PV Performance Modeling Workshop Goes to China

In early December 2017, 250 experts in the field of photovoltaic (PV) performance modeling converged in the seaside city of Weihai, China in Shandong Province for the 9th PV Performance Modeling and Monitoring Workshop. This event was organized by Sandia National Laboratories, Fraunhofer ISE, and the Harbin Institute of Technology (HIT), one of the premier engineering universities in China and the world.

This series of workshops was started at Sandia in 2010 when a group of 50 PV modeling experts were invited to Albuquerque, New Mexico to discuss modeling trends and new ideas for improving the accuracy of PV performance models. Following this initial workshop, Sandia founded the PV Performance Modeling Collaborative (PVPMC) to further stimulate innovation and information sharing in this discipline. Sandia developed a website (https://pvpmc.sandia.gov) and the open-source PVLIB Toolbox to share best practices for modeling and model validation. Today, the website attracts more than 10,000 pageviews per month. In 2013 and 2014 the 2nd and 3rd PVPMC Workshops were held in California. In 2015, the Collaborative joined efforts with partners from the International Energy Agency PVPS Task 13 working group to host the 4th Workshop in Germany. In the ensuing years, the PVPMC has hosted workshops in the US and Europe about two times a year. The most recent workshop in China is the first in Asia and had the largest number of participants.

The global market for PV is changing rapidly. Years ago, Europe and especially Germany, Spain, and Italy were market leaders in PV manufacturing and system installation. Since then, China has very quickly grown into the world's largest producer and consumer of solar electricity. In addition, Chinese universities and companies are increasingly developing new solar-related technologies. For these reasons, it is important for US researchers and industry leaders to establish technical collaborations within China so that they keep abreast of current trends.

There are significant challenges to collaborating in China that are primarily focused around language fluency but also include travel bureaucracy and distance. The 9th PVPMC Workshop in Weihai was a great example of how such challenges can be overcome to initiate a technical dialogue. The workshop content was focused around seven topical sessions with oral presentations followed by group discussions and Q&A. The seven areas included solar resource, modeling tool updates from industry, modeling case studies, PV degradation studies, new PV technologies, grid integration challenges, and soiling studies. In each area, presentations were given in English or Chinese and simultaneous translation services were provided via wireless headsets. The local organizer and host, HIT, did a fantastic job of preparing the translators in the technical terminology of the field by working with them for several days prior to the event. As a result, all the presentations were understandable, and the discussion sessions and Q&A were lively, highly technical, and right on topic. It was refreshing to be able to address a speaker or participant directly to either ask or answer questions in real time. For two days, language barriers fell and we all learned how each of us are trying to solve similar problems related to the energy transition.   All presentation slides are available for download here: https://pvpmc.sandia.gov/resources-and-events/events/2017-9th-pv-performance-modeling-workshop/.

2017 Weihai, China

Participants came to the workshop from over 10 different countries and from many parts of China. Speakers from the US included representatives from Sandia, NREL, SunPower, First Solar, Case Western Reserve University, Envision, and Atonometrics. Three keynote presentations started the workshop followed by seven topical sessions (all presentations are available for download).

Highlights from the keynotes are summarized below:

- Sicheng Wang from China's Energy Research Institute reported on the Chinese PV market now and projected into the future. China has committed to 15% non-fossil energy by 2020 and 20% by 2030. By 2050 they are aiming for 60% of total energy consumption to be from renewable energy. Solar PV is an important pathway to these goals and he provided many examples of how China is driving innovation in this sector. For example, China has just introduced new performance specifications in 2017 for PV cell and module manufacturers that set minimum efficiency goals for different market levels (e.g., market entry vs. market leaders vs. market super-leaders). These standards pressure companies to produce the most efficient technologies. He also presented on system innovations using trackers, bifacial modules, and BIPV to name just a few.

- Ben Bourne from SunPower presented a detailed 10-year retrospective on PV performance modeling, describing the state of the field in 2007 and all of the innovations and improvements made in the last ten years. He identified the following 10-year gains: satellite-based solar resource data and products, web-based energy modeling & design tools, shading calculators, the IEC 61853 test standard, and the PVLIB Toolbox. In his opinion, areas that still need improvement include better soiling and snow models, technology-specific models of shade loss, standards for wind speed in energy modeling and derivation of thermal response coefficients for module and arrays. He also called out a need for third party data management of module performance data and parameters.

- Harry Wirth from Fraunhofer ISE presented modeling results that described the optimal mix of generation technologies that will allow Germany to reduce its greenhouse emissions by 85%

(from 1990 levels) by 2050. He showed that both PV and wind capacity needs to increase by 4-5 times today's levels. These results motivate researchers to innovate ways to better utilize variable generation sources such as solar and wind using energy storage or demand response.

Check out the workshop website (https://pvpmc.sandia.gov/resources-and-events/events/2017-9th-pv-performance-modeling-workshop/) for a full list of talks and downloadable slide decks. The next PVPMC Workshop will be held in Albuquerque May 1-3, 2018 and will be co-hosted by Sandia, CFV Solar Laboratory, and EPRI. Signup on the PVPMC website email updates on upcoming events.