Sandia Labs benchmark helps wind industry measure success

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Sandia National Laboratories published the second annual 2012 Wind Plant Reliability Benchmark on Monday, and the results should help the nation's growing wind industry benchmark its performance, understand vulnerabilities and enhance productivity.

Until now, wind farm owners and operators had no way to compare their output with the output of similar operations. To benchmark the reliability of the U.S. wind turbine fleet and identify major causes of failures and downtime, the DOE commissioned Sandia in 2010 to build the Continuous Reliability Enhancement for Wind, or CREW, database. This is the first effort to compile a comprehensive, operator-independent dataset that accurately reflects the performance of the U.S. wind fleet.

Every year, Sandia Labs surveys the database and publishes the results to help benchmark the industry. This year, the more than 800 wind turbines studied are either producing electricity or are available to produce electricity 97 percent of the time, up from 94.8 percent in 2011.

"With better understanding of how major turbine systems are performing, wind operators can focus on improving those areas that will drive increased reliability and efficiency," said Sandia researcher and CREW team lead Alistair Ogilvie.

In 2008, a DOE collaborative published "20% Wind Energy by 2030." The report suggests that by 2030, wind could supply 20 percent of the nation's electricity, compared to less than 1 percent in 2007 and 3

percent in 2011. The report also discussed industry-wide risks related to lower-than-expected reliability and growing costs of operations and maintenance.

"Our assignment from DOE is to objectively characterize the national fleet," said Valerie Peters, CREW lead reliability analyst. "We're looking across technologies, locations and companies to create benchmarking statistics for the entire U.S. wind turbine fleet."

Major turbine systems include a set of three blades, rotor, shaft, generator and gearbox, and all of those components might break or otherwise need maintenance. Sandia's team is working to determine which components are the most vulnerable and help industry address those concerns to prevent downtime. The costs associated with a turbine going offline add up quickly. The owner not only loses productivity, but the cost of hiring a crane for repairs can be upward of $250,000. Since only a few cranes in the nation are large enough to handle turbine heights and component weights, it may be months before the turbine is up and running again.

Four wind plant owner/operators are participating in the development phase of the CREW project: EDF Renewable Energy (formerly enXco Service Corporation), ShellWind Energy, Wind Capital Group and Xcel Energy. The CREW team taps into turbines' existing Supervisory Control and Data Acquisition (SCADA) industrial control systems, and Sandia researchers are able to collect high-resolution data from key operating parameters such as wind speed, ambient temperatures, blade angles, component temperatures and torques. Every few seconds, a wind turbine's SCADA system captures a complete picture of how the turbine and its components are performing, compared to a defined operating environment.

Each plant is providing SCADA data to Sandia through a software tool

developed by Strategic Power Systems (SPS). SPS developed the automated data collection software originally to collect high-volume data from steam and gas turbines. SPS reengineered its Operational Reliability Analysis Program, or ORAP®, tool to ORAPWind®, which collects data from wind turbines and creates detailed event logs for all non-operating time, in addition to daily summaries of operating time.

Sandia's CREW database contains data for more than 800 turbines, which have generated two terabytes of raw data, about 20 percent as large as the entire print collection of the Library of Congress. Sandia's Enterprise Database Administration Team is processing this enormous dataset into a usable database that can readily support a wide range of rapid queries.

The gathered data is used for various analyses, including public benchmark reporting and DOE reports. The DOE uses its reports to guide research and development investments by identifying critical issues and strategies to improve wind technologies.

The annual public benchmark report characterizes the operations and maintenance experience of the U.S. fleet, using aggregated reliability and performance metrics that lets owner/operators compare their plant against the CREW fleet.

"We're excited about the results so far and look forward to the next few years as we make an important contribution to our industry to improve reliability through a component-level focus," Ogilvie said. "It's an important project that will help encourage increased use of a low-carbon power source, and it could not have succeeded without the outstanding support and leadership of the wind industry and DOE. Together we can share our expertise to help shape the future of the nation's wind energy generation."

More information: The CREW Database Wind Turbine Reliability Benchmark and other Sandia wind energy publications are available on Sandia's website at energy.sandia.gov/crewbenchmark

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