commonly utilized tools such as the Solar Pathfinder and the Solmetric SunEye.
  - Shade measurements are taken at the major corners of the array.
  - The results at each corner are then averaged together.
  - Each array’s shade measurement averages are entered individually into the EPBB calculator for each month of the year.
  - Changes to System performance must be communicated to PA’s via Revised Incentive Calculation Worksheet.

This data will need to be utilized in both the Reservation Request stage and Incentive Claim stage.

The goal of the “minimal shading criteria” definition was originally adopted from the CEC’s New Solar Home Partnership program and allows a simple method by which systems could be quickly determined to be high performance (as relates to shading) and not be required to have formal shade measurements taken.

**Impacts of Current Methodology**

- Shade must be addressed (either via estimation or measurement) prior to the calculation of the CSI incentive for EPBB proposed systems. In many cases this is before the customer agrees to have a solar electric system installed. This has four major effects on the marketplace:

1) Contractors perform more work without compensation before a contract for PV is signed.

    a) Multiple shade impacts are often performed by different contractors for the same site.

    b) Multiple shade impacts are often performed by the same contractor in order to provide quotations for installations that contain multiple system sizes or module quantities. Separate shade impacts must be performed for all proposed configurations.

2) Those contractors relying upon sales persons, who had not been required previously to perform shade impact studies at the sales stage, had to retrain them on the technical aspects of shade impacts.

3) Some contractors have had to incur additional Worker's Compensation insurance expenses for the sales force as these personnel now need to climb ladders and perform roof-top shade analyses. This work had previously often been performed by the site survey team who were already classified in the correct worker's compensation category to perform roof-top work.

4) Some contractors have incurred significant additional expenses as the shade impacts must be determined for <u>all potential</u> solar customers instead of the much smaller group who actually purchase systems. With a typical sales close ratio of about 20%, this means that shading analysis is done on 80% of the systems which don't even result in a sale or any compensation for the contractor. This increases the cost of the systems that do sell.

    a) Many installation contractor companies previously relied upon a sales force without shade tools. After the contract was signed, the site survey team would arrive to perform measurements and shade evaluation. The customer was then informed of the exact impact shade would have on the system and allowed to either downsize the system to avoid shade or cancel the contract if the shade impact was significant.

    b) Tool costs are between $215-$1355 each

    c) The logistics of sharing tools between the sales groups and installation crews is prohibitive

- The definition of the "minimal shading criteria" tends to require some kind of survey or measurement to determine if it indeed applies. The test is whether any shade objects extend above an angle of 26.6 relative to any point of the array. To ascertain this with any certainty requires measurements. Performing this type of survey or measurement is almost as demanding as performing a shading impact survey. Thus, in practice, it has not really saved labor, time, or additional measurement tool expenditures.

- The definition of the "minimal shading criteria" provides for an arbitrary impact not supported within the guidelines for rewarding high performance systems. Careful evaluation of the impact of the definition shows that a system that fits within the technical definition of "minimal shading" may receive a higher incentive than a system that does not fit the definition of "minimal shading" even when the non-minimally shaded system has a higher solar availability than the minimally shaded system. The current definition allows for an East (or West) facing system to have a lower availability necessary to receive maximum incentive than a South facing system.

- Systems with "minimal shading" may have summertime availability as low as 82%. However, not all systems with >82% summertime availability meet the definition of minimal shading. This contradiction between the technical definition and the practical recognition of a minimally shaded system has resulted in numerous inspections and re-inspections. There have been instances of PA inspections and re-inspections showing actual system availabilities as high as 99% that do not meet the "minimal shading" definition as indicated by the contractor on the Incentive Claim. This results in a failed inspection. Failed inspections require the contractor to accept the inspection results or supply the documentation to counter the inspection results. At a cost to the program of over $400 per inspection, plus Program Administrator labor cost, plus expenses the contractor incurs to justify the shade impact results, the definition of "minimal shading" has proven costly and impractical. These situations cost the ratepayers additional funds, increase the cost of doing business for the contractors, delay the incentive payment and generally cost more than the savings realized by correcting these non-minimally shaded systems.

- "Minimal shading" definition does not include any limits to what viewing area must be considered. Without such a limit, objects due North of the array technically could prevent a system from being classified as minimally shaded even though the object would never shade the array. The NSHP program includes a range from 305 degrees to 55 degrees (NW-N-NE) relative to the most northerly points on the array that may be ignored when applying their minimal shading definition.

