Project Overview
The University of Minnesota was one of three institutions to be awarded a U.S. Department of Energy (DoE) wind energy research grant. The University’s $7.9 million award, funded through the American Recovery and Reinvestment Act, supports a consortium focused on wind energy research and education activities, including construction of a 2.5 megawatt wind turbine at UMore Park. The project is expected to create economic opportunities and help further the national goal to increase wind power to 20% by 2030.

Objectives
• **Research.** Key components of the wind turbine research and testing will include:
  o **Capturing more energy from the wind:** Consortium researchers are exploring techniques for increasing the amount of energy than can be harvested from a wind turbine. One method is applying small devices to the blade surface to reduce drag and streamline airflow. Another method involves using smart-blade technologies to adjust the blade’s surface in response to changes in wind.
  o **Improving wind farm design:** Establishing the distance between turbines in a wind farm is critical for maximizing power produced at a site, as disturbances in the airflow downwind of a turbine can reduce efficiency of other turbines in the array. Consortium researchers are studying how best to orient multiple turbines to make wind farms more productive.
  o **Minimizing turbine’s impact on radar:** Wind farms detected by radar systems pose potential problems in differentiating them from low flying aircraft and some weather patterns. Consortium researchers are working to minimize the effects that wind farms can have on the Federal Aviation Administration (FAA) and weather radar.
  o **Reducing noise:** Wind turbine noise is caused by airflow separating from the blade surface. Consortium researchers are working to identify both the sources of noise and new ways of reducing or eliminating noise. Smart-sensor techniques for airflow adjustment at the blade surface will be studied using models and the UMore Park turbine.
  o **Preventing ice build-up on blades:** Ice build-up can cause mechanical failure and pose the hazard of “ice throw.” Consortium researchers are exploring how ice build-up occurs and plan to develop special film coverings that will help prevent the formation of ice on the blades.
  o **Monitoring turbine performance:** A single wind turbine consists of hundreds of different systems at work simultaneously, monitored by sensors throughout the machine that track temperature fluctuation, fluid pressures, vibrations, noise, and energy production. Consortium researchers are developing new monitoring approaches to improve turbine performance and safety which will also result in lowered maintenance costs.
  o **Improving turbine blade structure:** The turbine’s lightweight blades are over 140 feet long and designed to flex in strong winds. Consortium researchers are developing new numerical models to understand the interaction of air-flow and flexible blades. This is important for improving energy capture and improving the design of the next generation of turbines.

• **Education.** The consortium is also developing new wind energy curricula to train power-industry professionals, and graduate and undergraduate students across the United States.

Facility Location
The wind turbine will be located along the eastern border of the University of Minnesota Outreach, Research and Education (UMore) Park property in Rosemount, uniquely situated to fulfill requirements of the award. The project is consistent with the concept master plan for a vibrant, sustainable community on the UMore Park property.
Wind Turbine Features

- The Clipper Windpower 2.5 MW Liberty turbine will be approximately 415 feet from the ground to the tip of the top blade.
- Connection to the grid is required by the DoE, although energy production is not a goal of the research project.
- The turbine will be routinely taken off line in order to conduct sensor and materials analyses. On average, the turbine will be in operation only about 70% of the time.
- A 426-foot tall meteorological tower will measure weather conditions and wind speed while nearby lasers will measure any turbulence produced by the wind turbines.

Leadership

The University of Minnesota wind energy research project is an industry/academy consortium led by principal investigator and project director Fotis Sotiropoulos, James L. Record Professor and Director of the St. Anthony Falls Laboratory, College of Science and Engineering, University of Minnesota.

Consortium Partners

University of Minnesota, Twin Cities; Syracuse University; and Dakota County Technical College; Clipper Windpower; Barr Engineering; Lockheed Martin; 3M; Sandia National Laboratories, the National Renewable Energy Laboratory and WindLogics. The University of Minnesota’s Initiative for Renewable Energy and the Environment (IREE) provided significant early-stage research funding to support consortium collaborations.

Timeline

- Through a competitive process, a design/build contract for the wind turbine was awarded to Ryan Companies, US, Inc., in April 2010.
- The DoE is conducting an Environmental Assessment (EA) to assess the potential environmental impacts of the proposed project. The public scoping phase of the EA has been completed with a Draft EA anticipated mid-summer 2010.
- Construction of the wind turbine is expected to be completed at the end of 2010 with the research program starting in 2011. The University commitment to the DoE and the faculty is for use of the turbine in this location for up to 15 years.

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