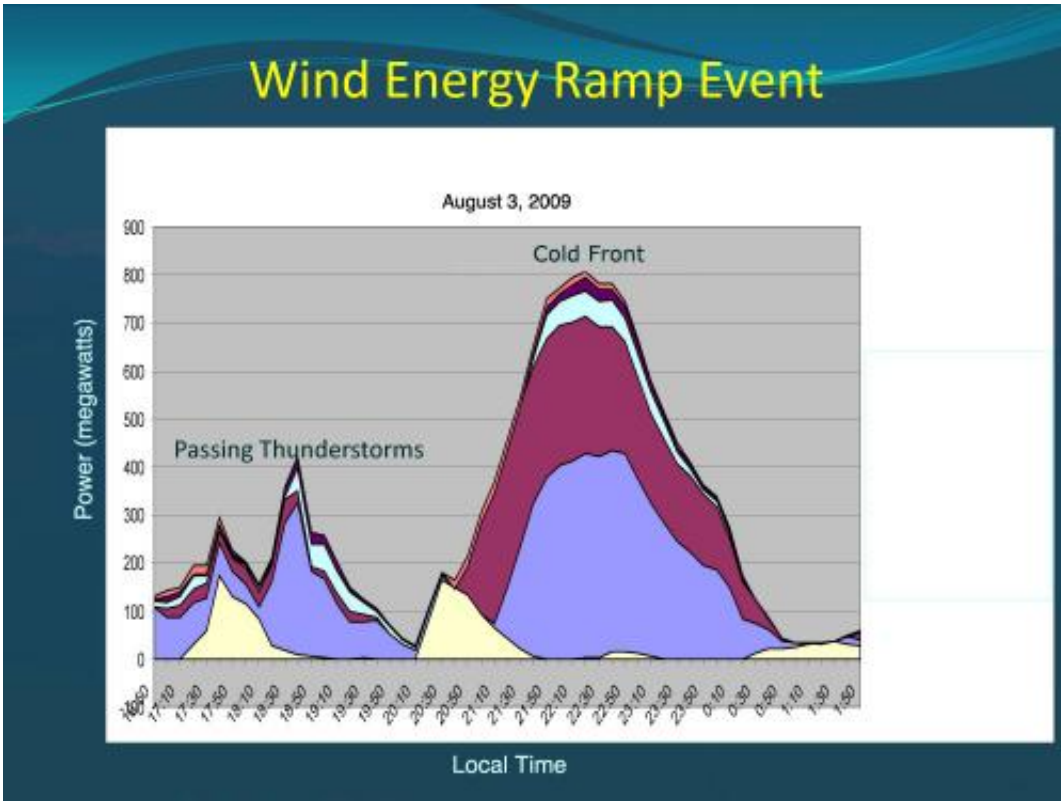


NCAR powers up renewable energy forecasts

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The new NCAR forecasting system will predict sudden changes in weather and the resulting impacts on wind and solar energy production. Credit: Image courtesy Sue Ellen Haupt, NCAR.

The National Center for Atmospheric Research (NCAR), building on a pioneering wind energy forecasting system that saved millions of dollars for Xcel Energy customers in eight states, has entered into a new agreement with the utility for even more sophisticated weather forecasts.

In the next two years, NCAR scientists and engineers will develop custom forecasting systems to predict sudden changes in wind, shut down turbines ahead of potentially damaging icing events, and even predict the amount of energy generated by private solar panels. The systems will be used by [Xcel Energy](#) control centers in Denver; Minneapolis; and Amarillo, Texas.

The cutting-edge forecasts will help Xcel Energy, and potentially other utilities, to provide reliable power to their customers and reduce costs while moving to greater use of wind and solar.

"This is pushing the state-of-the-art still further, using the latest science to enable Xcel Energy to generate energy from the atmosphere more effectively," says NCAR program director Sue Ellen Haupt, who is overseeing the new project. "Every improvement to the forecasts results in additional savings."

Xcel Energy officials say the more accurate forecasts are critical as they increase their use of renewable energy.