- Measuring at the "major corners" of the array is not always entirely clear considering arrays come in many non-geometric patterns. Although this allows for a lack of specificity in exactly where to take the measurements, the current method allows for flexibility where the measurement points are taken as well as the necessity to document and communicate those points.

- Measuring at the "major corners" of the array does not always lead to accurate shading impacts. The shading impacts between a 4x4 module array can be significantly different than a 1x16 module array.

- Lack of reasonableness or tolerance between the shade impact reported during the Reservation Request, Incentive Claim, and Inspection process. For systems not meeting the "minimal shading" definition, each 1% of difference between the Claim and the Inspection summer period shading reduces the incentive by approximately 1%. When this occurs, there is a chain reaction often disproportional to its impact. The purpose of inspections is to prevent fraudulent expenditures of rate payer funds not to create administratively burdensome (and thus expensive) procedures.

    1) all of the signed documentation – such as the Final Cost Affidavit – become invalid as they no longer match reality. In effect, the customer should either be required to re-sign all of the documentation such that the information all matches (this does not seem reasonable) or else the PA's have documentation that does not equate (the paper contracts signed by Applicant & Host stating an incentive is one amount but the internal PA database and trigger tracker show a different amount).

    2) All data input values have to be adjusted for even minor fluctuations. This is an administrative cost borne by the PA's as there are labor costs to make these often minor changes to the CSI Trigger Tracker, internal databases, the Statewide Online tool and the corresponding communications of this change to the Applicant, Host Customer, and/or System Owner. The PA's then have to re-run the EPBB with the new values to determine the actual incentive difference. Then, all the printed documents containing the revised values have to be reprinted and re-filed within the hard copy files.

    3) The installer must now go back to the customer to inform them the rebate has been reduced. This has obvious real and psychological costs. The installer must incur the expense of explaining, re-printing and having new documents signed and the customer is forced to evaluate the credibility of the contractor. This credibility gap now introduced for arguable trivial reasons may result in a lack of customer satisfaction and a reduction of customer referrals. Since most residential systems come from customer referrals, this can be a significant blow to CSI success.

a) For an average Residential system, this chain reaction may be triggered over as little as \$15. Assuming a 4kW system claiming a 98% solar availability, if the inspection shows as little as one month variance (say one month at 97% instead of 98%), the information is out of compliance with inspected results and technically a failed inspection even though the difference in incentives is only \$15.

b) This additional expense may not be warranted. See 4 below.

4) Unknown sensitivity and uncertainty within commonly used shade estimate tools

   a) SunEye and Pathfinder both provide estimates of shade impact on the performance of PV systems.

   b) In order for an accurate measurement to be taken, the tool must be level and oriented properly. Resulting shade impact variation due to measurement uncertainty and local magnetic effects are apparent in the field, but have not been characterized.

   c) The tools, in limited testing, have produced different solar availability results for the same location. At this time, it is not known how different the results can be. Intial data suggests a 2% to 3% difference is not uncommon and higher differences were seen in some cases. This situation is quite possible if the installer uses one tool and the inspector a different tool.

   d) Repeatability between measurements. Shade estimates can vary based on numerous factors including exact location where reading was taken, high wind events that shift tree tops, etc.

- The definition of a shading study and supporting documentation is completely lacking in the Handbook and is minimally described in the EPBB documentation. This lead to discrepancies in the documentation provided to auditors and confusion among installers.

**Recommendations for Immediate Implementation**

- Redefine “minimal shading” to be a fixed value of solar availability, expressed as a percentage, which allows it to be considered shade free for purposes of calculating the design factor.

1) The Committee proposes using a measured average summertime availability of 90+% to be considered "minimal shading."

   a. In practice, the Applicant will still supply the actual measured solar availability. The calculator will consider anything reported as 90% or above to be considered 100%.

   b. Any inspection will compare the inspected results with the unaltered availability reported. Example: If 93% availability is claimed, the inspection will compare inspected results to 93% (even though the 93% value equals 100% inside the calculator).

