

The SunPower logo is displayed in white, bold, sans-serif capital letters. Below the logo is a thin horizontal line. To the right of the logo is a large, dark gray grid of squares, representing solar cells, which is partially obscured by a vertical yellow bar on the far right of the slide.

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# PVSim – SunPower’s PV Simulation Tool

Ben Bourne

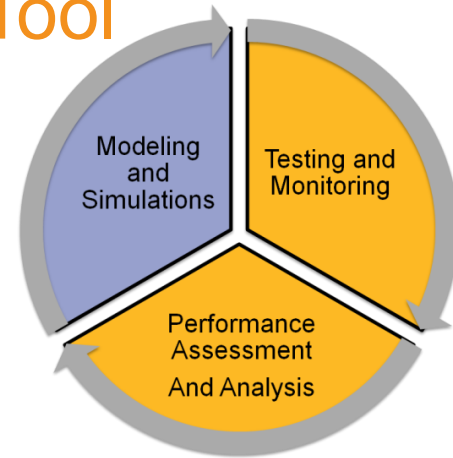
Presented at the 2013 Sandia PV Performance Modeling Workshop  
Santa Clara, CA. May 1-2, 2013

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# Why SunPower Maintains an In-House Tool

## SunPower systems are investments

- Customers need to know how much power and energy their system will produce over time
- SunPower needs to know how to price these systems
- SunPower needs to be able to demonstrate performance



## SunPower selects, develops and assembles the best models

- Publicly available/published models (irradiance, Sandia performance, soiling)
- Proprietary models (tracking, shading, thermal, etc.)

## Ongoing Validation

- PVSIM accuracy is based on measured data from our vast fleet
- PVSIM allows us to explicitly model our current, future and conceptual products with a high degree of accuracy

# PVSim v1 – Introduced at the Previous Workshop

The screenshot displays the PVSim v1.1.77 software interface, which is a web-based application running in a Microsoft Internet Explorer browser. The interface is divided into several sections:

- Configuration (Left Panel):** Includes a sidebar with navigation options: LOCATION, HARDWARE, SIZING, LOSSES, SUMMARY, RESULTS, CONFIGURATION, and Log Out. The main configuration area shows:
  - Weather Data Location: NREL (selected), Meteornorm, Measured
  - Country: United States
  - State/Province/region: California
  - Location: Sacramento
  - Override elevation: 8 Meters
  - Date Range: Start Date: January 1
- Results (Right Panel):** Titled "United States, California, Sacramento - Simulation - 21 September 2010". It displays key performance indicators:
  - Yield (Year 1): 1539.1 kWh/kWp
  - Performance Ratio (PR): 79.4 %
  - Capacity Factor (CF): 19.7 %
  - System Nameplate Rating: 124.2 kWp
  - Inverter AC Rating: 112.9 kW
  - PVUSA System Rating: 104.4 kW
- Monthly Performance Table:**

Month	Gh Insolation kWh/m <sup>2</sup> /day	POA Insolation kWh/m <sup>2</sup> /day	AC Energy kWh
Jan	1.87	2.23	7085
Feb	2.96	3.51	10114
Mar	4.25	4.77	15164
Apr	5.90	6.29	19074
May	7.19	7.36	22441
Jun	7.83	7.84	22764
Jul	7.89	7.99	23698
Aug	7.09	7.46	22254
Sep	5.78	6.45	18782
Oct	4.00	4.73	14519
Nov	2.34	2.87	8627
Dec	1.73	2.14	6636
Year: 1	4.91	5.31	191158
Complete Simulation	4.91	5.31	191158
- Itemized Annual Energy Losses Table:**

Itemized Annual Energy Losses	Loss (%)
Shading Loss	-0.40
Soiling Loss	-5.00
Angle-of-Incidence Loss	-3.99
Air Mass Adjustment	0.21
Operating Temperature Adjustment	-4.37
Efficiency vs. Irradiance Adjustment	-1.49
Thermal Voltage Adjustment	0.00
Module Flash Adjustment	0.87
Module Mismatch Loss	-1.00
DC Wiring Loss	-1.50
Inverter Efficiency Adjustment	-4.00
Inverter AC-Capacity Clipping Loss	0.00
Transformer Efficiency Loss (Day)	0.00
Transformer Efficiency Loss (Night)	0.00
AC Wiring Loss	0.00
Site Shading Loss	0.00
Auxiliary Load Loss	0.00
Annual Availability	98.00
- Additional Settings:**
  - Locale uses Daylight Savings Time (not in Hawaii, Arizona, or Eastern Indiana):
  - DST begins on: March 9
  - DST ends on: November 2