"The importance and value of accurate renewable energy generation forecasts increases with the size of our renewable energy generation portfolio," says Ben Fowke, chairman, president, and CEO of Xcel Energy. "Xcel Energy has been the largest utility provider of wind energy for the last nine years and we are continuing to grow our renewable energy portfolio."

The new project represents the latest venture by NCAR into renewable energy. In addition to the lab's earlier work with Xcel Energy, NCAR is also spearheading a three-year, nationwide project to create unprecedented, 36-hour forecasts of incoming [energy from the Sun](#) for solar energy power plants.

"By creating more detailed and accurate forecasts of wind and Sun, we can produce a major return on investment for utilities," says Thomas Bogdan, president of the University Corporation for Atmospheric Research, which manages NCAR on behalf of the National Science Foundation. "This type of cutting-edge research helps make [renewable energy](#) more cost competitive."

Reliable forecasts needed

Xcel Energy has been utilizing increasing amounts of energy from renewable sources, especially wind. But this shift means relying on resources that are challenging to predict and manage.

Energy generated by a wind turbine, solar panel, or any other source must be promptly consumed because large amounts of electricity cannot be stored in a cost-effective manner. If an electric utility powers down a coal or natural gas facility in anticipation of wind-driven energy, those plants may not be able to power up fast enough should the winds fail to blow. The only option in such a scenario is to buy energy on the spot market, which can be very costly.

In order to help utility managers anticipate wind energy more reliably, NCAR began designing a wind energy prediction system for Xcel Energy in 2009 that saved the utility's customers more than \$6 million in 2010 alone. The specialized system relies on a suite of tools, including highly detailed observations of atmospheric conditions, an ensemble of powerful computer models, and artificial intelligence techniques to issue high-resolution forecasts for wind farm sites.

Following up on that work, NCAR has entered into a two-year agreement with Xcel Energy to focus on the following areas:

- Forecasting "ramp" events. A new system under development at NCAR can provide utility managers with advance notice of a major change in wind energy over a few hours due to a passing front or another atmospheric event. The system, known as VDRAS (Variational Doppler Radar Analysis System) relies on techniques that combine observations from radars and other tools with computer simulations to create more accurate forecasts for particular wind farms.
- Predicting ice and extreme temperatures. To keep aircraft safe from potentially lethal icing conditions while aloft, NCAR has created state-of-the-art ice forecasting systems that use computer models and specialized algorithms. Applying similar technology, researchers at NCAR and Pennsylvania State University will develop a 48-hour forecasting system at designated wind farms to predict the impacts of freezing rain and fog on wind turbines, which cannot operate when coated in ice. The team also will forecast extreme low and high temperatures, which can cause wind farms to temporarily shut down.
- Generating solar forecasts. Xcel Energy customers who have their own solar panels draw far less energy from the grid while the sun is out, and can even sell excess energy back to the utility. To help Xcel Energy better anticipate when their customers are getting power from their own panels, NCAR will create a solar energy [forecasting system](#), using a combination of computer models and specialized cloud observing tools.

Some of these new systems will provide "probabilistic forecasts," estimating the chances that a particular weather event will occur. This means that utility managers will be able to make decisions based on whether there is an 80 percent chance of certain weather events at a [wind](#) farm the next day, or a 20 percent chance.

"We're taking our expertise in critical areas, such as keeping airplanes

safe from icing, and applying it to obtaining as much energy as possible from the atmosphere," says NCAR program manager Marcia Politovich, who is overseeing the development of icing and extreme temperature forecasts. "This is cutting-edge science."

Once the systems are finalized, they will be turned over to Xcel Energy or a utility contractor for ongoing operation. NCAR researchers will publish the results in peer-reviewed journals, enabling other utilities and forecast providers to learn about the technologies.

"Xcel Energy is recognized by the energy industry as a national leader in proactively moving forward with the utilization of renewable [energy](#)," says William Mahoney, deputy director of NCAR's Research Applications Laboratory. "This new project is an example of how improved understanding of the atmosphere can provide significant benefits to society."

Provided by National Center for Atmospheric Research

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