- Propose a sliding scale for the EPBB calculator to evaluate solar availability

  1) The Committee proposes using the following chart:

Chart A – 90+% = minimal shade

| Measured % Available for Summer Period | EPBB Calculator % for Summer Period |
|---|---|
| 90-100% (minimal shade) | 100% |
| 89% | 97% |
| 88% | 94% |
| 87% | 91% |
| 86% | 88% |
| 85% | 85% |
| <85% | Measured % Available = EPBB %) |

a) The awarding of 100% availability within the EPBB for certain high performance systems with a low level of shading is consistent with the current methodology as "minimal shading" does not currently mean no shading.

b) Solar availability of 90% or greater is the equivalent of a south facing system receiving no shading between the hours of 8:30am to 5pm.

c) Solar availability of 85% or greater is the equivalent of a south facing system being shade free from 9am to 5pm.

d) The reason for the sliding scale was to remove the discontinuity that exists in the current model. Currently, a system with 90% availability (that fits within existing minimal shade definition) receives a value of 100% on the EPBB. But a system with a measured 89% availability receives an EPBB value of only 89%. This is a massive 11% difference within the current shade methodology for systems that might only vary by a measured 1%. Under the new proposal, a 90% available system yields a 100% value, and an 89% available system yields a 97% value, thus smoothing out the incentive differences between very similar systems.

- Publish the inspection tolerance values.

    1) The Committee proposes adopting a +/-5 percentage point tolerance when evaluating monthly reported solar availability.

        a) This value is simple and transparent to all stakeholders.

        b) The goal of inspections is to support the installation of high quality systems not create endless quibbling over minor incentive discrepancies.

        c) Given the unknown accuracy variances of and between tools, the Committee concludes this to be an acceptable interim tolerance.

        d) This removes the inspector from being in the unsupportable position of lowering incentives that may have been a result of minor user or tool discrepancies.

- Utilize the EPBB Printout as the preferred method of communicating system changes to the PA's .

    1) Since the shade impact may vary between Reservation Request and Incentive Claim, these changes will show up as a new Design Factor on the Incentive Claim. However, since the Incentive Claim does not specify why the Design Factor changed, the EPBB will more accurately illustrate the reason for the size change.

    2) Recommend using the revised EPBB Printout as the "Revised Incentive Calculation Worksheet."

        a) The Handbook 4.7.2.8, page 61, refers to a heretofore undefined Revised Incentive Calculation Worksheet that must be submitted if a system change results in an incentive change. The EPBB Printout communicates all the required information therein required as well as providing the PA's the monthly solar availability percentages.
        b) This change does not add any additional paperwork or add any additional steps. This is simply a clarification of required documentation.

3) Installer shade documentation may be requested if field verification shows a discrepancy outside of the inspection tolerance that results in a change in the rebate amount.

- Alter EPBB tool to accommodate revised Solar Availability Table (Chart A)

  1) Remove the “minimal shading” checkbox as an option
     a) Doing so will reveal the monthly solar availability input fields

  2) Change the underlying shade impact values to reflect the proposed sliding scale in Chart A.

**Proposed Methodology**

- Only shade impacts occurring between the months of May through October affect EPBB incentive, although all 12 months of shade impact are input to provide an estimate of annual performance.

- Shade impact is expressed as a percentage of solar availability during a given month on the panel surface at the tilt, azimuth and location for the proposed system.

- Shade measurements are taken at the level of the PV panels and thus must often be taken from atop the customer’s roof.

- Shade impact can be determined using commonly utilized tools such as the Solar Pathfinder and the Solmetric SunEye. These are the tools currently utilized by the CSI Inspectors.

- Shade measurements are at minimum taken at the major corners of the array.

- The multiple shading measurements are averaged together resulting in 12 monthly solar access averages to be entered into the EPBB calculator.

- The term “minimal shading” only applies to a certain threshold of solar availability. It is no longer a choice on the EPBB Calculator. Rather the EPBB Calculator will evaluate the inputs into the calculator and consider certain high solar availability percentages as “minimal shading” and award them the same incentive benefits as currently provided by the definition of minimal shading.

- Changes to System performance must be communicated to PA’s via Revised EPBB Printout.

- Other requirements are documented in the EPBB Calculator User’s Guide.

**Evaluate Impact of Committee Recommendations**

Committee recommendations were based on several guiding principles

a) Result in more Electricity per rate payer dollar spent
b) Administratively simple
c) Promote high quality, high performing system design
d) Remove or reduce barriers within the marketplace

**Conclusion**

The adoption of inspection tolerances in conjunction with the revised definition of the "minimal shading criteria" allows for some degree of estimation during the sales process. That estimate must still be supported via a shade impact estimate before the incentive claim can be submitted. This will alleviate the need to perform highly detailed shade impact studies prior to the contractor having a signed contract for work. Further, this will allow installation companies to carry Worker's Compensation Insurance on only the select employees who must be on the roofs for their primary work – site surveyors and installers – and not on the sales force or independent contractors doing the bulk of initial customer contacts. The need to outfit every employee with additional tooling is also alleviated.

