



First Wind Energy Storage Application in the U.S.

S&C Featured Solution: Smart Grid Storage Management Systems

Location: Beaver Creek, Minnesota

Customer Challenge

Xcel Energy—a major wind energy supplier—wanted to maximize the value of the renewable energy generated by the turbines at their Minwind Energy wind farm, in Beaver Creek, Minnesota. Part of Xcel Energy's Smart Grid strategy involves testing emerging technologies and energy storage devices, which they believe are a key to expanding the use of renewable energy. To this end, they contracted with S&C to furnish and install an S&C Smart Grid Storage Management System.

The Smart Grid Storage Management System is a fast-response, solid-state automatic power controller that converts ac power to dc to charge a sodium-sulfur battery system, as well as control the discharge of the battery system into the utility distribution system. The Smart Grid Storage Management System is suitable for a wide range of applications, including peak shaving at the point of common connection to the utility system, energy arbitrage, power quality improvement, and power islanding in conjunction with S&C's IntelliTEAM II® Automatic Restoration System.

Minwind Energy thus became the site of the nation's first use of direct wind energy storage.

S&C Solution

In addition to the Smart Grid Storage Management System, the installation consists of a 1-MW sodium-sulfur battery system, a step-down pad-mounted transformer connected to Xcel Energy's Rock County Substation, and a backup diesel generator to heat the batteries in the event that utility power is lost.

The battery system consists of twenty series-connected battery modules, each containing

352 battery cells. In total, the battery modules can store and supply up to 7.2 MWh. They have a nominal discharge capacity of 1 MW...enough to power 500 homes for 7 hours.

Smart Grid Storage Management Systems have been installed at a number of locations in the United States, to solve a variety of transmission and distribution planning issues. But this is the first application in which a Smart Grid Storage Management System and sodium-sulfur battery system store real power during off-peak demand times and supply real power during peak demand times. The stored energy is immediately dispatchable, making it a valuable resource for contingency events. Or, alternately, it can be sold on the ISO market.

In addition to manufacturing and installing the power conditioning system, S&C served as integrator for the Smart Grid Storage Management System installation. In this role, S&C was responsible for overall project management, including all aspects of engineering and equipment installation. S&C provided the following:

- Equipment layout,
- Procurement and installation of all medium- and low-voltage cables and terminations,
- Installation of the battery modules,
- Procurement and installation of the backup generator,





- Assistance with integration into the existing SCADA system and new communication and control system,
- System and equipment testing and commissioning,
- Project operation and maintenance manual, and
- Training.

Results

The Smart Grid Storage Management System was placed in service on an automatic charge/discharge schedule in the fall of 2008. In the spring of 2009, final functionality testing was performed.

The system is currently being tested by Xcel Energy to:

- Evaluate the ability of large-scale battery storage technology to effectively firm wind energy, enabling a shift of wind-generated energy from off-peak to on-peak availability.
- Evaluate the ability of a battery-based power-conditioning system to compensate for the variability and uncertainty impacts of wind.
- Evaluate the potential for battery-storage technology to provide ancillary service support to the grid.
- Assess the obtainable value of storage in wholesale energy markets, for current and future wind penetration scenarios.
- Assess the overall operating characteristics of a battery-based power conditioning system, including the impacts of operational mode and weather conditions.

