Assessing the Impact of Wind Energy On the Electric Grid

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Introduction

The aggressive development of wind energy is beginning to affect the way utilities provide reliable power to customers. Understanding the characteristics of this variable power source is essential for reliable operation of the electric grid. This poster provides an overview of critical data and advanced methods for assessing the addition of wind energy to the grid, and presents results of previous successful research in this area.

Background

Given the nature of its fuel source, wind energy output is subject to both variability of power delivery and uncertainty around its future schedule. These attributes raise concerns for power system operators around reliability and cost.

WindLogics has partnered in numerous wind integration studies in the U.S. that have attempted to quantify wind integration cost impacts, and have speculated on the potential for system improvements that can serve to mitigate the impact of severe weather events.

In addition to weather model-based wind energy forecasts, it has been found that contextual information in the form of data feeds from off-site meteorological data collection (met) towers and severe weather displays that are integrated into utility control room data visualization systems can have direct benefit.

Figure 1, below shows the various time horizons under consideration for electrical grid reliability. Data feeds and automated tools can be applied to each, however, human-assisted forecasts in the form of consultations with meteorologists are also applicable to the challenges presented by each time horizon.

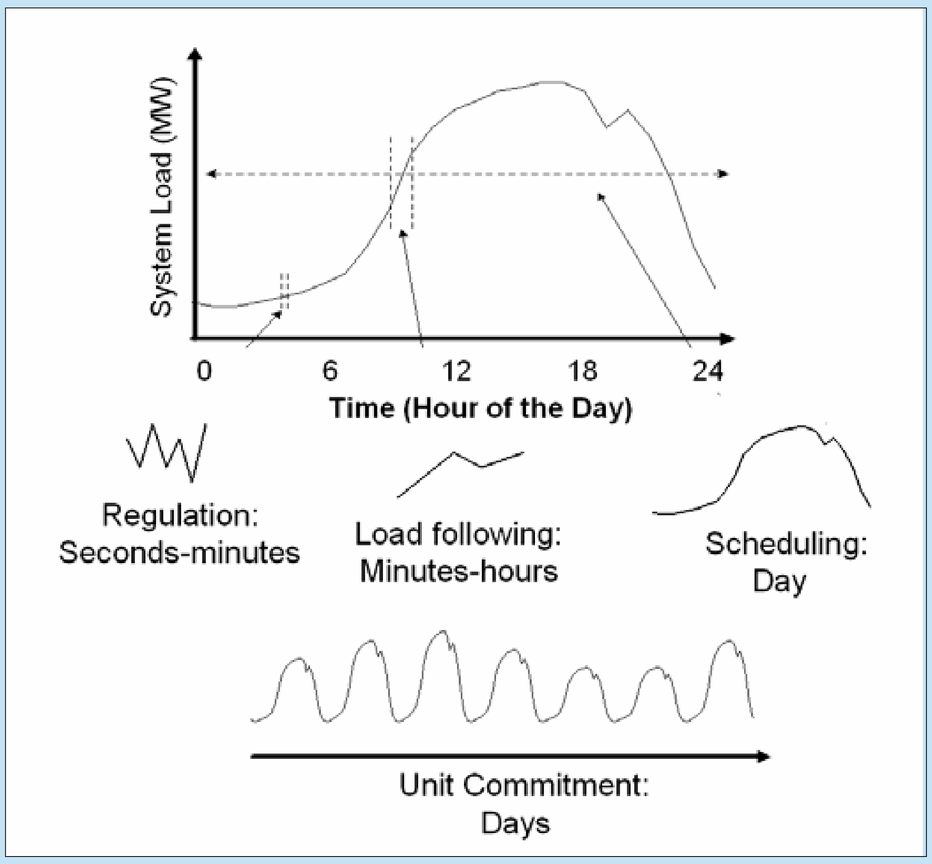

Figure 1: Characteristic time scales for grid operations[1]

Case Study

In February 2008, the ERCOT system in the State of Texas experienced a significant ramp event in which wind energy production decreased drastically, load projections were flawed, and dispatchable fossil generators were unable to respond. Unfortunately, the wind generation received the majority of the blame for the severity of the event.

Wind energy forecasts were available as much as 32 hours prior to the ramp event which accurately predicted the magnitude of the negative ramp, see Figure 2 (left), below. At 26 hours prior to the ramp event, the forecast predicted both the magnitude and the timing of the event almost perfectly (Figure 2, right).

Had these forecasts been in widespread use, it is highly likely that the severity the wind impact of the event would have been less pronounced than it turned out to be.

