Lawrence Livermore ramps up wind energy research

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As the percentage of wind energy contributing to the power grid continues to increase, the variable nature of wind can make it difficult to keep the generation and the load balanced.

But recent work by Lawrence Livermore National Laboratory, in conjunction with AWS Truepower, may help this balance through a project that alerts control room operators of wind conditions and energy forecasts so they can make well-informed scheduling decisions. This is especially important during extreme events, such as ramps, when there is a sharp increase or decrease in the wind speed over a short period of time, which leads to a large rise or fall in the amount of power generated.

"We're trying to forecast wind energy at any given time," said Chandrika Kamath, the LLNL lead on the project. "One of our goals is to help the people in the control room at the utilities determine when ramp events may occur and how that will affect the power generation from a particular wind farm."

The project, dubbed WindSENSE, is funded by the Department of Energy's Office of Energy Efficiency and Renewable Energy.

To understand ramp events better, Kamath used data-mining techniques to determine IF weather conditions in wind farm regions can be effective indicators of days when ramp events are likely to occur. She used wind energy and weather data from two regions – the Tehachapi

Pass in Southern California and the Columbia Basin region on the Oregon-Washington border.

"Our work identified important weather variables associated with ramp events," Kamath said. "This information could be used by the schedulers to reduce the number of data streams they need to monitor when they schedule wind energy on the power grid."

With wind farms predicted to provide more energy for the grid, Kamath said it is necessary to get the wind speed predictions on target.

Wind farms in the Tehachapi Pass currently produce 700 megawatts (MW) of power, but soon will be producing 3,000 MW. In the Columbia Basin, the farms were producing 700 MW of power in 2007, but by 2009, they were producing 3,000MW. So it is important that the wind forecasts are accurate, especially during ramp events, when the energy can change by over 1,000 MW in an hour.

"The observation targeting research conducted as part of the WindSENSE project resulted in the development and testing of algorithms to provide guidance on where to gather data to improve wind forecast performance," said John Zack, director of forecasting of AWS Truepower. "These new software tools have the potential to help forecast providers and users make informed decisions and maximize their weather sensor deployment investment."

The wind generation forecasts used by utilities are based on computer simulations, driven by observations assimilated into the time progression of the simulation. Observations of certain variables at certain locations have more value than others in reducing the forecast errors in the extreme events, the location of the event and the look-ahead period.

Part of the WindSENSE effort was to identify the locations and the

types of sensors that can most improve short-term and extreme-event forecasts. The team used an Ensemble Sensitivity Analysis approach to identify these locations and variables.

"We're trying to reduce the barriers to integrating wind energy on the grid by analyzing historical data and identifying the new data we should collect so we can improve the decision making by the control room operators, " Chandrika said. "Our work is leading to a better understanding of the characteristics and the predictability of the variability associated with wind generation resources."

Provided by Lawrence Livermore National Laboratory

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