NREL
NATIONAL RENEWABLE ENERGY LABORATORY



Fast Facts

- Sunnova Pro minimizes human error when simulating the amount of shade that individual solar panels receive throughout the year.
- Sunnova and NREL conducted a blind study to determine the accuracy of Sunnova Pro's remote shading algorithms. Sunnova Pro was compared to Solmetric's SunEye, and solar access value results were equivalent, with SAV tolerance intervals of ±4.48.

Evaluating Accuracy of the Sunnova Pro Platform Shade Measurement

Sunnova Energy's new solar energy design platform, Sunnova Pro™, automatically generates a three-dimensional (3-D) model of a building and surrounding shading objects. The product is designed to automate the process of engineering a system, sizing batteries, and preparing sales proposals.

Advanced computer vision techniques offer sales personnel and homeowners an intuitive, tactile experience that is delivered in augmented reality through a phone's camera screen.

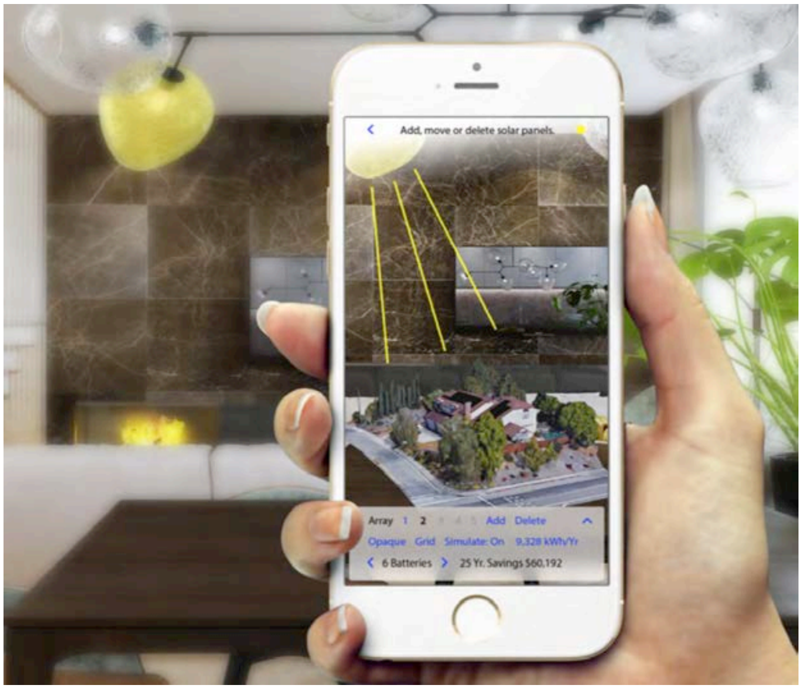

Figure 1. A system designer touches a virtual hologram on the camera screen to add solar panels.

After entering a home's address and a recent electricity bill, a user touches an image of the home's roof to add solar panels. As panels are added, Sunnova Pro simulates the number of kilowatt-hours that are fed directly to the home, stored in solar batteries, and/or curtailed—all on an hourly basis. Any additional electricity needed from traditional base-load utilities to augment solar generation is also factored in, based on both current and assumed future rate plans.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

As users drag and drop panels on the roof, feedback is provided to assist in crafting a solution that is maximizes yearly electricity cost savings to the homeowner. Using a series of heuristics, the app engineers the balance of system in real time as modules are placed. Battery quantity is then recommended based on a series of hourly calculations that include annual demand curve, solar performance curve, and cost of grid power, along with the cost and performance profiles of the batteries.

A 3-D model of the home and its surrounding objects such as trees and nearby buildings is developed automatically "in the cloud" without human intervention, working to reduce modeling labor costs and mistakes as the results are algorithmically generated. The resulting textured 3-D mesh, generally consisting of about 20,000 polygons, working to mimic the actual shape of each object – in contrast to other approaches that use proxies to represent various shading objects.

Because the roof's slope and rotation are estimated algorithmically, users only need to review the results match their understanding. This feature, along with automating the creation of shade objects, is of key importance when ensuring accurate projections of production—and ultimately, cost-savings—to homeowners.

Verifying the Accuracy of Remote Shading

The National Renewable Energy Laboratory (NREL), in partnership with Sunnova Energy, independently verified the accuracy of Sunnova Pro's remote-shading solar access values (SAVs) on an annual basis for locations in Los Angeles, California, and in Denver, Colorado. Estimates of annual SAVs were calculated using the Sunnova Pro mobile app at 43 roof locations across four houses in the Los Angeles metro area, and at 38 roof locations across four houses in the Denver metro area. Table 1 provides an analysis of annual SAV equivalence intervals of ±3%, ±5%, and ±10%. The table uses a Yes/No designation for each equivalence interval and location to indicate whether or not the product was able to meet the equivalence intervals.

Table 1. Estimated annual solar access value equivalence interval ranges from Sunnova Pro.

SAV Equivalence Interval	Los Angeles	Denver
± 3%	No	No
± 5%	Yes	Yes
± 10%	Yes	Yes

In total, 81 roof locations were assessed on houses with varying slopes, rooftop obstructions, surrounding trees, and other factors that affect rooftop SAVs. Sunnova Pro's estimated SAVs were compared with the averaged readings taken from two Solmetric SunEye devices at the physical roof locations. Table 1 shows the results of the two one-sided statistical test (TOST) used to evaluate the differences in Sunnova Pro's readings and the SunEye readings.[1] Readings between Sunnova Pro and the SunEye devices are considered to be statistically equivalent if the confidence intervals of their mean differences fall within a given interval.

The results of the analysis show that annual SAV measurements calculated by Sunnova Pro were statistically equivalent within ±3.52 SAVs to those of on-site measurements made with SunEye devices in Los Angeles and within ±4.48 SAVs in Denver.

Potential for Soft-Cost Savings

Sunnova Pro is a comprehensive platform that enables Sunnova's dealer network to quickly and intuitively design and quote PV systems and to produce accurate, permit-ready proposals in less than five minutes.

The cost of analyzing site data and conducting an on-site assessment before a quote is estimated to constitute 55% of the customer acquisition and engineering design costs for residential solar photovoltaic installations.i Accordingly, NREL estimates that bid preparation software tied with integrated shading analysis can save $0.17 per watt on a 5-kilowatt system.[2]

Although NREL has not independently certified Sunnnova Pro's soft-cost savings, the estimated savings of this type of mobile application deployed at market scale is generally understood to reduce soft costs to a similar degree.

[1] Analysis of Solar Census Remote Solar Access Value Calculation Methodology *http://www.nrel.gov/docs/fy15osti/63098.pdf*

[2] Ardani et al. 2013. Non-Hardware ("Soft") Cost Reduction Roadmap for Residential and Small Commercial Solar Photovoltaics, 2013–2020. NREL/TP-7A40-59155. National Renewable Energy Laboratory, Golden, CO. *www.nrel.gov/docs/fy13osti/59155.pdf*