The revised minimal shading definition, even combined with the known inspection tolerances, constitutes a slightly higher threshold than the current definition of minimal shading allows for a 100% solar availability. The system performance will still be exactly as it would be using either definition (these are all estimates for determining expected performance after all), but the increased clarity in how to identify and report a "minimal shade" system and the resulting reduction in unnecessary and costly re-inspections and inspection challenges is well worth the trade-off.

By allowing a better transition between EPBB Solar Availability percentages as compared to measured solar availability will reduce the discontinuity associated with being 1% less available but taking a 10% incentive reduction. Requiring the input of all the solar availability percentages will increase the transparency of shading impacts for all involved parties – installer, customer, PA. This will also lead to a more informed marketplace who will be presented with shade impact information and how it affects their incentive as shown on the EPBB Printout.

Adopting these changes will simplify the program administration for all parties. Since systems reported need to be reasonably close to that which is claimed rather than exact, the program will no longer have to spend hours and hundreds of rate payer dollars to make minor adjustments within all the various databases and perform all the reprinting that would ensue. The costs for making these changes has been usually more expensive than the resulting "savings."

The above changes do not conflict with any existing inspection protocol. A failed inspection, one outside of the tolerances, is a failed inspection. The major difference is that a failed inspection in the proposed model is more likely to warrant the whole chain reaction triggered by a failed inspection than the minor failures experienced to date. This will reduce the number of unwarranted re-inspections and associated payment delays.

The Committee would like to thank the CPUC for enabling such direct program participation in helping to solve market barriers to solar.

## Appendix A: Terms and Definitions

Array – an array is defined as a quantity of identical photovoltaic modules with the same tilt and azimuth connected to one or more identical inverters. Any panels not fitting within that definition must be considered a different array.

Discontinuity – an excessively large difference in the values awarded to two figures with minor differences. For example, the measurement of solar access in sample A is 90% and for B is 89%. These figures are only separated by one percent. If we award A a value of 100 and B a value of 89, there is a major value difference

Statewide Online Application Tool aka Statewide Tool

EPBB Calculator – incentive calculator located at [www.csi-epbb.com](http://www.csi-epbb.com). Uses monthly solar availability percentages as part of creating overall system design factor.

EPBB Incentive – lump sum incentive paid after system installed. Incentive formula is system CEC-AC Rating * Design Factor * Reserved Maximum Incentive Rate per watt.

Design Factor – Design Factor is a ratio comparing a proposed system to a reference system. This number can be influenced by shading as the proposed system is assumed to have "minimal shading."

Minimal Shading Criteria – is met if no object is closer to the PV array than a distance from the closest edge of the array twice the height it extends above the PV array, the system is considered to have "minimal shading." Numerically, this can be expressed as an object having an angle from the closest point of the array to the height of the object of no more than $26.6^{o}$. So, if no object has an angle greater than $26.6^{o}$ relative to the closest point on the array, the system is considered to have "minimal shading." The current definition of minimal shading does not include the azimuth range to include when looking at potential shade objects.

**Appendix B – Solutions Evaluated but Not Adopted**

1) 80/20
2) Bin Method
3) 9am to 5pm Shade Free Zone
4) Performance Based Evaluation
5) NSHP Methodology

<u>80/20</u>

If the system had 80+% summer availability average, it would be considered to have 100% availability for EPBB calculation purposes. Any system less than 80% availability would be prohibited from the CSI program, or forced to go PBI. The current CSI program allows for a, for example, 50% access and a 50% availability (and the resulting 50% of incentive amount). The committee agrees that the purpose of the committee is to reform our shading methodology, not to disallow or raise additional barriers for systems with poor availability beyond the already steep reduction of incentives they warrant.

<u>Bin Method</u>

This solution grouped all solar access percentages into increments of 5%. So all values for solar access were 100%, 95%, 90%, 85%, etc. Any value between 96-100 would be rounded up to 100%. Any value between 91-95 would be rounded to 95%. This provides for overcoming some of the uncertainty about inspection tolerances and allows for certain amounts of estimation. However, this slightly over pays and creates a 5% incentive difference for a 1% access difference. The committee agreed that discontinuity in incentives was not a desirable outcome.

