

# Accuracy Study of Photon Shade Analysis for Residential Solar Installations

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## Glossary of Acronyms

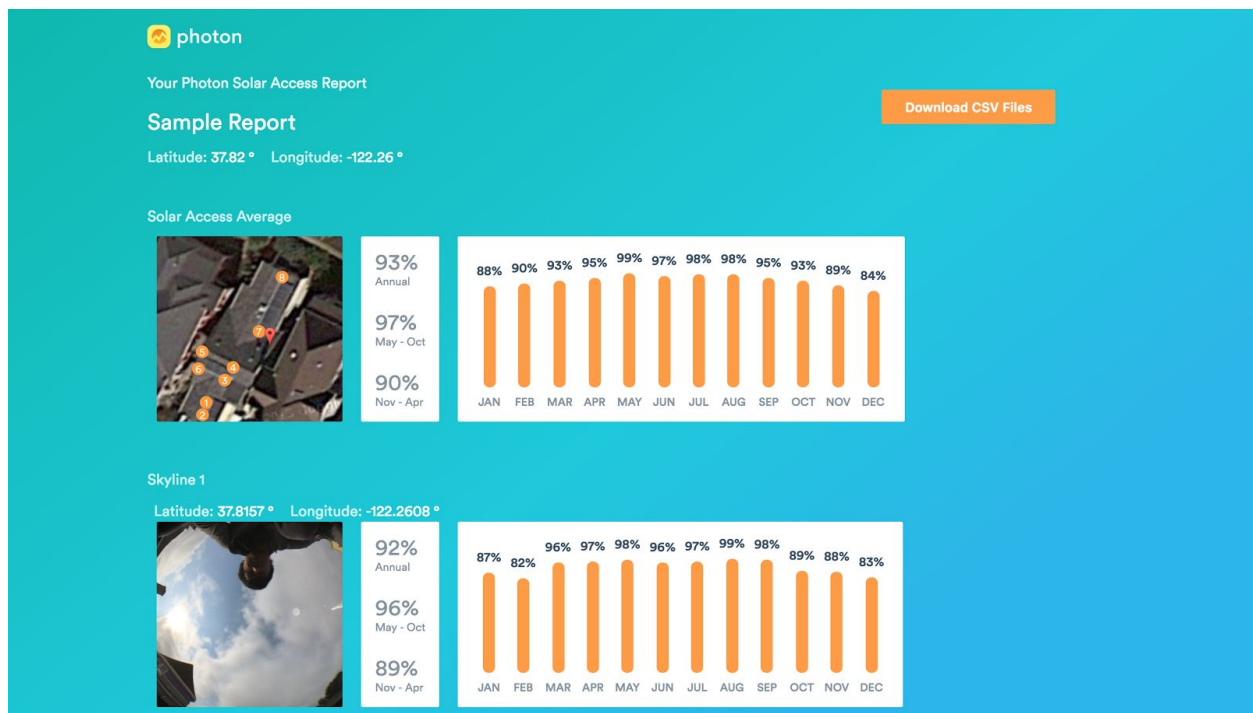
NREL: National Renewable Energy Laboratory

PV: Photovoltaic

SAV: Solar Access Value

## Introduction

Photon Software, Inc. (Photon) has built a mobile application that residential PV system installers use to conduct a shade analysis using their smartphones and tablets. A portion of a Photon Shade Report is provided in the image below.



Photon has completed comparative assessments of on-site shade measurements between Photon and the Solmetric SunEye – the tool currently regarded as the industry standard shade analysis tool. This study’s purpose is to determine the accuracy of Photon’s on-site shade measurements.

## Executive Summary

Our analysis indicates that solar access data from Photon are statistically equivalent to solar access data from the Solmetric SunEye within  $\pm 2$  SAVs using a 95% confidence level.

