Representatives from the Blackhawk Project, LLC, recently installed an innovative wind energy system at INL's Center for Advanced Energy Studies.

Center for Advanced Energy Studies tests new wind energy system

by Ryan Weeks, *INL Communications and Public Affairs*

Blackhawk helicopters accomplish our nation's missions every day. Now, Idaho National Laboratory's Center for Advanced Energy Studies (CAES) is supporting a new kind of Blackhawk to develop energy solutions.

The system's tilt rotor lets the turbine self-start without external devices, reducing the noise, electronics and heights associated with traditional wind systems.

Researchers from the Blackhawk Project LLC are testing and monitoring a new Blackhawk Tilt Rotor (TR-10) Vertical Axis Wind Turbine (VAWT) recently installed at CAES. This wind system, developed by Blackhawk, represents what could be a significant evolution in wind energy technology.

"One of the reasons we chose Blackhawk is that it invites involvement from students and faculty," said Raymond Grosshans, program coordinator at CAES. "And it supports economic development in Idaho."

Students and researchers will monitor the turbine's performance, acoustic profile, strength, safety and durability.

Blackhawk's unique design distinguishes it from traditional wind energy systems. The most obvious distinction is that its helicopter-like wings, known as airfoils, rotate parallel to the ground, unlike most commercial turbines.

The airfoils attach to a patent-pending tilt rotor in the center of the turbine. The slanted rotor allows the turbine to self-start without any external devices. This passive-control system offers power generation without the noise, clutching, electronics, tower heights or heavy blades often associated with common wind machines.

The TR-10 is part of The Blackhawk Project's prototype series and produces around 1.5 kilowatts of power -- enough electricity to supplement a home, power a workshop or drive other small applications.

The power generated from the system will feed directly into CAES, but supplying the building with extra electricity is not why the center agreed to test the Blackhawk.

"CAES' main focus is to create opportunities for research collaborations between Idaho National Laboratory researchers, the Idaho research universities and the private sector," Grosshans said.

The Blackhawk wind energy system's unique design uses airfoils that rotate parallel to the ground.

Students and researchers at CAES will be monitoring the turbine's performance, acoustic profile, strength, safety and durability.

A student crew chief will oversee maintenance of the turbine, which, Blackhawk says, is more durable than traditional windmills because it has fewer electronic gadgets and parts. Plus, the long arms of the turbine create such a high degree of torque that the unit is able to produce more power with fewer revolutions per minute (RPMs), which reduces wear and tear. When the turbine does need repairs or maintenance, locking magnets hold the rotor in place and prevent accidental spinning, creating a built-in safety feature.

Students also will be responsible for developing operation and procedure manuals for the turbine and helping write grants for the company.

The system will create research opportunities for students, universities, INL and the private sector.

"Collaboration with our company is a natural fit," said Dawn Cardwell, Blackhawk's project manager. "The data-collection capabilities and access to universities and researchers is something we don't have."

The project also provides learning opportunities for high school students.

A Web cam streams video to high schools all over the country, and telemetry gives students of all levels easy access to real-time data from CAES' grid-type system.

"Students, faculty and researchers can use it for instrumentation, developing modeling tools and to support ongoing classroom activities," said Grosshans.

Developers have found that the VAWT can produce electricity in winds as light as 7 mph. Propeller-type wind mills typically require speeds of 12 to 15 mph.

Pushrods and elastomeric bands, which Grosshans describes as "high-tech rubber bands," are attached to the airfoils and help protect the turbine from storm damage. These rods adjust to the wind and allow the rotor to tilt without overworking the turbine. These features have allowed the turbine to successfully function in wind speeds as high as 101 mph.

Blackhawk hopes the data tracked at CAES will narrow the commercialization gap for its system, which the company bills as a low-cost, low-maintenance alternative to horizontal-axis residential turbines currently on the market.

The entire turbine fits in the back of a pickup and takes about three hours to install. With a mere 10-foot diameter, the TR-10 is set to enter the small-turbine industry targeting farms, shops and homes in rural and semirural areas.

"We can be the market leader for bang-for-the-buck," said Bruce Boatner, Blackhawk's lead engineer.

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