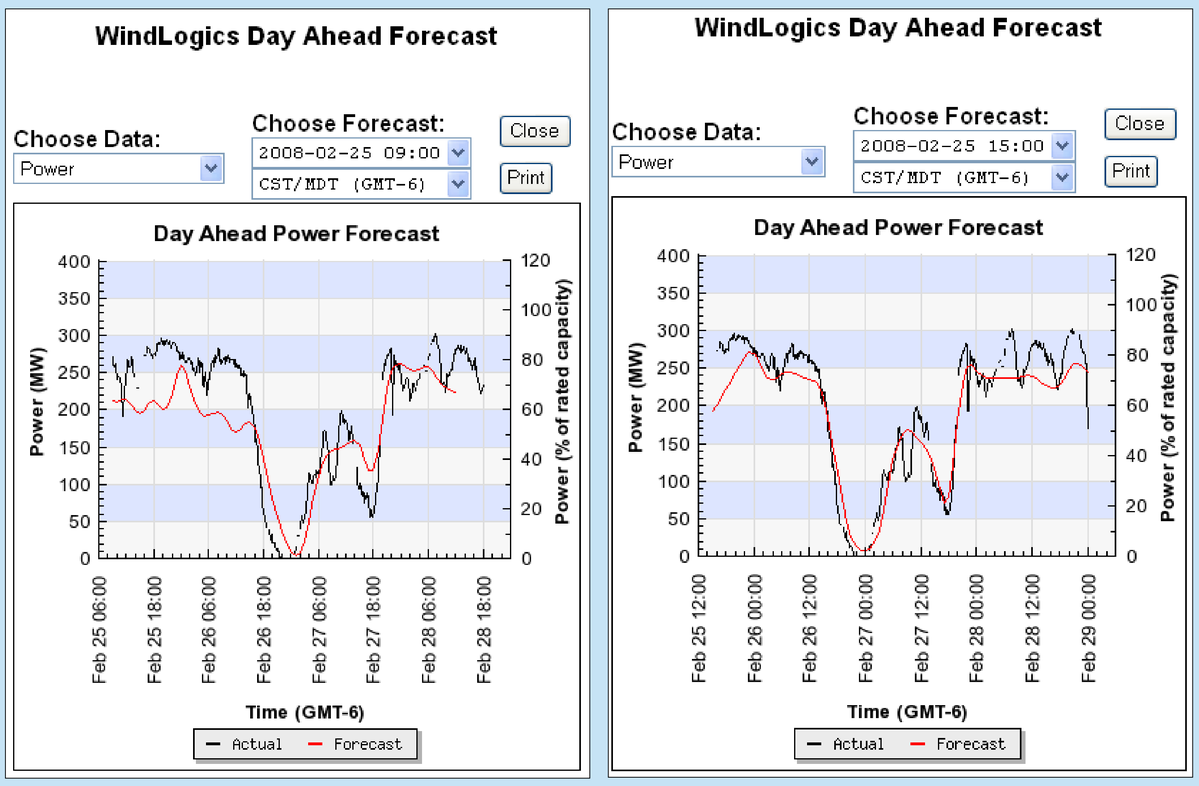

Figure 2: February 25 09:00 Forecast (left), February 25 15:00 Forecast (right)

Proactive Solutions

WindLogics has developed a prototype High Wind Warning System (Figure 3) to give grid control operators access to real-time severe weather displays that not only show data from weather service feeds, but calculate the *number of megawatts at risk* as the weather system moves through the region.

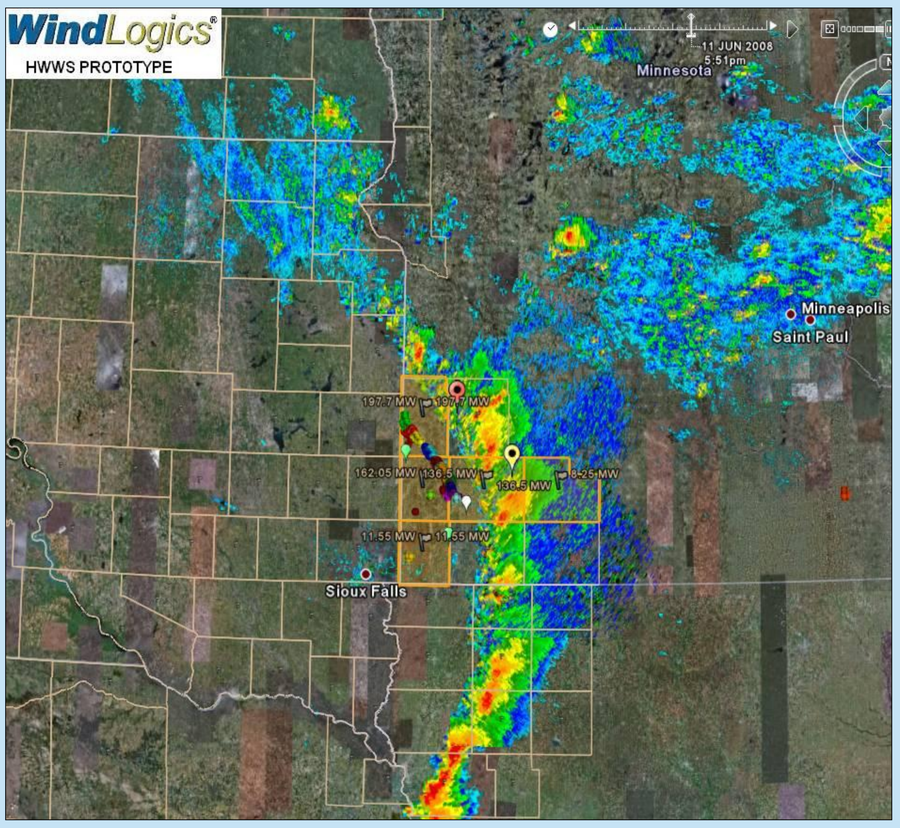

Figure 3: Prototype High Wind Warning System

References

[1] B. Parsons, M. Milligan, J. C. Smith, E. DeMeo, B. Oakleaf, K. Wolf, M. Schuerger, R. Zavadil, M. Ahlstrom, and D. Yen Nakafuji, *Grid impacts of wind power variability: recent assessments from a variety of utilities in the United States,* presented at the European Wind Energy Conference, Athens, Greece. March 2006.