

# Utility-Scale PV Projects in SAM

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# SAM Webinar Series 2023

Geothermal Electricity Technology Evaluation Model (GETEM) in SAM	January 19
Linkages between NREL's dGen, REopt and SAM Models	July 11
Financial Models for Utility-scale Projects in SAM	July 19
<b>Modeling Utility-scale Photovoltaic Projects in SAM</b>	<b>August 23</b>
Modeling Behind-the-meter (BTM) Batteries in SAM	September 20

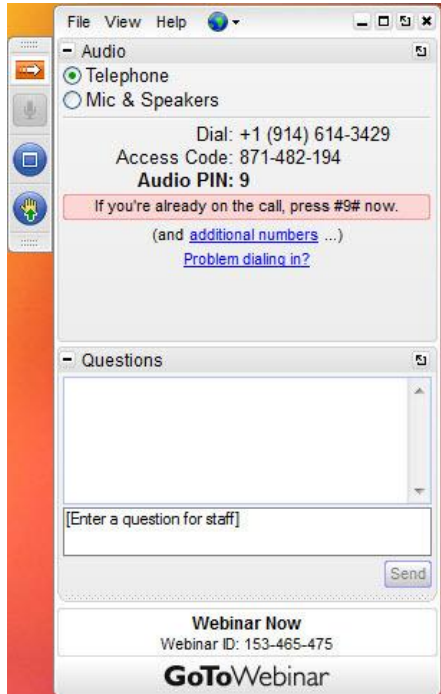
Webinars are free

- Register at <https://sam.nrel.gov/events>

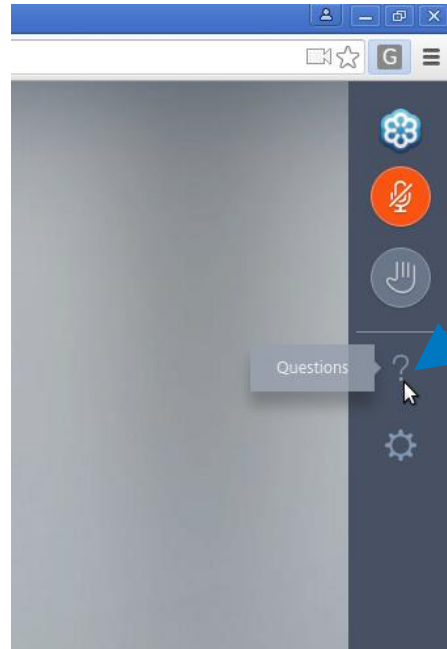
Webinars are recorded

- <https://www.youtube.com/@SAMDemoVideos>
- “Videos” pages at <https://sam.nrel.gov>

# Questions and Answers



Desktop application



Instant Join Viewer

We will either type an answer to your question or answer it at the end of the presentation.

Find webinar recordings at <https://sam.nrel.gov/>

# Agenda

**1** What is considered utility-scale PV?

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**2** Live Demo

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**3** Other Resources

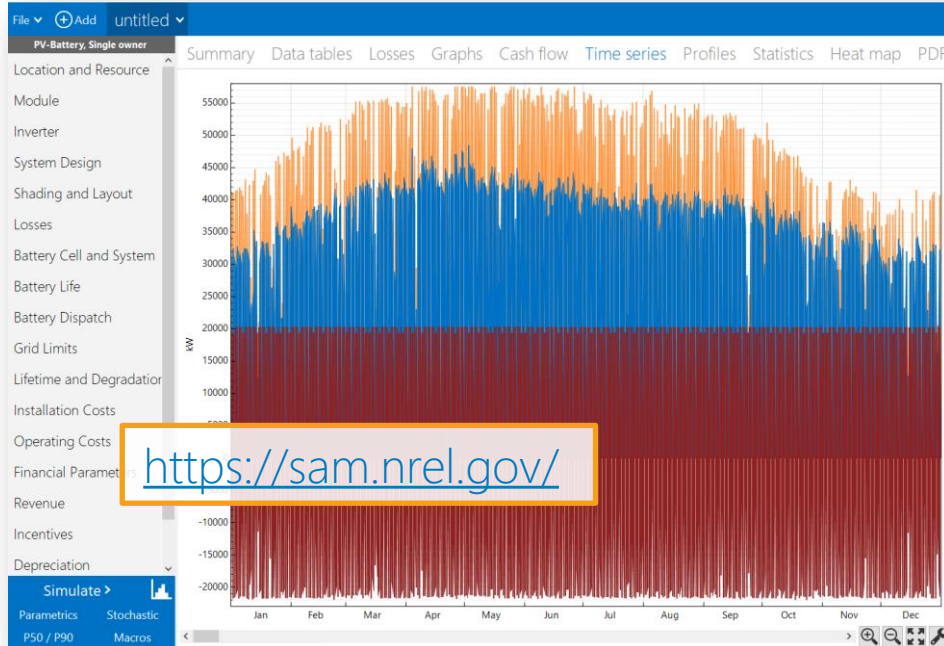
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**4** Q&A