<u>9am to 5pm Shade Free Zone</u>

This solution allowed only systems with 100% access between the hours of 9am to 5pm to receive 100% access values in the EPBB. Adopting this would virtually eliminate any ability to estimate for any system (except in very rare cases). Further, this did not add any value when considering what to do when shade did occur between the hours of 9am to 5pm. Originally, this was proposed as 9am to 3pm, but that really only makes sense for South facing arrays. When extended to 5pm, the impact of that on West facing arrays was punitive compared to East facing arrays and thus counter to the existing emphasis on production during on-peak hours.

<u>Performance Based Evaluation</u>

This solution required a performance check-up after one year of operation. As originally proposed, this checkup was on the combination of solar production and energy consumption. Any underperformance was charged to the installer. Any over performance was paid to the system owner. This led to an installer being open to fines if the system performed as expected but the customer usage increased. Later, this was discussed to apply only to the solar production. At this point, it became similar enough to PBI which is already an option.

NSHP Shading Methodology

This method exists within the NSHP program already. Adopting this methodology was dismissed for several reasons. This method overestimates the shadow cast by an obstruction – a telephone pole, for example, using this methodology, would cast a shadow covering fully 22.5$^{o}$ (or the equivalent of 1 full hour) of the sunlight impacting the array when in real life it would rather cast a fairly narrow shadow. Further, an object, such as a tree, that had any portion of it extending into the next 22.5$^{o}$ increment (regardless of how small the encroachment is) is considered to fully shade that window as well. Second, the impact of any shading on any part of any sized array would result in zero production from the entire array. Taken at face value, this would mean a single vent pipe casting a shadow on a single module would result in the complete elimination production for all modules for purposes of calculating the impact of shade on an incentive amount. Considering a single commercial inverter can handle upwards of 1000 modules, with up to 78 independent strings, incorporating this is strict avoidance of any amount of shade becomes illogical and unreasonable.

**Chart proposed but not adopted**

Chart B – 95+% = minimal shade

| Measured % Available | EPBB Calculator % |
|---|---|
| 95-100% (minimal shade) | 100% |
| 94% | 98% |
| 93% | 96% |
| 92% | 94% |
| 91% | 92% |
| 90% | 90% |

(for values less than 90%, Measured % Available = EPBB %)

## Appendix C – Supporting Details

The following, Table 1, shows the discontinuity that occurs between systems with the same Measured Availability, but by the unique skylines associated with these projects, some will comply with Minimal Shading definition and others will not.

**Current**

| | Value for Incentive (DF) | |
|---|---|---|
| Measured Availability | if meeting Minimal Shade Definition | If Not meeting Minimal Shading Definition |
| 95% | 100% | 95% |
| 90% | 100% | 90% |
| 89% | 100% | 89% |
| 88% | 100% | 88% |
| 87% | 100% | 87% |
| 86% | 100% | 86% |
| 85% | 100% | 85% |
| 82% | 100% | 82% |
| 80% | 80%* | 80%* |

* We have not found values below 82% measured availability that would be capable of complying with existing Minimal Shading definition

As Measured Availability decreases, the Value used for determining the incentive may not change (if meeting Minimal Shading). In cases where it does change, the delta between Incentive Values for systems meeting Minimal Shading and those not meeting Minimal Shading can be as high as 18%. Consider the cases of the 82% and the 80% available systems. If the 82% meets minimal shading (and thus receives 100% Incentive Value), the delta between incentive values is 20% less even though the measured availability is only 2% less for the 80% system.

One objection to this conclusion is that the 82% minimally shaded system is merely hypothetical as it would have to be surrounded with a consistent height of obstructions at exactly 26.6$^{o}$ above panel height. On residential systems, this could be achieved fairly easily when considering trees around the property trimmed to an even height. On a commercial project, this is even easier to happen with flat roof installations. Consider an 18” parapet on the roof and a 36” standoff between the panels and the parapet. This puts us exactly at the 26.6$^{o}$ point. A shift of 1” in either of those heights or distances would put a system either squarely into or distinctly out of the Minimal Shading definition.

To reconcile that discontinuity, see Table 2 below.

| Proposed | | |
|---|---|---|
| Measured Availability | Minimal Shading | Value for Incentive (DF) |
| 95% | YES | 100% |
| 90% | YES | 100% |
| 89% | NO* | 97% |
| 88% | NO* | 94% |
| 87% | NO* | 91% |
| 86% | NO* | 88% |
| 85% | NO | 85% |
| 82% | NO | 82% |
| 80% | NO | 80% |

* The Measured values between 86-89% receive a slightly higher valuation so as to smooth the transition between minimal shading and non-minimal shading.

