



Multi-Megawatt Turbine Research

The two largest wind turbines ever erected at the National Renewable Energy Laboratory's (NREL) National Wind Technology Center (NWTC) towered into the sky in the fall of 2009. A 1.5-MW turbine manufactured by General Electric was dedicated for research in November, and a 2.3-MW turbine manufactured by Siemens Power Generation was dedicated for research in October.

The U.S. Department of Energy (DOE) purchased the GE 1.5SLE turbine (referred to as the DOE 1.5) for long-term wind energy research and development activities. The DOE 1.5 allows NWTC and industry partners to conduct research to improve performance and reliability. The turbine, which is 119-m tall and has a 77-m rotor diameter, will be extensively instrumented to collect detailed data that will help researchers study the microclimate in which the turbine operates, the aerodynamics of its design, the effects of turbulence on its loads and performance, and how the combination of these factors may affect wind plant performance. The turbine will also be used to educate budding wind



The Siemens 2.3 MW turbine is part of a CRADA with the NWTC to conduct research and testing. PIX17118



A crane at the NWTC installs the nacelle of the DOE 1.5 wind turbine atop an 80-m tower. Credit: Pat Corkery/PIX16568

engineers and researchers from universities, laboratories, and companies nationwide.

The Siemens 2.3-MW turbine is part of a cooperative research and development agreement (CRADA) with Siemens Power Generation to conduct research and testing. At 131-m tall, with a rotor diameter of 101-m, this turbine is among the largest land-based turbines deployed in the United States. Critical tests include structural, performance, modal, acoustics, power quality, and aerodynamics.

In addition to conducting research on the turbines, NREL has a 3 year CRADA with wind project developer RES Americas to study the performance of turbine foundations and thermal characteristics of underground electrical cables to increase reliability and

Turbine Specifications

	DOE 1.5 MW Turbine	Siemens 2.3 MW Turbine
Tower Height	80 m / 263 ft	80 m / 263 ft
Rotor Diameter	77 m / 253 ft	101 m / 331 ft
Swept Area	4700 m ² / 5100 ft ²	8000 m ² / 86,300 ft ²
Total Height	119 m / 389 ft	131 m / 428 ft
Met Tower Height	134.1 m / 440 ft	134.1 m / 440 ft

reduce installation and maintenance costs. Because the turbines are so large, their custom-designed foundations contain between 400 and 800 tons of steel rebar and concrete. Data collected on the foundations of these turbines will result in some of the first-ever measurements of structural loads inside and under an operating wind turbine. In addition to its research on foundation and cables, RES will also install multiple brands of sensors, data loggers, and wireless communication systems at the NWTC for a “side-by-side” comparison of their performance.

Beyond these results, the commissioned turbines will generate clean electricity to meet the laboratory’s aggressive sustainability goals, including the reduction of greenhouse gas emissions, for its expanding research campus and support facilities. The new turbines are expected to generate twice as much energy as the NWTC consumes. Work toward an agreement to allow the export of surplus power to the local utility grid is underway.

NREL’s wind center, nestled at the base of the Rocky Mountains is located just south of Boulder, Colorado. It is DOE’s premier wind energy research and development facility. At the NWTC, NREL researchers work side by side with industry partners to create the next generation of wind energy systems.

For more information about the NWTC’s multi-megawatt turbines, contact the National Wind Technology Center at 303-384-6900.

National Renewable Energy Laboratory

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