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# System Advisor Model (SAM)

Free software that enables detailed performance and financial analysis for renewable energy systems



- ✓ Desktop application
- ✓ Software development kit with PySAM Python package
- ✓ Open source code repositories

# What is SAM's definition of utility-scale PV?

- SAM doesn't enforce any specific definitions of scale!
- It's up to the user to choose the combination of technology and financial model options that make the most sense for their system
- The important distinction is with the financial model
  - Sells the power it generates (front-of-meter models)
  - or reduces the owner's electricity bill (behind-the-meter)

**What I will be showing today is how you can use the Detailed PV model to model a large, ground-mount single-axis tracking system with central inverters**

# Live Demo

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SAM Version 2022.11.21

# Help Resources

## Help System

- Press F1 key or click **Help** in SAM software
- Web version at <https://sam.nrel.gov/help>

## SAM Forum

- <https://sam.nrel.gov/forum>
- Use search box to find information
- Register on website to post questions

## Email

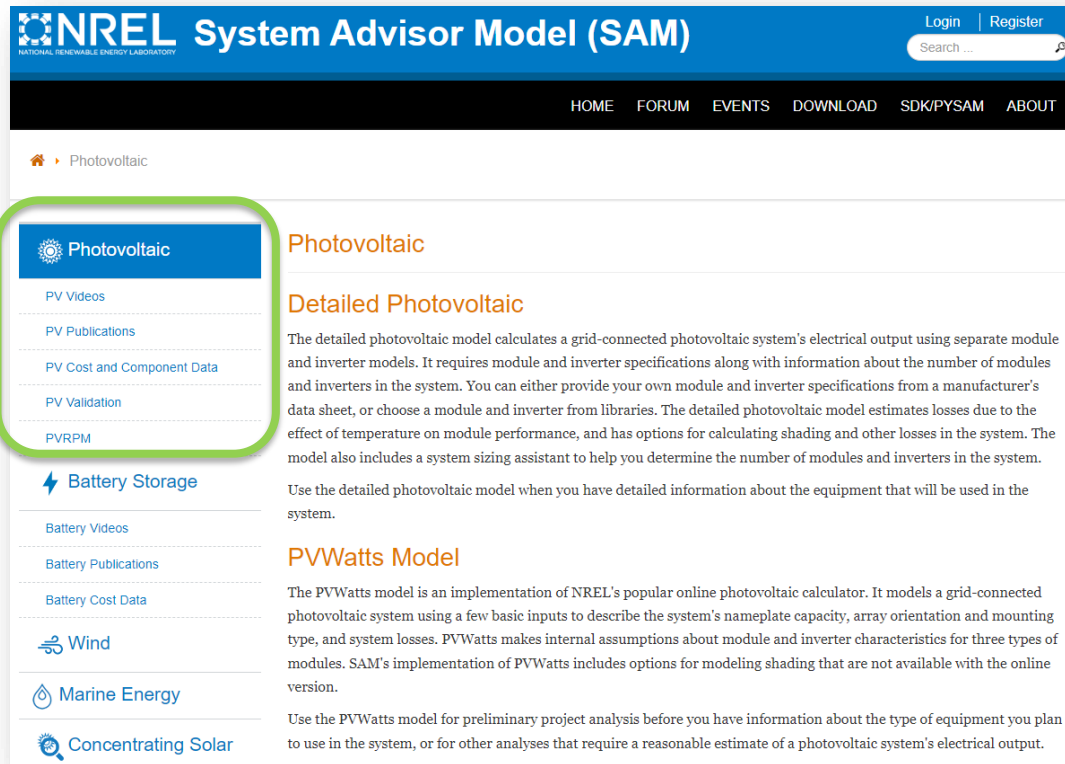
- [sam.support@nrel.gov](mailto:sam.support@nrel.gov)



