Modeling and Analysis Activities at the National Renewable Energy Lab

1. Transferring data and algorithms from research organizations to the solar industry via ready-to-use tools.
2. Filling knowledge gaps in modeling with original research.
4. Supporting R&D program planning with software to evaluate R&D improvements impact on LCOE.

Web site: pv.sandia.gov

Modeling and Analysis Activities at Sandia National Laboratories

1. Promoting standards and transparency in PV performance modeling.
2. Identifying and reducing sources of uncertainty.
3. Developing methods and tools for validating PV performance models.
4. Field validation of models and algorithms at multiple locations.

SAM Development and Support

The System Advisor Model (SAM) calculates renewable energy project metrics by combining time series modeling of system performance with cash flow modeling of project finances. SAM implements models and algorithms developed by research organizations, and presents them in a robust user flow modeling of project finances. SAM includes models and algorithms developed by research organizations, and presents them in a robust user flow modeling of project finances. SAM’s twelve performance models can model PV, CPV, parabolic troughs, towers, linear fresnel, and dish Stirling CSP systems and non-solar systems, while its eight financial models can model single owner or more complex multi-partner financial structures. SAM’s users include project developers, equipment manufacturers, academic researchers, utility companies, and consultants from around the world.

PVWatts and IMBY Combined

PVWatts is a map-based web application for non-experts to rapidly calculate basic performance and cost metrics for grid-connected PV systems. This year, NREL has added a basic financial model, and integrated PVWatts with IMBY (In My Back Yard, another NREL web application) using a drag-and-drop interface. NREL plans to continue integrating its models into a single web application to facilitate basic performance and financial analysis. SAM will serve as the “engine” behind this web application.

Defining Standard Modeling Steps

PV performance modeling applications are used to choose between technologies, optimize system designs, and ultimately estimate the amount of energy a PV system is expected to produce. Such estimates form the basis for determining the value of the system and are used as the basis for financing. Sandia is promoting the benefits of adopting a more standard set of modeling steps in order that various production estimates can more readily be compared and validated.

PV_LIB Toolbox for Matlab

Sandia has developed a PV performance modeling toolbox (PV_LIB) for Matlab. It contains a set of well-documented, transparent functions and example scripts that allow model users and developers to better understand how PV performance is predicted and independently validate commercial modeling packages. This toolbox is meant to help make the multi-step process of modeling a PV system accessible for beginning to advanced model users. The toolbox includes the following function categories:

1. Time and Location Functions
2. Irradiance Functions
3. Insolation Translation Functions
4. Photovoltaic System Functions

Recent Papers


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Sandia National Laboratories, SAND2012-1099.

Photovoltaic Systems. 6th International Conference on Concentrating Photovoltaic Systems, Freiberg, Germany.