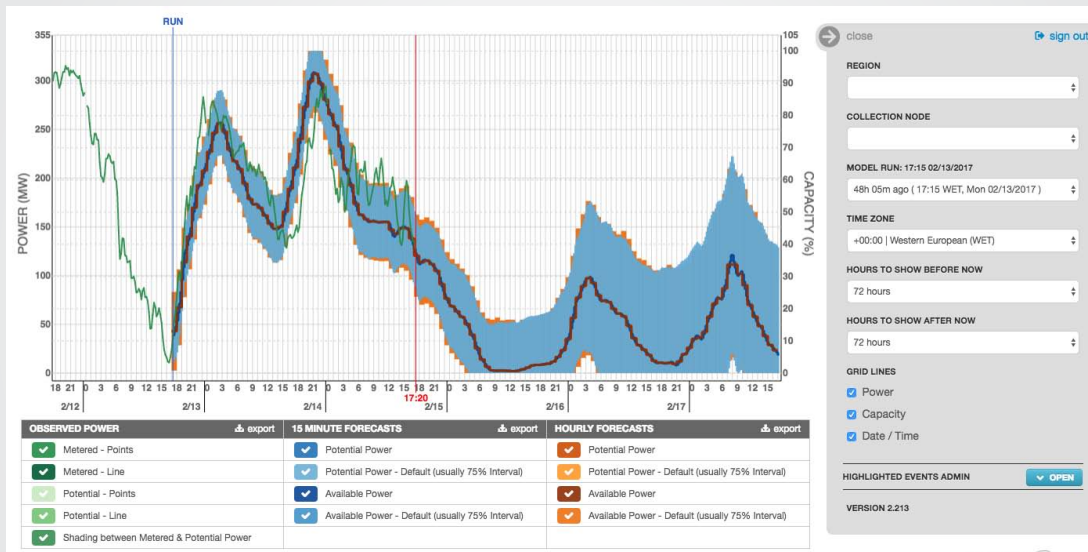


Global Weather Corporation's WindWX™ service provides forecasts of hub height wind speed and estimated power output (when system characteristics are available), for any wind farm at any location in the world. WindWX's accurate estimates of hub height wind speed enable reliable monitoring and prediction of wind energy systems, including power production. Typical users include utilities, energy traders, farm operators, farm maintenance crews, and transmission operators. Forecasts can be displayed in our simple, intuitive, web-based display, shown here. Alternatively, our forecast data feed can be integrated into any customer system.

## User Interface for WindWX Services



Observed power (green line) is displayed with hourly average forecasted power (orange line). The forecast of 15-minute power is shown by the blue line. The shaded areas show the prediction interval for the forecasts.

WindWX combines two critical modeling steps.

1. The first is GWC's best-in-the-world atmospheric forecast,<sup>1</sup> used in this case to generate hub height wind speed information.
2. The second is our power conversion model that converts wind speed to output power. Some customers need only hub height wind speed; others need the conversion to power as well. When observational data are available, the system can provide an improved forecast based on statistical analysis of the observations.

The increasingly accurate wind energy forecasts for Xcel Energy have led to opportunity cost savings of \$59.3 million, using the day-ahead forecast. The accuracy of the GWC day-ahead forecast is about 11% at the Xcel projects, an increase of 35% from 6 years ago.

### Forecast Error Reduction Saved Xcel Customers \$59.3 million

Forecasted MAE:			
2009	Sept. 2015	Improvement	Total Savings
16.83%	10.92%	35.1%	\$59.3 Million

1. ForecastWatch is an independent provider of forecast accuracy and skill information. Read the report at [http://forecastwatch.com/static/Three\\_Region\\_High\\_Temperature\\_Study\\_2014.pdf](http://forecastwatch.com/static/Three_Region_High_Temperature_Study_2014.pdf)

WindWX includes forecasts at both hourly and 15-minute resolution. Both datasets are updated every 15 minutes and extend out to 7 days.

Observations of wind speed and power, when available, are input to the system. These data are used to optimize the forecast generation and power conversion steps in the processing chain. Output is available through GWC's web-based time-series graphical user interface and as a data feed for integration into automated processes. The table below summarizes the standard output variables when power output data are provided in addition to hub height wind speed.

## Data for WindWX Services

### VARIABLES AVAILABLE

- › Potential Power at Node
- › Average Wind Speed at Site
- › Rolling 7-day Power %MAE
- › Rolling 30-day Power %MAE
- › Potential Power 25th Percentile
- › Potential Power 75th Percentile
- › Power as % of Capacity
- › Available Power at Node
- › Available Power 25th Percentile
- › Available Power 75th Percentile
- › Available Power 7-day %MAE
- › Available Power 30-day %MAE

### DELIVERY METHOD

- › Standard web services as bulk CSV files

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