Blending Regional Power

"Basin Electric's current power supply includes 8.1 percent from renewable projects."

by Tom Schoening

A FICKLE RESOURCE, WIND TURBINE OUTPUT varies as winds rise and fall throughout each day, month and year. Blending this intermittent resource into the Touchstone Energy® Cooperatives' power supply while maintaining grid stability is a sophisticated dance undertaken each day by a dedicated team.

On a hill east of Watertown, S.D., a team of dispatchers control and operate the regional electric grid and dozens of generators, including several wind farms. The Watertown Operations Center is the nerve center for the Upper Great Plains Region of Western Area Power Administration. A federal agency, Western markets and delivers bulk power to public utilities and electric cooperatives in a 15-state region.

Western dispatchers are learning to integrate the growing number of wind resources into the power supply, according to Dispatch Supervisor Earl Cass at the Watertown Control Center. Despite the complexities, Cass is a big supporter of wind power.

"Wind is a renewable, clean source of electricity, which is good for the environment," Cass said. "We are learning to meld wind with existing resources into the electric system by utilizing tools for predicting wind farm output."

Western's power marketers must plan several days in advance to schedule the units needed to meet the forecasted load. Because alternating current cannot be stored, electrons-generated must match electrons-used continuously, to maintain grid stability. Forecasting the wind turbine output, however, is imprecise.

"From the 138 megawatts (MW) of potential wind power our dispatchers monitor, we often see 30 to 40 MW actually produced," Cass said. "Two days ago, we forecasted 50 MW of wind energy, however, the winds did not blow; we only got 4 megawatts. Fortunately, Basin Electric Power Cooperative had other generation resources available that day to cover the windpower gap."

The Watertown Operations Center looks like the hub of a supersized spider's web, power lines stretching toward the horizon in several directions. Huge electrical devices fill a fenced complex, giving it the look of a monster substation on steroids.

From a storm-proof concrete building, electric system operators control the bulk power delivered to 315 public utilities, electric cooperatives and other entities in seven states. Thirty dispatchers on several shifts and a team of 11 power marketers buy, sell and deliver electricity around-the-clock every day of the year.

The dimly lit, computer-filled control room resembles a spaceship command center. On two wide walls, backlighted indicators show the status of 9,000 miles of transmission lines and 200 substations. Transmission system operators at consoles direct power flows to public utilities and cooperatives from Montana to western Minnesota.

At another console, two generation operators

control and direct 5,600 MW of generating capacity. The units include seven federal dams on the Missouri River, the power plants serving Basin Electric and the generators of other utilities. All these generation resources, including the output of 93 large wind turbines purchased by Basin Electric, are gathered and delivered on transmission lines to local Touchstone Energy Cooperatives, which distribute this power to their member-consumers.

The wind does not always blow when power is needed. On July 30, 2006, Basin Electric experienced an electric system peak demand of 1,947 MW. That day, wind power generated only 6 MW of their 136 MW potential, officials reported.

"The wind prediction tools are getting better and making the dispatchers' job easier," Cass said. "As the wind industry matures, we will rely more on wind power. That will require better forecasting tools and more efficient, productive wind turbines."

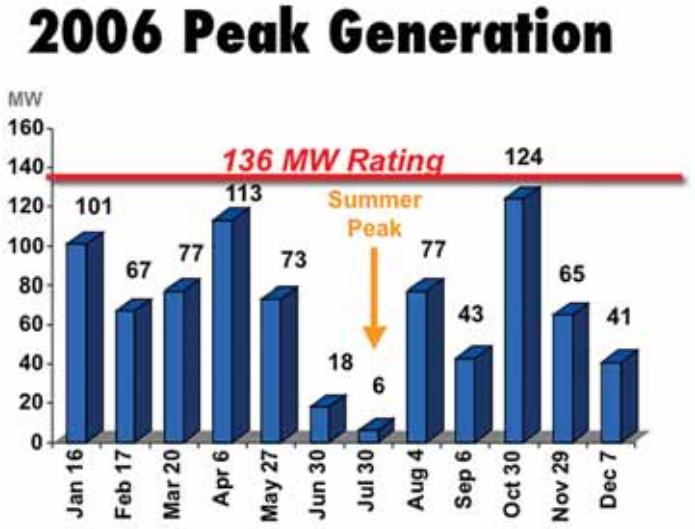
Touchstone Energy® Cooperatives developed a variety of environmentally friendly projects in the Dakotas during 2006. Electric cooperatives worked with partners to connect four heat-recovery units and a dairy-digester-powered generator, which are generating electricity from waste products. The FPL Energy wind farms at Wilton, N.D., and the Oak Lane Hutterite Colony's two small wind turbines near Alexandria, S.D. were also connected to the electric system last year.

