Forecasting approach aimed at improving revenue, making solar more grid-friendly

April 9 2014, by Elizabeth Resenic

Sky cam images and forecasting system will be used to optimize the performance of solar photovoltaic systems. Credit: Kevin Wright

(Phys.org) —Penn State's GridSTAR Center and multiple industry partners will be exploring and demonstrating an innovative and collaborative approach to improve the performance of solar photovoltaic (PV) systems. By using weather data and images of the sky to "train" a control system to operate solar photovoltaic and energy storage systems, the variability of a solar system's output will be "smoothed" and, at the same time, responsive to variations in the price of electricity throughout the day.

"One challenge facing the expansion of solar energy systems is the

impact of their variability on the electrical grid," explained David Riley, associate professor of architectural engineering and director of the GridSTAR Center. "Weather systems and changes in cloud cover can result in large swings in the output of a solar energy system that are hard for the grid and utility companies to absorb. We are very excited about the new approach we will be testing to address this challenge."

Based on a new, commercially available forecasting system, the components of this system include weather and solar monitoring devices, a sky camera, and a neural learning system to process data and learn patterns of the solar array output. Initial testing of the approach has produced forecasts of a solar PV system's output at a very high degree of accuracy over multiple time frequencies. This level of accuracy and reliability could be used to control the throttle of a PV system and the use of energy storage devices to maximize energy production, while also protecting the grid from large swings in the system's energy output.

"We are excited about the next phase of this research and how the GridSTAR Center will allow us to demonstrate and test how the system works in a full scale community approach," said Kevin Wright, managing partner of UMC-Power, who is leading the installation of the research equipment at the GridSTAR Center's location at The Navy Yard in Philadelphia. "The combination of these technologies in a live system would be hard to achieve without the collaborative approach we can pursue with Penn State. Five industry partners from across the U.S. will work together on the study including Pennsylvania-based UMC-Power, Forecast Energy (California), Pacific Data and Electric (California), Dynapower (Vermont) and Solar Grid Storage (Pennsylvania)."

The training phase of the research will begin with the installation of the system components at the GridSTAR Center. Following this phase and the development of increasingly accurate predictions of solar output, the

system will be integrated into an advanced solar and energy storage system designed by Pacific Data Electric and Dynapower. Over time, market conditions and variable pricing structures will be incorporated into the system to enable complex decisions to be made about how to deploy the energy from the solar array and the use of batteries as "shock absorbers" between the solar system and the electric grid.

"The cost of solar energy technologies has dropped dramatically thanks to research investments and increasing global demand for solar energy systems," added Riley. "While many countries recognize the need to expand solar energy investments, we still have challenges to overcome before solar can become a large percentage of our energy supply. This research is an important step toward addressing one of the biggest challenges that remains."

Applications of this approach are broad, and will be explored with the increasing number of firms that are exploring the deployment of solar photovoltaic systems coupled with energy storage. The approach is expected to be particularly valuable and cost effective in island communities like Hawaii and Puerto Rico, where electric costs are high and electrical grids typically lack the robust features needed to absorb high variability of solar system outputs.

Provided by Pennsylvania State University