SAND2016-4782PE

PVPerformance MODELING COLLABORATIVE

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Welcome and Introduction to the Workshop

5th PV Performance Modeling Workshop
Santa Clara, CA May 9, 2016





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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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Mercury Transit Across the Sun Today!

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- Thank you to Greg Smestad for offering viewing opportunities!
- These are rare events.
  - After 2016, the next two Mercury transits will take place on November 11th 2019 and November 13th 2032.

- Live Feeds
  - SLOOH SpaceCamera
  - ESA's BepiColombo mission (from space, Spain and Chile)
  - ServiAstro (University of Barcelona, Spain)
  - NASA's Solar Dynamics Observatory ('near-live feed')
  - Smithsonian National Air and Space Museum (Washington DC, USA)

Background

- Welcome to the 5th PVPMC Workshop!
- Aim is to bring together international experts on PV performance modeling and monitoring to discuss new trends and present research results to the community.
  - Focus on technical issues. Information transfer between researchers and industry
  - Support discussion, networking, and partnerships
  - Identify gaps and opportunities for improving models (and technology)

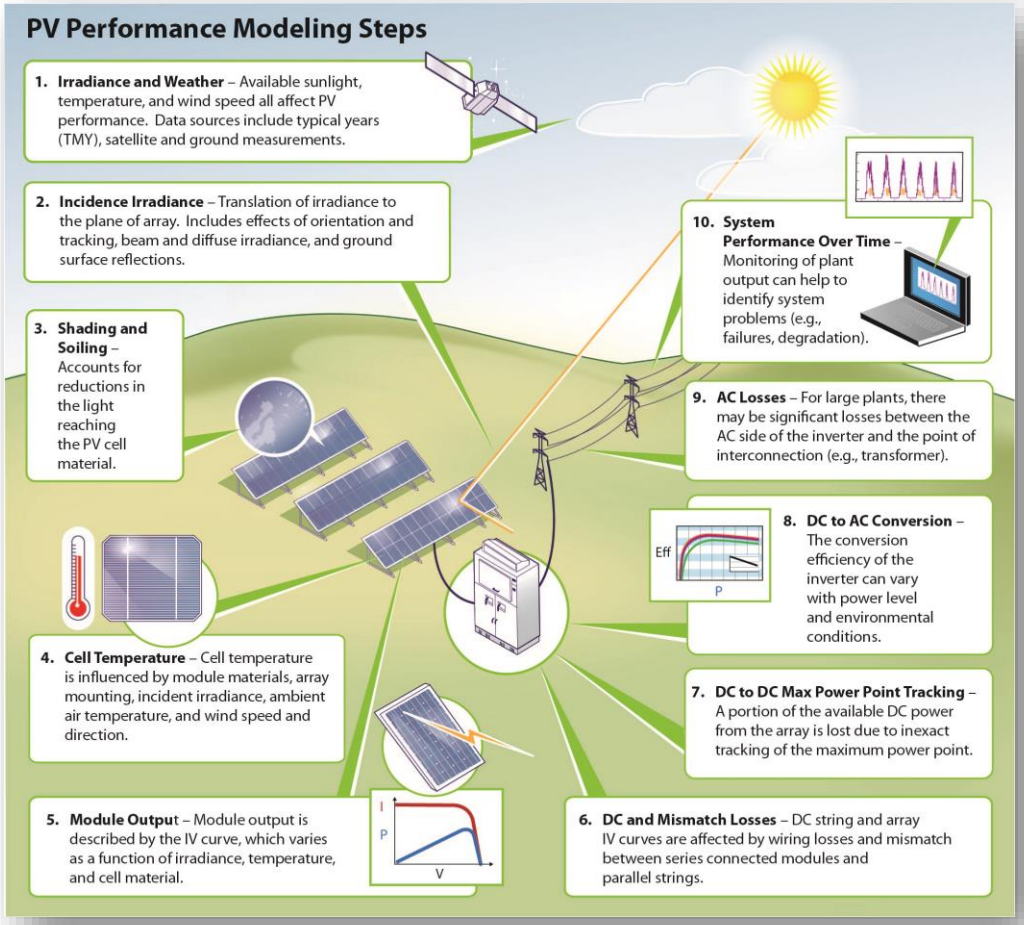
Previous and Future Workshops

1.	2010	Albuquerque, NM
2.	2013	Santa Clara, CA
3.	2014	Santa Clara, CA
4.	2015	Cologne, Germany
5.	**2016**	**Santa Clara, CA**
6.	*2016 (24-25 Oct)*	*Freiburg, Germany*
7.	*2017 (30 Mar)*	*Lugano, Switzerland*
8.	*2017 (?)*	*USA??*

PV Performance Modeling and Monitoring Landscape

PV performance is modeled by following the flow of energy from the sun to the meter.

- Each step in the journey is represented with a model.
- Comparison of monitoring data to model predictions helps to detect failures and degradation
- The PVPMC aims to document and improve these models so that best practices are available and used by the solar PV industry.

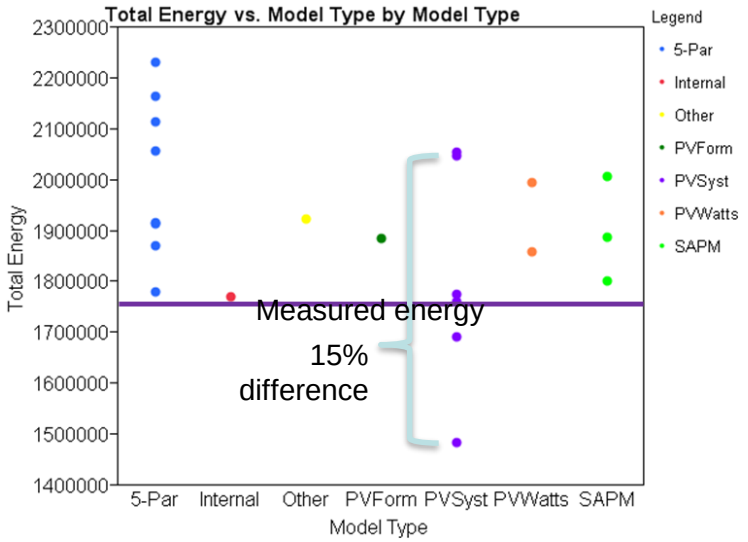


Stein, J. S. and B. H. King (2013). Modeling for PV plant optimization. Photovoltaics International, Solar Media Ltd. ***19th: 101-109.***

2010 and 2015 Blind Modeling Studies

2010 Blind Study Facts

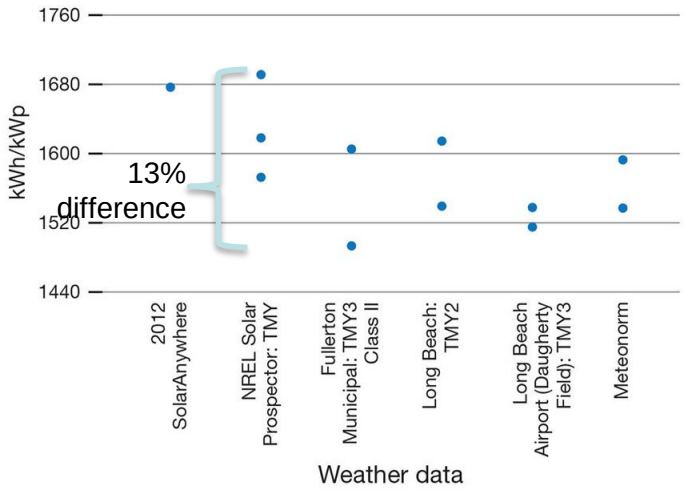
- 20 participants given measured weather and irradiance and 3 PV system designs
- Asked to predict annual energy from systems
- Results compared with measured annual energy



Cameron, C., J. Stein and C. Tasca (2011). PV Performance Modeling Workshop Summary Report. Albuquerque, NM, Sandia National Laboratories.

