

What If Your Energy Supply is Gone with the Wind?

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(PhysOrg.com) -- A new research program at Oregon State University proposes to tackle one of the major remaining problems with wind energy – how do you provide a steady, or at least predictable flow of electricity when the wind itself is never steady and often unpredictable?

Wind energy production costs are increasingly competitive and the technology of wind turbines is already sophisticated and nearing optimal levels, experts say. But due to associated costs, much less has been done to develop more advanced energy storage systems and coordinate their use with a natural energy source that can be highly variable – a major impediment to greater use of wind power.

A new \$725,000 research project will help address that, with \$358,000 in support from the Bonneville Power Administration, and other cost-share funding from the Central Lincoln People's Utility District, OSU and the Oregon Built Environment and Sustainable Technologies Center. The goal of the initiative is to find ways to smooth out the peaks and valleys of wind energy so it can more fully take its place as a dependable form of alternative energy for Oregon and the nation.

“The high variability of wind energy production is the primary limiting factor to using more of it in our electrical system,” said Annette von Jouanne, a professor of electrical engineering at OSU. “For short periods wind can disappear almost without notice. Because of that, electric utilities right now are reluctant to use wind as more than 15 percent of their overall energy resource because of its variability and lack of

adequate energy storage systems.”

In Oregon, the stated future goal is to produce 25 percent of the state’s electricity with renewable energy by 2025. Oregon’s wind resource has the potential to be a substantial portion of that. But the fundamental problem is the same with wind energy all over the world – electricity has to be produced at the same time it is being used, but sometimes the wind just doesn’t blow.

The solution, researchers say, includes a better understanding of existing technologies to store the energy from wind, continued improvement of them, and more commitment to wind energy storage. Particularly needed are sophisticated power electronic systems that precisely control when wind energy should be used immediately, directed to a storage system, or sent in both directions.

“We want to create smoother levels of power availability from wind, similar to what we can do with hydroelectric power,” said Ted Brekken, an OSU assistant professor of electrical engineering. “Because it’s a natural resource with daily and seasonal fluctuations, we’ll never be able to produce a completely steady power flow.

“But we’re going to try to greatly improve the predictability of wind energy, so that about 90 percent of the time we can at least deliver to the grid the amount of electricity we said we would deliver.”

To deal with short-term wind fluctuations on the order of a few minutes, researchers will examine such technologies as different types of batteries; “supercapacitors” that function as a high energy storage device; flywheels that use mechanical approaches to store energy; and a concept called superconducting magnetic energy storage, or SMES devices.

For longer terms uses, there are systems that can store energy with

pumped water that's later used to power a hydroelectric generator, compressed air systems, or energy stored in hydrogen fuel cells.

All of these technologies waste some of the energy in the transmission process, some may be more useful and cost-effective than others, and little has been done to coordinate their use. That's the basis of the research challenge, von Jouanne said.

As part of this project, a new test platform with generators used in the wind industry will be created in OSU's Wallace Energy Systems and Renewables Facility. Sudden changes in load will be experimentally simulated, and the effects of unbalanced system voltages and loading will be investigated. Optimal ways to integrate wind technology and energy storage will be examined.

"Even with traditional electrical energy production systems, the constantly fluctuating demand for electricity and dependability of energy sources have been a problem," von Jouanne said. "Those challenges are simply greater with wind energy, and we're realizing that we have to do more with storage systems, bring down the costs and optimize the control of these systems. There's a lot of room for improvement here."

Provided by Oregon State University

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