The Value for Incentive will be embedded into the EPBB calculator. That Value declines in a more consistent pattern as the measured availability decreases until, at 85%, the two values become identical.

**CCSE Experiences with Minimal Shading during the Inspection Process**

The following are all systems within CCSE territory that failed inspections due to not meeting Minimal Shading as claimed on the Incentive Claim form as well as the actual Measured Availability at inspection. All failed inspections to date have been due to Minimal Shading non-compliance. This is the complete list for CCSE territory and is meant only to illustrate the experiences with one PA.

| Project | Measured Availability | Obstruction(s) |
|---|---|---|
| SD-CSI-00084 | 99.7% | 1 chimney next to array |
| SD-CSI-00106 | 98.4% | 2 roof vents |
| SD-CSI-00049 | 98.0% | 1 tree and 2nd story roof |
| SD-CSI-00026 | 96.7% | 1 tree in neighbor yard to SE |
| SD-CSI-00015 | 96.1% | 1 tree to West |
| SD-CSI-00110 | 91.2% | 1 tree to SE |

## Appendix D – Shade Committee Participants

**David Saltzman**
Operations Manager
AMECO
amecosolar@aol.com
(562) 595-9570

**Janelle Kellman, Esq.**
Director of Regulatory Affairs and Strategic Growth
Solmetric Corporation
janelle@solmetric.com
(415) 308-8499 (cell)

**JP Ross**
Director of Programs
The Vote Solar Initiative
jpross@votesolar.org
(415) 817-5061 (o)

**Raghu Belur**
PVI Solutions Inc.
rbelur@pvisolutions.com
(707) 235-9624 – cell

**Scott Cronk**
Energy Matters LLC
scott@energymatters.net
(707) 237-5204

**Michelle Courter**
Solar Pathfinder
info@solarpathfinder.com

**Tyson Grul**
Marin Solar
tyson@marinsolar.com
(415) 456-2800 x105

**Christopher C. Blunt**
President
Ojai Solar, Inc.
info@ojaisolar.com
(805) 650-8700 office/fax

**Devan Johnson**
Project Manager
kW Engineering
johnson@kw-engineering.com
(510) 834.6420 x15

**Tom Hoff**
Clean Power Resources
tomhoff@clean-power.com
(707) 224-9992

**Hal Slater**
Solar and Pool Design and Consulting
hal@bringback.biz
(888) 883-9979

**Nicole Clock**
Technical Design Specialist
SPG Solar
nicole.clock@spgsolar.com
(415) 459-4201

**Ronald Mulick**
Solartronics
ron@mulick.com
(818)889-0440 off.

**Judy Ledford Staley**
Director of Legal and Legislative Relations
REC Solar, Inc.
jstaley@recsolar.com
(805) 540-5477

**Bill Marion**
Research Principal Supervisor
NREL
Bill_Marion@nrel.gov
(303) 384-6793

**Martin Learn**
Home Energy Systems
martin.learn@gmail.com
(858) 278.2300

**Richard Perez**
perez@asrc.cestm.albany.edu
(518) 437-8751

**Michael Kyes**
KGA Associates, LLC
michaelkyes@sbcglobal.net
(707) 823-3248

**Willard MacDonald**
President Solmetric Corporation
willard@solmetric.com
(415) 868-1749

**Ronald K. Ishii, P.E.**
Vice President
AESC, Inc.
rishii@aesc-inc.com
(760) 931-2641 x112

**Daniel Sullivan**
Sullivan Electric
DSullivan@sullivan-electric.com
(858)271-7758

**Don Pratt**
AESC, Inc.
dpratt@aesc-inc.com
(760)931-2641

**McKinley Barns**
California Solar Electric
mckinley@californiasolarelectric.com
(805) 640-7903

**Cam Campbell**
California Solar Electric
cam@californiasolarelectric.com
(805) 640-7903

**Richard Bennett**
Western Region Sales Manager
BP Solar
Richard.Bennett@bp.com
(707) 438-0329

**Sue Kately**
Executive Director
SEIA
info@calseia.org
(916) 747-6987

**Michael Daugherty**
Business Developer
BP Solar
mike.daugherty@bp.com
(360) 866-8044