

NREL FACILITIES

NREL's National Wind Technology Center

...harnessing the wind

Standing in a rocky field just north of Golden, Colorado, you can feel the raw power of the wind. Strong westerly gusts sweep down from the Continental Divide in the fall and winter, occasionally reaching speeds of 120 miles per hour. In late winter and spring, easterly and northeasterly winds blow steadily from the Great Plains.

It's an ideal place to test the strength and durability of wind turbines—machines that turn the wind's abundant energy into electricity. That's why the U.S. Department of Energy (DOE) decided to transform this 280-acre site into the nation's largest center for wind turbine research and development.

National Wind Technology Center

The National Wind Technology Center is a place where government scientists work side-by-side with U.S. industry to create advanced wind systems of the future. Wind plant operators and electric utilities come here for technical assistance as they integrate wind power plants into our nation's electricity supply. And manufacturers come here for the world's leading research and test support.

Developing lightweight, reliable components and testing complete systems are crucial for the emerging U.S. wind industry. The National Wind Technology Center is designed to meet these critical needs from the ground up.

What's Inside

Inside the 23,000-square-foot office building and high-bay laboratory, researchers analyze the performance and strength of components such as wind turbine blades. Sometimes the ultimate strength of the blade is tested by bending it until it breaks. In nondestructive tests, the blades are embedded with sensors to study vibrations from hand-held hammers or ground-mounted shakers. Special coat-

ings change color as the blades are bent or twisted, allowing researchers to see where stress could cause problems during actual operation. Sophisticated computer models help researchers analyze the results of these tests and improve future designs.



What's Outside

Outdoors, 16 test pads handle wind turbines ranging from one kilowatt to one megawatt of power output.

The first advanced wind turbines developed by industry with support from NREL are installed at the center. These include the largest experimental wind turbine ever operated in Colorado, a 600-kilowatt Westinghouse machine. Other machines now at the site include a 275-kilowatt machine developed by R. Lynette and Associates of Redmond, WA, a 50-kilowatt turbine developed by Atlantic Orient Corp. of Norwich, VT, a 10-kilowatt machine by Bergey Windpower Co. of Norman, OK, and a 20-kilowatt experimental turbine designed and operated by NREL researchers.

NREL is the U.S. Department of Energy's premier laboratory for renewable energy & energy efficiency research, development and deployment.

Operated for the U.S. Department of Energy by Midwest Research Institute • Battelle • Bechtel

The test pads are fully instrumented so that researchers can study every aspect of wind turbine performance, including wind speed and direction, power output, torque, and other critical factors. Data collected by sensors or video cameras are relayed to a computer for real-time monitoring or storage.

Facilities

DOE has invested more than \$5 million to make the facility the nation's largest and most sophisticated center for wind energy research.

Industrial User Facility

The 10,000-square-foot *industrial user facility* is the center of collaborations within the U.S. wind industry. Together, NREL and industry engineers use computer models to simulate operating wind turbines and individual components. The facility is partitioned so that users can work with their machines in privacy, essential for protecting trade secrets. Machine and wood shops, indoor test bays, and a complete electronics laboratory are available to users, with NREL researchers on hand to provide assistance.

Advanced Turbine Research Facility

The *advanced turbine research facility* consists of two test machines that can be configured for testing advanced components. The two side-by-side machines allow researchers to discriminate between small (5% to 10%) differences in performance while testing different machine configurations in turbulent winds.

Hybrid Power Test Facility

The *hybrid power test facility* focuses on commercially available hybrid power systems, which combine a wind turbine with other renewable energy sources (such as photovoltaics), battery storage, and a back-up power system such as a diesel generator.

NREL researchers also support U.S. companies with certification testing of power performance, acoustics, and other factors affecting wind turbine performance. Wind companies could use these test results to obtain certification and type approvals in accordance with international standards now being developed.

A breezy future

Thanks to the combined efforts of government and industry at the National Wind Technology Center, the cost of wind energy should reach 4¢ per kilowatt-hour or less by the year 2000. Wind power will then be more economically competitive with conventional energy sources throughout the nation.