2015 Blind Study Facts

- 12 participants given 1 PV system design and location.
- Asked to predict annual energy from system
- Participants had to find their own weather data.



Andrews and Yates, Solar Pro Magazine Sept/Oct 2015

Lesson Learned: Greater consistency and transparency in modeling is still needed.

Topics for this workshop

1. Solar Resource Data
   - Solar Anywhere, SolarGIS
   - Irradiance correlations
   - Field instrumentation
   - Multi-year vs. TMY
2. PV Performance Modeling
   - Transposition modeling
   - Spectral modeling
   - CIGS performance
3. Modeling Tool Updates
   - PVsyst, SAM, Open-source tool from Canadian Solar
4. Modeling Challenges for Bifacial PV
   - Developing rating standards
   - Backside irradiance resource
   - Modeling approaches
5. Performance Modeling During Operations
   - Loss factor analysis
   - Improving production estimates using operational data
   - Using POA data for modeling
   - Open-source machine learning for PV monitoring

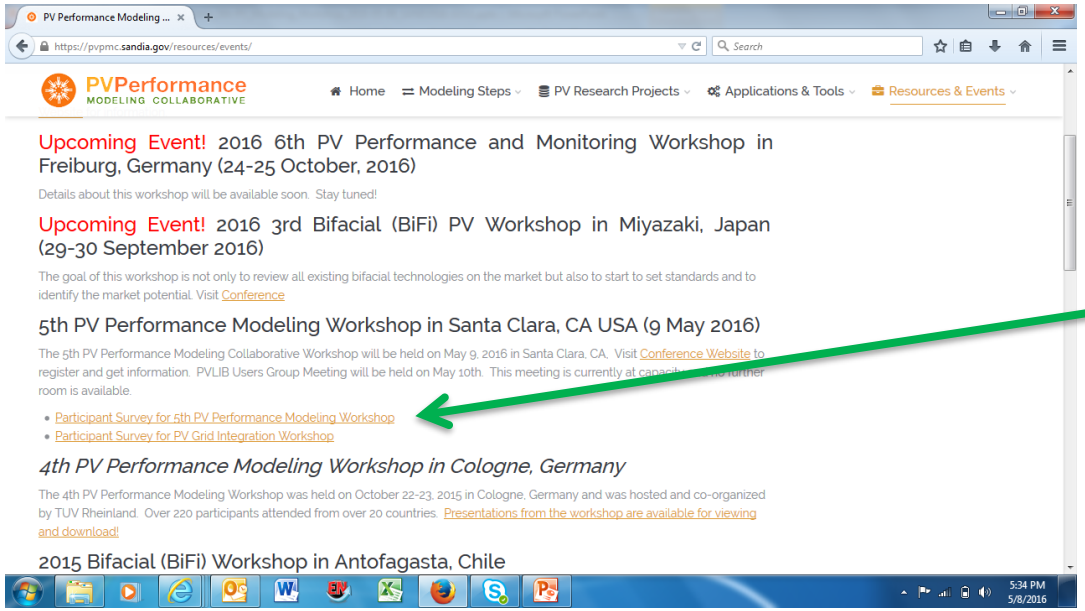
***Professional development hours (PDH) are being offered as part of PV Symposium attendance. Make sure to sign in for each workshop.

Protocols

- Speakers
  - Time limits will be enforced!
  - Ensure presentations are uploaded well before your scheduled session.
  - We would like to be able to post/share presentation materials after the workshop. If there are restrictions, please notify organizers.
- Audience
  - Silence cell phones
  - Return from breaks on time
  - Ask questions
  - Participate in discussion sessions
  - Meet colleagues and network during breaks

Workshop Presentations

- We will be making presentations available after the workshop to the public via the PVPMC.sandia.gov website.
- Please fill out Workshop Survey: http://1.usa.gov/1NlWQmc
- Survey is also available on the pvpmc.sandia.gov website under Resources and Events →Events and Workshops



Thank You and Enjoy the Workshop!

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