Although this analysis will not certify the non-hardware (“soft”) cost savings of Photon, the price difference is nontrivial. The current cost of a Solmetric SunEye is \$2,195 before taxes, and comes with a 2 year warranty. In contrast, Photon costs users \$30 per user per month. Deployed at market scale, Photon would be generally understood to reduce soft costs.

## Methodology

Measurements were taken on 20 different rooftops across the San Francisco Bay Area in a variety of conditions, ranging from sunny to cloudy, clear to highly obstructed. In total, 87 points were measured by both the Solmetric SunEye and Photon.

A summary of the shade values gathered from the roof used to calculate the mean and standard deviation can be found here:

Roof #	Photon Annual (%)	Photon Summer (%)	Photon Winter (%)	SunEye Annual (%)	SunEye Summer (%)	SunEye Winter (%)	Annual Difference (%)	Summer Difference (%)	Winter Difference (%)
1	78	79	77	76	77	74	2	2	3
2	94	97	90	94	97	89	0	0	1
3	85	88	81	85	92	75	0	-4	6
4	90	92	87	89	90	87	1	2	0
5	93	97	88	90	93	87	3	4	1
6	97	98	95	96	98	92	1	0	3
7	89	85	93	88	86	92	1	-1	1
8	97	97	97	98	98	97	-1	-1	0
9	95	98	92	95	96	93	0	2	-1
10	77	88	63	79	87	68	-2	1	-5
11	77	84	68	76	80	69	1	4	-1

12	89	95	81	91	96	83	-2	-1	-2
13	81	84	77	83	85	80	-2	-1	-3
14	81	84	78	82	85	79	-1	-1	-1
15	87	91	82	87	92	82	0	-1	0
16	79	86	71	77	85	66	2	1	5
17	85	88	81	83	87	77	2	1	4
18	67	71	63	71	73	68	-4	-2	-5
19	87	90	84	88	91	84	-1	-1	0
20	66	79	50	66	78	48	0	1	2
Mean	84.7	88.55	79.9	84.55	88.15	79.45	0.0	0.25	0.40
Std. Dev.	8.9625	7.3519	12.1131	8.7808	7.5969	11.8343	1.7168	1.9702	2.9451

A two one-sided statistical test (TOST) with a confidence level of 95% was used to compare the SAVs measured by Solmetric SunEye and Photon. A similar study conducted by NREL in 2015 (available here: <http://www.nrel.gov/docs/fy15osti/64470.pdf>) found that a tolerance interval of  $\pm 5$  SAVs is optimal, based on a survey of PV system installers.

Photon Mean Solar Access Minus SunEye Mean Solar Access			
	Annual	Summer	Winter
Mean	0.0	0.25	0.40
Standard Deviation	1.71	1.97	2.95
CI Lower Bound	-0.75	-0.61	-0.89
CI Upper Bound	0.75	1.11	1.69
Equivalence @ $\pm 1$ SAV	Yes	No	No
Equivalence @ $\pm 2$ SAV	Yes	Yes	Yes

In this TOST, the null hypothesis is that the SAVs measured by Photon are different than those measured by the SunEye, all other conditions being equal. The alternate hypothesis is that the SAVs computed by Photon are the same as those computed by the SunEye, all other conditions being equal.

Because the 95% confidence interval falls in the  $\pm 2$  SAVs tolerance interval, we reject to the null hypothesis. This means that Photon's SAV measurements are statistically equivalent to those of the SunEye within  $\pm 2$  SAVs. Given that the SunEye is the industry standard tool for

shade analysis, this study proves that Photon also produces data that matches the industry standard.

All of the data from each rooftop, including the images taken, can be found here:

<https://www.tryphoton.com/dataset>

## Conclusion

This analysis indicates a high level of statistical equivalence between the outputs of Solmetric SunEye and those of the Photon mobile application for multiple residential sites in Northern California. For on-site shading analysis, the Photon results are shown to be scientifically equivalent to Solmetric SunEye measurements at  $\pm 2$  SAV.