Smarter Forecasting

IMPROVING WIND'S PREDICTABILITY

BY SALVATORE SALAMONE

MATCHING WIND POWER'S unpredictability with customer electricity demands has always been a challenge. But the issue is getting much more attention today.

First, no one wants a repeat of the problems that occurred in Texas earlier this year when wind power generation suddenly dropped from 1,700 megawatts to 300 megawatts at the same time a cold spell drove up customer demand for electricity.

And second, utilities, states, and countries are installing ever-more wind capacity. For example, the U.S. wind energy industry installed 1,400 megawatts of new generating capacity in the first quarter of this year alone, according to the wind industry trade group, the American Wind Energy Association. That brings the total U.S. capacity to 18,000 megawatts, according to the group. China doubled its wind-generating capacity to over 3 gigawatts in 2007, according to the Global Wind Energy Council. And some industry experts believe China will add another 4 to 5 gigawatts of capacity this year. So any problems are likely to have a much greater effect.

To minimize problems caused by variability in both wind generation and customer demand for electricity, utilities and grid operators are taking a number of steps.

Many install additional reserve capacity to supplement the wind power during lulls. The rule of thumb often cited in this regard is to add an equal amount of reserve backup power for each incremental addition of wind capacity. That can be quite expensive.

Fortunately, a 2007 international collaborative study carried out by the VTT Technical Research Center of Finland for the International Energy Agency found such large amounts of reserve capacity are not necessarily required if certain steps are taken.

One thing that can be done is to distribute wind systems over a wide geographical region to reduce fluctuations in the total aggregate power. The study also found that what's needed is "an integration of wind power production and production forecasts into system and market operations."

Others have come to similar conclusions – particularly when it comes to that last point. "We need to have better measurements of wind power plants' output as we integrate wind energy into existing power systems," said Surya Santoso, an assistant professor in the Department of Electrical and Computer Engineering at the University of Texas at Austin. Working on a two-year, $200,000 grant from the National Science Foundation, Santoso and his students are developing computational methods to calibrate the actual output of wind farms so system planners can calculate how much a wind farm can contribute to meeting expected power needs.

Utilities and grid operators want to avoid the problems that occurred in Texas earlier this year. Naturally, they know the wind is highly variable and cannot be reliably forecasted far in advance, but they are now seeking ways to reduce their risks.

To that end a 24-hour in advance prediction of the electricity output of a wind farm would be ideal. That would give providers enough time to buy additional capacity – if needed – and not have to pay exorbitant prices for that extra capacity as would be the case if they needed to overcome a sudden shortfall in wind energy output.

To address the issue requires a combination of on-site weather data collection, detailed modeling of the current and expected wind conditions, and a correlation between the expected wind at a particular wind farm and the farm's electrical output.

All aspects of this operation are quite complex. Still, a number of organizations including several state electric reliability councils and independent system operators are focusing on this type of endeavor. The ISOs are particularly interested because many of them are increasingly relying on numerous independent wind farm operators to supply energy.

Some of these organizations are turning to third parties who specialize in marrying highly refined wind measurements and day-ahead forecasts with turbine-specific output information to produce total wind predictions for a given wind farm.

In April, the New York Independent System Operator announced that starting this summer it would use such a service from AWS Truewind to "better accommodate wind power in New York's bulk electricity grid."

"The advance forecasts will allow us to accommodate wind power more accurately and reliably," said Robert Hiney, a NYISO board member and interim president. AWS Truewind is also involved in projects in California and Texas. Its competitors include 3 Tier Environmental Forecast Group, WindLogics, and a number of international companies.

All of these efforts simply aim to help utilities and grid operators better incorporate more wind power into their offerings.