



## Small Wind Independent Testing

NREL and the U.S. Department of Energy's (DOE) Wind and Water Power Program established the Small Wind Independent Testing project in 2008 and the Small Wind Regional Test Center project (RTC) in 2009 to conduct tests on small wind turbines to meet national and international standards.

### Independent Testing

In 2008/2009/2010, the National Wind Technology Center (NWTC) selected and tested five commercially available small wind turbine systems:

- Abundant Renewable Energy's ARE 442 – 10kW
- Entegry Wind System's EW50 – 50kW
- Gaia-Winds – 11kW
- Mariah Power's Windspire – 1.2kW
- Ventera VT10 – 10kW

At NREL, the small wind turbines are tested to standards published by the International Electrotechnical Commission (IEC). Regional Test Centers likely will follow American Wind Energy Association (AWEA) standards for small wind turbine systems.

### Small Wind Turbine Tests and Testing Approach

The National Renewable Energy Laboratory (NREL) has testing capabilities that are accredited by the American Association of Laboratory Accreditation (A2LA). Currently, NREL is one of only a few facilities in the United States that are accredited for small wind turbine testing.

NREL is the only organization accredited for the full suite of tests conducted on small wind turbines, including acoustic noise emissions, duration, power performance, power quality, and safety and function. Each of the tests is briefly described below. Tests are performed to International Electrotechnical Commission (IEC) standards and in compliance with NREL's accredited Quality Assurance (QA) system.

Testing generally takes about a year to complete and the results are posted on the NWTC web site. The data from these tests may be used by the Small Wind Certification Council (SWCC), a non-profit organization formed with support from the Department of Energy (DOE), AWEA, state energy offices, and turbine manufacturers to certify small wind turbine systems. The Small Wind



ARE442 small wind turbine tested at the NWTC



Gaia small wind turbine tested at the NWTC



Entegry small wind turbine tested at NWTC.



Ventura small wind turbine tested at the NWTTC.

Certification Council received over a dozen applications for turbine certifications in early 2010; it is expected that several of these turbines will be certified by the end of the year. Test data could also be submitted to international certification agents as partial qualification for international certification.

## Regional Test Centers

NREL's National Wind Technology Center (NWTTC) has facilities sufficient for testing up to eight small wind turbines per year. This testing ability allows manufacturer's to meet SWCC or other certification body requirements. The SWCC certification helps satisfy certification requests from consumers, manufacturers, and state and utility incentive programs. More facilities are needed. NREL and the U.S. Department of Energy created the Regional Test Center project, in which facilities competitively vied for awards to establish Regional Test Centers.

In 2010, DOE named Intertek Testing Services NA, Inc. in New York, Kansas State University, The Alternative Energy Institute at West Texas A&M University, and Windward Engineering, LLC in Utah as the first regional test centers. DOE provides funding, training, and technical support for each Regional Test Center to conduct testing of two small wind turbines to support the burgeoning U.S. small wind turbine market.

The Regional Test Center project supports the U.S. small wind market by increasing the number of organizations qualified to conduct small wind turbine standards testing and to drive down the cost of this testing. Test results are used by certification bodies, such as the Small Wind Certification Council, to certify small wind turbines for mechanical strength and performance.

Certification testing allows small wind turbine buyers to make informed choices and provides states with the data they need to determine turbine eligibility for incentive programs. Regional Test Centers are scheduled to begin testing later in 2010 with testing expected to last 12-18 months.

## Acoustic Noise Emissions

Acoustic noise emissions testing reports sound power levels, one-third octave levels, and tonality at different wind speeds. Noise testing is performed according to IEC Standard 61400-11.

## Duration

The purpose of the duration test is to investigate the structural integrity and material degradation (corrosion, cracks, deformations), qualify of environmental protection of the wind turbine, and dynamic behavior of the turbine. Data is collected for at least 2500 hours when the turbine is producing power and must be conducted for a minimum of 6 months across a range of wind speeds. Duration testing is performed according to IEC Standard 61400-2.

## Power Performance

Power performance testing produces a graph for power versus wind speed to summarize the turbine's power generation performance at different wind speeds, the efficiency of the turbine, and estimates the annual energy production. This test is performed according to IEC Standard 61400-12-1, referencing Appendix H for small turbines.

## Power Quality

Power quality testing is performed according to IEC Standard 61400-21. Power quality testing determines the electrical characteristics of 3-phase grid connected turbines including flicker, harmonic emissions, and power control.

## Safety and Function

Safety and function testing is performed to verify that the turbine displays its designed behavior as indicated by the manufacturer. Features tested are drawn from the wind turbine documentation. The testing is conducted in accordance with IEC Standard 61400-2.

## National Renewable Energy Laboratory

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