12th PV Performance Modeling and Monitoring Workshop Highlights

The 12th workshop was held in Albuquerque, NM May 14-16, 2019 at the Hotel Albuquerque in the heart of the historic Old Town. It was part of the 2019 PV Systems Symposium, which also included sessions and tutorials on grid integration issues. Presentations from industry experts covered a broad range of topics related to:

- PV performance modeling and monitoring (https://pvpmc.sandia.gov/resources-and-events/events/2019-12th-pv-performance-modeling-and-monitoring-workshop/) and
- Grid integration (https://pvpmc.sandia.gov/resources-and-events/events/2019-12th-pv-systems-symposium-grid-track/).

We had a keynote presentation given by Sarah Cottrell Propst, Cabnet Secretary of New Mexico, Minerals and Resources. She spoke about New Mexico's new Energy Transition Act of 2019 that calls for a phased transition to renewables (50% electricity by 2030, 80% by 2040, and 100% for utility companies by 2045.)

Below are some of the highlights from each of the technical sessions.

Session 1: Solar Resource Data and Modeling

- Artur Skoczek from Solargis presented great progress in the creation of an All-in-one application for pre-feasibility of solar PV plants. This app includes a wide variety of unique graphical plots to illustrate PV performance characteristics for a given site.
- Patrick Keelin of Clean Power Research presented an interesting comparison between remote satellite and ground-based albedo measurements. He showed that for sites with uniform ground cover and not much spatial variability, the two measurement types can come close. However, many sites have fine-scale spatial variability and only more detailed ground measurements can provide an accurate assessment of site albedo. He also recommended that modelers run sensitivity studies on albedo to help determine the acceptable level of uncertainty.

Session 2: PV Module Characterization

- Nick Riedel from the Technical University of Denmark presented on an experimental round robin he is running to evaluate and compare methods for measuring the incident angle modifier for PV modules. He demonstrated that lab measurements are becoming better and more consistent since the round robin that was done in 2018.
- Ben Bourne of SunPower presented on deriving thermal response coefficients for PVSyst. He found that wind has a greater influence on system operating temperatures than indicated by PVSyst. He also showed that greater errors occur for systems at lower tilt angles and for roof mount systems with less room for air-flow beneath the array.

Session 3: PV Performance Model Updates

- Chetan Chaudhari from SunPower presented a method to model the performance of module level power electronics using open source software (PVMismatch).
- Janine Freeman presented recent and planned improvements for NREL's System Advisor Model (SAM).

Session 4: PV Performance Standards and Studies

- Michael Deceglie from NREL gave a great overview of DOE's new program PV Fleets, which is gathering fleet-scale performance data in exchange for system degradation analysis from NREL. This project aims to provide critical information to PV stakeholders on the degradation rates in system performance.
- Daniel Fregosi of EPRI gave an interesting talk demonstrating the variability in degradation rates simply due to the methods used to calculate them. More work in this area is needed to ensure that calculated degradation rates are accurate and robust. More standardization is needed.
- Birk Jones of Sandia presented a methodology for converting field data of irradiance and temperature histories to cumulative exposures in order to better compare PV degradation measured in a variety of climates. Early results indicate that the methodology helps with the interpretation of degradation from PV systems at four locations around the country.

Session 5: Bifacial PV Performance Modeling

- Keith Mcintosh of PV Lighthouse gave an impressive talk about their work to understand the effects of nonuniform irradiance on bifacial modules caused by shading from the torque tube on single axis trackers. Their ray-tracing solution, SunSolve, runs on the cloud and is capable of performing 20 million ray calculations per incident angle and only takes ~45 min to solve for an entire annual simulation.
- Silvana Ayala Pelaez from NREL presented an update on bifacial radiance, an open source python wrapper for the ray tracing code Radiance. She introduced a new GUI for the code and outlined the development goals of the project.

Session 6: PV System Monitoring

- James Richards from CFV Solar presented on new PV monitoring hardware that he has developed that is both low cost and accurate.
- Juergen Sutterlueti of Gantner Instruments provided an update on their cloud-based monitoring and analytics Webportal. The showed several examples of how the service provides value ot plan operators.
- Marios Theristis of the University of Cyprus presented on their investigations of using mechanistic and machine learning models for evaluating the performance of operating PV plants. They demonstrated the sensitivity of filtering methods on the results of the models.

Session 7: Open Source Software Updates

- Ben Taylor of Exyte Energy and Jessica Forbess of Sunshine Analytics presented their open source python package: captest, which implements ASTM E2848 standard for measuring PV system performance.