# PVSim v2.3 – Current Release & Demo

**SUNPOWER**

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**LOCATION**

HARDWARE

**SIZING**

LOSSES

SUMMARY

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RESULTS

---

CONFIGURATION

---

DOCUMENTATION

---

LOG OUT

Feedback

**Weather Data Location**

TMY
  Measured
  Custom

**Locate Weather Data**

Search by Address  
 Address:

Search by Latitude and Longitude

Latitude:  °      Longitude:  °

Search radius:  miles

**Search Result**

Country:	State:	Locale:	Data Source:	Latitude:	Longitude:	Distance:	GHI:	DNI:
United States	California	Sacramento	TMY2	38.516667	-121.500000	4.49	1793	1990
United States	California	West Sacramento	Meteonorm	38.616667	-121.583333	5.39	1796	2048
United States	California	SACRAMENTO EXECUTIVE ARPT	TMY3	38.500000	-121.500000	5.64	1803	2031
United States	California	Sacramento	Meteonorm	38.516667	-121.400000	6.80	1798	2007
United States	California	SP 121653855	Solar Prospector	38.550000	-121.650000	8.71	1807	1963
United States	California	El Macero	Meteonorm	38.550000	-121.650000	8.71	1797	2022
United States	California	SACRAMENTO METROPOLITAN AP	TMY3	38.700000	-121.583000	9.47	1808	2005
United States	California	SP 121453875	Solar Prospector	38.750000	-121.450000	11.86	1845	2082

**Location**

Data source: TMY2      Global Horizontal Irradiance (GHI): 1793 [kWh/m<sup>2</sup>/year]

Site: United States, California, Sacramento      Direct Normal Irradiance (DNI): 1990 [kWh/m<sup>2</sup>/year]

Override elevation:      Contains Rainfall Data: Yes

Elevation:  feet

Save      Configurations: Default (Public)

Site: United States, California, Sacramento      System size: 124.2 kWp

Lat: 38.52°      Site elev: 26.25 ft      Modules: 540 SunPower SPR-230E-WHT-D [Archived]      Logging detail: 1

Long: -121.50°      Time Zone: GMT -8.00      Mounting: T10      Units: Imperial

# Why SunPower Maintains an In-House Tool

## How to register as a PVSIM user

- Go to <https://pvsim.sunpowercorp.com> and click on the registration link to submit your request






## Documentation & References

**SUNPOWER**

Welcome Ben Bourne

- LOCATION
- HARDWARE
- SIZING
- LOSSES
- SUMMARY
- RESULTS
- CONFIGURATION
- DOCUMENTATION**
- LOG OUT

Documentation

Document Name	Description	File Type	Added on	Download
<a href="#">PVSIM 2.3.0 User Guide</a>	This is the manual that describes how to use SunPower PVSIM 2.3.0	PDF Document	04/12/2013 11:13:48 AM	
<a href="#">PVSIM 2.3.0 Release Notes</a>	This document describes the new features released in PVSIM 2.3.0	PDF Document	04/12/2013 7:15:34 AM	
<a href="#">PVSIM Evaluation Report by BEW Engineering</a>	This extensive and detailed evaluation of PVSIM by BEW Engineering, an independent 3rd party, expounds the state-of-the-art capability and high accuracy of PVSIM, as well as the superiority of PVSIM over other simulators	PDF Document	01/08/2013 4:53:04 PM	
<a href="#">PVSIM Model and Validation Overview</a>	This document gives a brief overview of the theory behind the calculation used in PVSIM and its validation against the SunPower operational fleet	PDF Document	10/12/2012 11:40:32 AM	
<a href="#">PVWatts Inaccuracies</a>	This paper summarizes numerous sources that illustrate shortcomings in the accuracy of PVWatts	PDF Document	10/12/2012 4:21:57 AM	
<a href="#">SunPower E-Series Release Notes</a>	This document describes the addition of SunPower E-Series modules to the PVSIM database	PDF Document	01/29/2013 3:05:28 PM	

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