AVEVA

Xcel Energy uses the PI System™ to improve wind forecasting

Xcel Energy - www.my.xcelenergy.com
Industry - Power Generation

Goal

- Enable a data model that provides frequent wind-forecasting reports

Challenge

- Volatility of wind speed made for problematic wind-power forecasting, prompting costly surges in other forms of power generation

Solution

- The PI System, PI Server

Result

- A reduction in the need to quickly shift to coal and gas plants, resulting in savings of more than $7 million per year

When Xcel Energy began working with wind energy around 2005, it ran into a problem: predicting wind speed. Wind could go from providing 900 megawatts of power to zero in just a half hour, causing havoc when operators have to then ramp up coal or gas plants to compensate, and it quickly would get expensive. The PI Server, including Asset Framework and Notifications, brought clarity and predictability to wind forecasting, resulting in massive reductions in operational costs and furthering Xcel's commitment to renewable energy.

Unpredictable wind power and high maintenance costs

Xcel provides power for 3 million electric customers and 1.9 million natural gas customers across eight states. It began a centralized installation of the PI System in its Colorado transmission operations in 2003, quickly followed by the company's Minnesota and Texas regions. "We then added in our generation and market-pricing data for commercial operations," said Kasen Huwa, senior business manager at Xcel. The company began wind forecasting in 2008 and in 2011 signed an Enterprise agreement covering transmission operations and commercial operations and wind data integration.

Unpredictability with wind speed led to the wind-forecasting initiative. "Up here in Colorado, northeast section, there is around 900 or 1,000 megawatts all coming down one line," Huwa said. "When you have a lot of wind event coming up and you start producing wind, that is great. Once wind hits a certain speed, if you don't know the turbine's clutch, then they stop producing power. You go from having 900 megawatts of power to 0 in about a 30-minute time span. For these guys in generation to make up for that wind power, you have to turn up your coal plants or your gas plants.

"It's a maintenance nightmare," he added. "You try to ramp them up real fast, and that is not the way that they are meant to operate. In order to counteract that, either you carry a lot of spinning reserves or you have a lot of power plants running at a base load. That costs a lot of money."

Improving wind forecasting with the PI System

To improve wind forecasting, Xcel went to the experts, the National Center for Atmospheric Research (NCAR) and the National Renewable Energy Laboratory (NREL). Then they got data from these wind farms, anywhere from 4 to 9 points per turbine, for just over 1,200 turbines in northeast Colorado. In 2015, Xcel, in partnership with NCAR and NREL, improved displays for the PI Server data. "It's all web-based," Huwa said, "a lot sleeker, a lot cleaner, [with] a lot more options."

The current wind forecasting data model runs every 15 minutes and users can go up to 72 hours before to show real-time data and then 168 hours after. "You can go pretty far out there to see your forecast," Huwa said. The model display also provides 15-minute forecasts for the next three hours to identify potential power and available power. After three hours, it switches to an hourly forecast with potential power, available power, and real-time metered lines and metered points.

Ensuring data quality through Asset Framework

Asset Framework (AF) has been critical to capturing high-quality wind-forecasting data for Xcel. "If we don't have good data in, you don't get good forecast out," Huwa said. "We actually built Notifications so [if] we hit a certain limit – say, 30% data error – we will get a notification to our team and be able to … figure out the issue and get it quickly resolved. That way, our forecast on the back end is also good … Without the use of AF and Notifications, it would be almost impossible to chase down those data-quality errors. You would find them a month later, which doesn't really do you any good."

"Savings and efficiencies are roughly estimated over the last six years at $46 million."

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Kasen Huwa,
Senior Business Manager, Xcel Energy
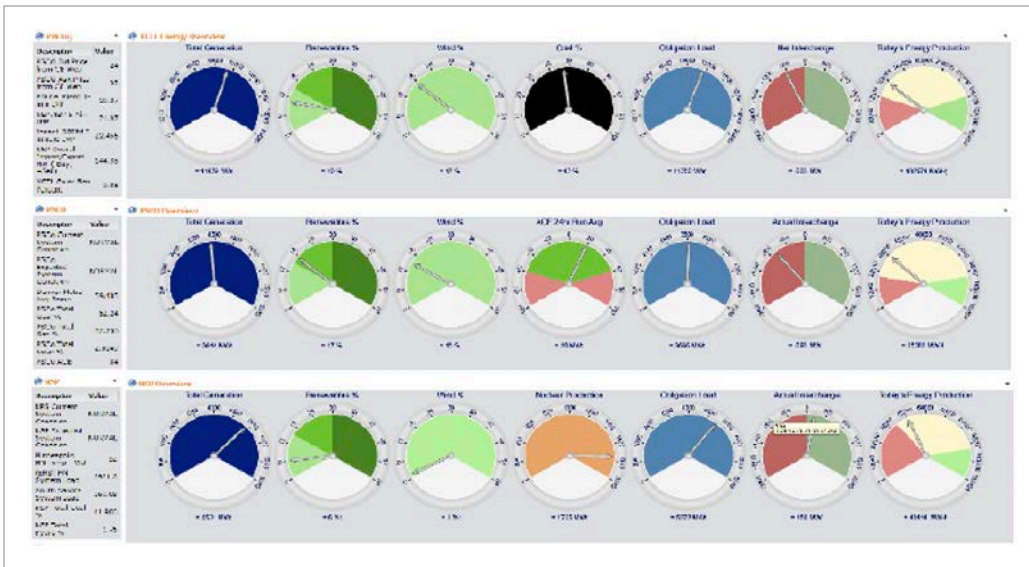
WHUD employees can evaluate the health of the water distribution system, energy consumption and the potential costs lost to leakage, quickly by combining ESRI and the PI System.

Xcel's meteorologists were initially skeptical of data modeling to forecast wind. However, the forecasting was so reliable that after about a month or two of using the system, they stopped doing their own forecasts. "It was neat to see our IT system be automated enough that meteorologists who were very skeptical of our systems wanted to use them," Huwa said.

From the wind-forecasting data initiative alone, Xcel has reduced its mean average error by 38% and realized significant cost savings as plants now run better. Xcel was able to turn a coal plant off for a whole weekend because "we knew that wind was going to be there," Huwa said. "It makes it much easier on your maintenance cycles ... You can now tell [your plants] hours ahead of time rather than last-minute."

Xcel cut down on curtailment payments, and the wind forecasting has led to savings and efficiencies estimated at $46 million over the last six years, Huwa said.

Xcel's future data initiatives, according to Huwa, could include gas distribution, gas transmission, emission monitoring, electric distribution, adding substations, distributed generation, and smart meters.

For more information about Xcel Energy and the PI System, watch the full presentation here.