# Related Resources

- <https://sam.nrel.gov/photovoltaic/pv-videos.html>
  - Bifacial modeling video
  - PV Reliability Performance Model video
  - Sizing PV Systems video
- <https://sam.nrel.gov/photovoltaic/pv-validation.html>
- <https://sam.nrel.gov/financial-models.html>
- <https://sam.nrel.gov/battery-storage/battery-videos.html>

More PV  
resources on  
the website!



The screenshot shows the NREL System Advisor Model (SAM) website. The header includes the NREL logo, the title "System Advisor Model (SAM)", and links for "Login" and "Register". A search bar is located in the top right. The main navigation menu includes "HOME", "FORUM", "EVENTS", "DOWNLOAD", "SDK/PYSAM", and "ABOUT". The breadcrumb trail shows "Home > Photovoltaic". A sidebar on the left lists various resources, with the "Photovoltaic" section highlighted by a green rounded rectangle. This section includes links for "PV Videos", "PV Publications", "PV Cost and Component Data", "PV Validation", and "PVRPM". Below this are sections for "Battery Storage", "Wind", "Marine Energy", and "Concentrating Solar". The main content area features a "Photovoltaic" heading, followed by a "Detailed Photovoltaic" heading and a paragraph describing the model's capabilities. Below this is a "PVWatts Model" heading and a paragraph describing its use.

**NREL** System Advisor Model (SAM)  
NATIONAL RENEWABLE ENERGY LABORATORY

Login | Register  
Search ...

HOME FORUM EVENTS DOWNLOAD SDK/PYSAM ABOUT

Home > Photovoltaic

**Photovoltaic**

- PV Videos
- PV Publications
- PV Cost and Component Data
- PV Validation
- PVRPM

**Battery Storage**

- Battery Videos
- Battery Publications
- Battery Cost Data

**Wind**

**Marine Energy**

**Concentrating Solar**

## Photovoltaic

### Detailed Photovoltaic

The detailed photovoltaic model calculates a grid-connected photovoltaic system's electrical output using separate module and inverter models. It requires module and inverter specifications along with information about the number of modules and inverters in the system. You can either provide your own module and inverter specifications from a manufacturer's data sheet, or choose a module and inverter from libraries. The detailed photovoltaic model estimates losses due to the effect of temperature on module performance, and has options for calculating shading and other losses in the system. The model also includes a system sizing assistant to help you determine the number of modules and inverters in the system.

Use the detailed photovoltaic model when you have detailed information about the equipment that will be used in the system.

### PVWatts Model

The PVWatts model is an implementation of NREL's popular online photovoltaic calculator. It models a grid-connected photovoltaic system using a few basic inputs to describe the system's nameplate capacity, array orientation and mounting type, and system losses. PVWatts makes internal assumptions about module and inverter characteristics for three types of modules. SAM's implementation of PVWatts includes options for modeling shading that are not available with the online version.

Use the PVWatts model for preliminary project analysis before you have information about the type of equipment you plan to use in the system, or for other analyses that require a reasonable estimate of a photovoltaic system's electrical output.

# Thanks! Questions?

Janine Freeman Keith – project lead, photovoltaic and wind models

Nate Blair – emeritus lead, financials, costs, systems

Darice Guittet – software development, battery models

Brian Mirletz – software development, battery models, utility rates

Matt Prilliman – photovoltaic and marine energy models

Steve Janzou – programming, utility rate structures (subcontractor)

Paul Gilman – user support and documentation (subcontractor)

Ty Neises – concentrating solar power models

Bill Hamilton – concentrating solar power models

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