With the new wind turbines, heat-recovery units and dairy digester coming on line, electric cooperatives are moving toward their voluntary goal passed at the 2005 Basin Electric annual meeting. Basin Electric member systems agreed to set a goal of meeting 10 percent of the members' demand for electricity from renewable resources by 2010. Basin Electric's current power supply includes 8.1 percent from renewable projects.

Plus, cooperatives' contracts for purchasing federal hydropower deliver additional energy from naturally renewing resources. East River Electric Power Cooperative receives approximately 30 percent of its bulk power from hydropower while Rushmore Electric Power Cooperative receives approximately 20 percent hydropower.

This region's cooperative leadership believes efforts to harness renewable resources must be balanced with the responsibility to deliver reliable, affordable electricity to customers. Only alternative energy options that are practical and cost-effective will benefit cooperative members and the rural economy over the project lifetime.

Left: At the Watertown Operations Center, generation dispatchers Jim Jugert, left, and Cliff Moter, right, control the output of hydropower, coal plants and wind farms in the region. In the background, transmission system dispatchers direct power flows on 9,000 miles of high-voltage lines to utilities and cooperatives from Montana to western Minnesota. Inset: The Watertown Operations Center is the hub of the electric grid, serving electric cooperatives and other utilities in seven states. From the concrete bunker, dispatchers for Western Area Power Administration blend the output of hydropower, traditional and wind generators into the regional power supply. *Photos by Tom Schoening, East River Electric* **Cover: Wind power from turbines such as these are folded into the electric grid at Western Area Power Administration's Watertown Operations Center.** *Photo by Steve Crane, Basin Electric Power Cooperative*



Above: The chart shows the ups and downs of wind generation during the month of December 2006 for the PrairieWinds Turbines at Chamberlain. The red line at 2,600 kilowatts reflects the nameplate potential output. Of the potential 100 percent capacity factor, the wind turbines generated 19 percent of capacity during the month.

Increased Use of Renewables Meets Members' Expectations

With the surplus generation from power plants built in the 1980s now utilized and continuing load growth anticipated, Touchstone Energy® Cooperatives are entering a new era of resource development. Research teams are currently determining the right mix of generators to build – fueled by traditional and renewable resources.

The opinions of cooperative members were also surveyed by a research organization last year. Focus groups, comprised of cooperative members, were interviewed at four locations on their expectations from their energy provider.

After looking over a list of expectations of their cooperative, each focus group selected resource planning as their top expectation. "An electric cooperative should look to the future by helping to find new energy sources, especially renewable resources," the members said.

Anticipating this trend, electric cooperatives have been leaders in developing renewable energy in the Dakotas, since installing the first commercial-sized wind turbines at Chamberlain in 2001. Today, wind power is blended into our power supply mix, along with hydropower, fossil fuels and other renewables.

Basin Electric Power Cooperative purchases the output from three FPL Energy wind farms at Wilton and Edgeley/Kulm in North Dakota and near Highmore, S.D., to serve cooperative members. According to marketing manager Ron Rebenitsch, Basin Electric's resources now include 93 commercial-size wind turbines. "These wind turbines in the region – rated at 136 megawatts – produce enough power to serve 40,000 average homes during a year," Rebenitsch said. "That's enough electricity to serve all the residences in the cities of Aberdeen, Brookings, Huron, Mitchell and Pierre, S.D."