

Building State-of-the-Art Wind Technology Testing Facilities

The new Wind Technology Test Center is the only facility in the nation capable of testing wind turbine blades up to 90 meters in length.

A critical factor to wind turbine design and development is the ability to test new designs, components, and materials. In addition, wind turbine blade manufacturers are required to test their blades as part of the turbine certification process.

The National Renewable Energy Laboratory (NREL) partnered with the U.S. Department of Energy (DOE) Wind Program and the Massachusetts Clean Energy Center (MassCEC) to design, construct, and operate the Wind Technology Center (WTTC) in Boston, Massachusetts. The WTTC offers a full suite of certification tests for turbine blades up to 90 meters in length.

NREL worked closely with MTS Systems Corporation to develop the novel large-scale test systems needed to conduct the static and fatigue tests required for certification. Static tests pull wind turbine blades horizontally and vertically to measure blade deflection and strains. Fatigue tests cycle the blades millions of times to simulate what a blade goes through in its lifetime on a wind turbine.

For static testing, the WTTC is equipped with servo-hydraulic winches and cylinders that are connected to the blade through cables to apply up to an 84-mega Newton meter maximum static bending moment. For fatigue testing, MTS developed a commercial version of NREL's patented resonant excitation system with hydraulic cylinders that actuate linear moving masses on the blade at one or more locations. This system applies up to a 21-meter tip-to-tip fatigue test tip displacement to generate 20-plus years of cyclic field loads in a matter of months.

NREL also developed and supplied the WTTC with an advanced data acquisition system capable of measuring and recording hundreds of data channels at very fast sampling rates while communicating with test control systems.

Technical Contact: Derek Berry, derek.berry@nrel.gov



NREL verified the functionality of the WTTC facilities and test systems by testing a blade from one of Clipper Windpower's 2.5-megawatt wind turbines. Photo by Derek Berry, NREL/PIX 20067

Key Research Results

Achievement

NREL partnered with DOE and MassCEC to design, construct, and operate the only wind turbine blade-test facility in the nation that is capable of testing blades up to 90 meters in length and is equipped with the most advanced test systems in the world.

Key Result

NREL provided the wind industry with the capability to test the longer blades used by larger turbines. The WTTC features three test stands, 100 tons of overhead bridge crane capacity, a commercial version of NREL's resonant excitation technology, and a data acquisition system that measures and records hundreds of data channels at very fast sampling rates while communicating with test control systems.

Potential Impact

The WTTC's new test capabilities will help industry develop the next generation of wind technologies and accelerate wind deployment to ensure that wind power becomes a cornerstone of the nation's energy infrastructure.