



PC-based control improves the availability and performance of wind turbines

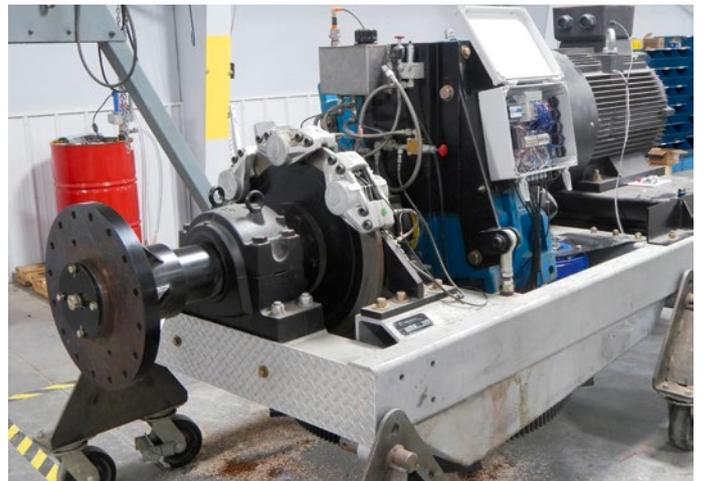
Renewtech makes small wind power projects cost-effective

Despite fluctuations in the subsidies for the alternative energy sector, the U.S. government continues to support initiatives for the use of wind energy in single-turbine projects. In many cases, operators take advantage of investment tax credits for wind energy projects below 1 megawatt. This market segment, which had particularly strong growth in 2013 and is expected to increase in 2014, is the specialty of wind turbine specialist, Renewtech LLC.

Renewtech specializes in the construction and maintenance of 99-kW wind turbines, which are popular for smaller wind energy projects in the U.S.



Renewtech, which is located in Elbow Lake, Minnesota, focuses on 99-kilowatt wind turbines with stall control. The company's services range from system planning and design to nacelle and control unit assembly to rotor and tower production. Renewtech also uses its team of experienced specialists to renovate and monitor existing systems. Many wind turbines in the 50-to-150-kilowatt range in the U.S. were built in the 1980s and 1990s, and their technology has become unreliable and inefficient by today's standards. "We see great demand in the areas of refurbishment and replacement, and Renewtech is qualified to maintain many of these installations," explains Jackie Chelemedos, Director of Business Development at Renewtech. Typical Renewtech projects, for example, are wind turbines that are operated by public institutions such as schools and universities, but also by farms and ranches.



A standard Ethernet cable connects the nacelle with the foot of the tower. The communication is based on EtherCAT.

Winds of change dislodge legacy turbine controls

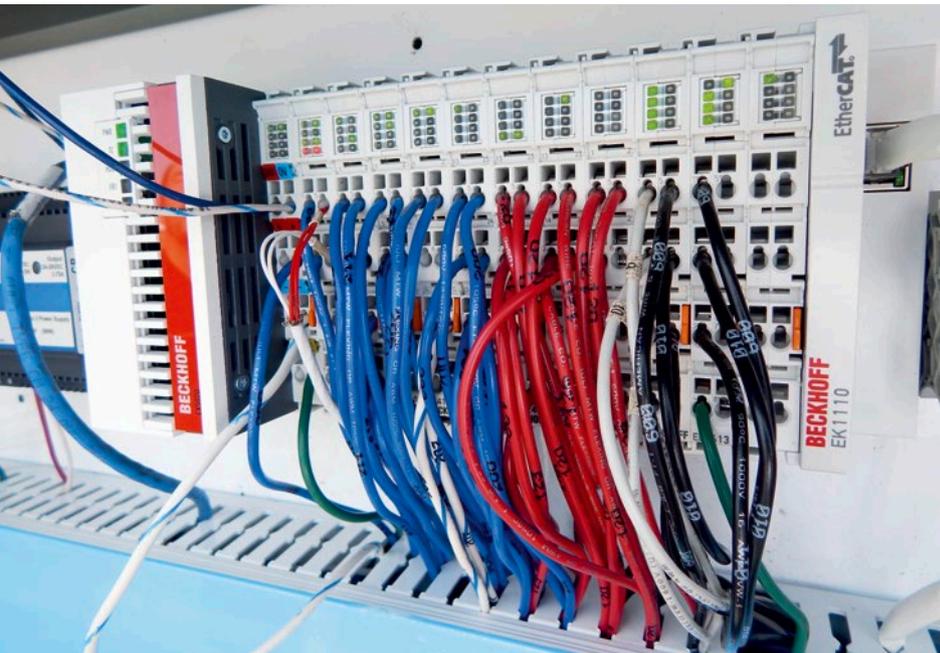
Wind turbines from Renewtech have a 20-year warranty and pay for themselves over seven to twelve years, depending on the utility rates at each particular location. The long warranty period is based on the company's use of high-quality components and their capacity reserves, which far exceed the peak requirements for regular wind turbines. This is particularly critical in areas where heavy wind gusts can occur. "For our 99-kW systems we use gearing that is designed for 150 kW with a ratio of roughly 2.3 so that they can handle more than 300 kW in peak periods," explains Matt Kugler, the company's Senior Commissioning Technician. "In addition, wind turbines from Renewtech operate with two generators instead of one. Despite the systems' high reliability and redundancy, having remote access and diagnostic capabilities is a key benefit for Renewtech and its customers: "We record the data from each turbine and the entire wind farm. We also store the data from all wind farms in our headquarters. From here we can remotely monitor all of our turbines," explains Kugler.

In 2012, Renewtech entered the next stage of system development by subjecting the controls of its 99-kW turbines to a critical analysis. As it turned out, the platform used at the time faced a few limitations such as limited vendor support, problems with connecting the systems to standard media and networks, and inflexible software. In short, the company needed a new control platform for its

turbines. "We knew that Beckhoff had been very successful on the global wind turbine market and that its technology was suitable for our 99-kW systems," remembers Steve Martineau, Renewtech's Director of Operations. During the subsequent development and test stages, Beckhoff application engineers helped Renewtech develop the programming for the new generation of wind turbines. Shortly thereafter, the company decided that PC-based control technology and EtherCAT as the communication system would best fit its needs.

PC-based automation technology advances wind turbine modernization

The standard controller for Renewtech's 99-kW dual-generator system consists of a CX5020 Embedded PC with Windows CE and TwinCAT PLC Runtime, a TwinCAT SMS/SMTP server, and EtherCAT I/O Terminals. For wind farms with up to 50 turbines, C69xx-series Industrial PCs are also employed as servers. The CX5020 functions as the central controller for the turbine. It monitors the power feed, makes necessary wind direction alignment, records data, and generates error messages. Besides executing PLC, measurement and communication functions, the CX5020 runs the HMI software for visualization on the turbines and monitoring the installed base of Renewtech systems in the U.S. "With its wide operating temperature range from -25° to $+60^{\circ}$ C (-13° to $+140^{\circ}$ F), it is also suitable for installations in regions with a hot climate," says Steve Martineau.



The CX5020 Embedded PC functions as the central controller for the turbine. It monitors the power feed, makes necessary wind speed and positioning adjustments, records data, and sends error messages.

Flexible and cost-effective monitoring via EtherCAT Terminals

The Renewtech system records data continuously. "The EL3413 3-phase power measurement terminal provides us with the most important data. It enables us, for example, to perform power and frequency measurements and manage our complex 480-volt system," explains Matt Kugler. "Finding a flexible and affordable power measurement system that's also easy to integrate has not always been easy. Most devices are standalone systems that require special hardware, software and other layers of complexity. They are also very expensive." The system with EL3413 terminals collects the power data of all Renewtech applications via EtherCAT and TwinCAT and sends acquired status information to the corporate headquarters in Elbow Lake. Power monitoring alarms are simply e-mailed to Renewtech's experts, who can then fix faults remotely or request help locally.

"Particularly important for us is the EL1502 up/down counter, an EtherCAT Terminal that monitors the speed of the main shaft of the two generators as well as the wind speed with the help of an anemometer," says Matt Kugler. The up/down counter counts binary pulses and transmits the counter value in a galvanically separated manner to the upstream automation system. "At the end of the day, it is safe to say that the broad portfolio of Beckhoff EtherCAT

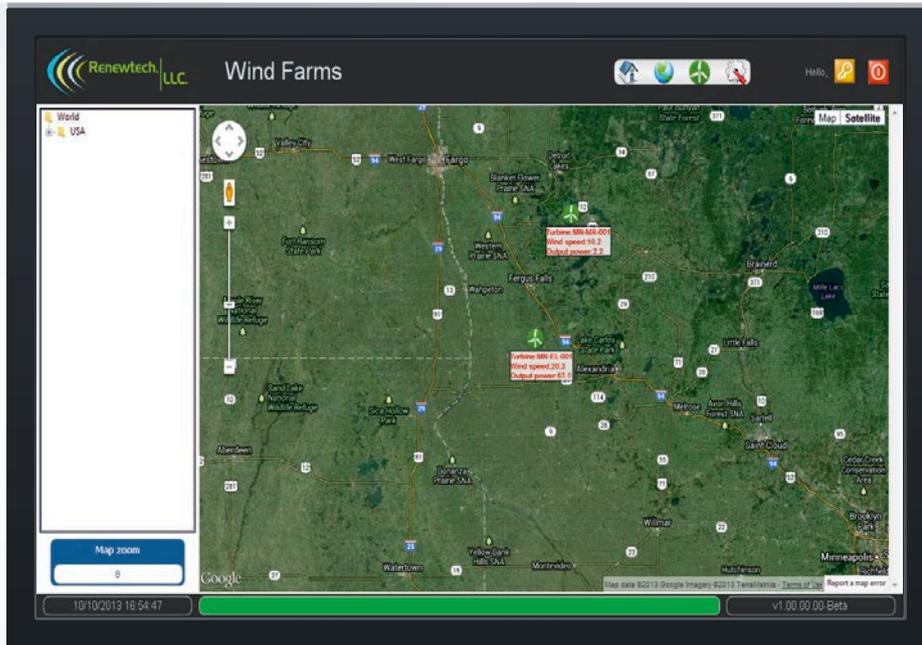
I/O Terminals with their many special features enables us to come up with very interesting developments," adds Kugler. "For example, if we have to add vibration monitoring on all our turbines, we can integrate this feature very easily by using the EL3632 EtherCAT CMS terminal."

Making customers happy is a breeze for Renewtech

"Ever since we added the Beckhoff control system in our Renewtech turbines, their reliability and availability has improved by at least 50 percent," says Steve Martineau. "And since availability is a prerequisite for generating power, and generating power makes money for our customers, its importance cannot be overstated."

Using EtherCAT in wind turbines and wind farm networking has additional benefits, however, says Steve Martineau: "After switching to EtherCAT we needed only two easy-to-handle standard connectors instead of 40 copper cables for 80 connection points. This has saved us two to three labor hours per turbine for cabling."

"Based on our positive experience, we will equip all our wind turbines with Beckhoff controllers in the future," concludes Jackie Chelemedos.



Since Renewtech stores all its customer data at its headquarters in Elbow Lake, Minnesota, it can remotely monitor all turbines from this central location.

Further information:

www.renewtechllc.com

www.beckhoffautomation.com