



Proposed turbine placement for Wind R&D Park

MISSION

Since 1981, the Wind Energy Institute of Canada has been Canada's national facility for testing of small wind turbines. The Institute's mission to "*advance the development of wind energy across Canada through research, testing, training, and collaboration*", is accomplished by focusing on the four strategic areas:

- *Testing Leading to Certification*
- *Research, Development and Demonstration*
- *Training, Outreach and Public Education*
- *Technical Consultation and Assistance*

Described in this document are the Institute's projects.

WIND ENERGY R&D PARK

Wind Energy R&D Park and Storage System for Innovation in Grid Integration

The Government of Canada's Clean Energy Fund awarded the Wind Energy Institute of Canada a \$12 million federal grant to demonstrate the economic and technical feasibility of wind energy storage in Canada. The demonstration will feature five DeWind D9.2 wind turbines with a gen-

erating capacity of 10MW, an electricity storage system, and grid integration technologies to increase the economic viability of intermittent electricity generation. Support received through a \$12.6 million loan with the Government of PEI, will be repaid from the sale of power produced by the 10MW Wind R&D Park.

The 10MW wind farm will be supported by a utility-sized energy storage system designed to demonstrate the dispatch of stored wind energy by the utility and system operator. The grid integration project will provide storage facilities to mitigate energy variability and enhance the integrated power system by increasing modeling capabilities.

The wind turbines will be operational in winter 2011 and the energy storage system in the summer of 2012. To follow the Project's progress, sign up for our distribution list: <http://weican.ca/distribution.php>.

AREAS OF STRATEGIC FOCUS

Testing leading to Certification

The Wind Energy Institute has a collaborative agreement with DEWI (www.dewi.de), the German Wind Energy Institute, for prototype testing of large wind turbines.

The Institute is recognized as a non accredited test site by the Small Wind Certification Council (SWCC) for testing small wind turbines for the North

American market. This past year TUV NEL (www.tuvnel.com), of Scotland, visited the Institute to perform an audit of test procedures, staff, equipment, and capability to conduct testing of small wind turbines against the requirements of Microgeneration Certification Scheme (MCS). This resulted in a collaborative relationship with TUV NEL so that test results can be certified to the MCS standard for the United Kingdom market.

The Institutes Type Testing program for wind turbines is in accordance with the International Electrotechnical Commission (IEC) 61400 standards, and for small wind testing include the American Wind Energy Association (AWEA) standard. Specific tests performed can include; power performance, load measurement, power quality, acoustic noise emissions, duration and safety. Results can be certified through organizations such as DEWI-OCC, SWCC, and TUV NEL to name a few. Listed below are wind turbines contracted for testing at/by the Wind Energy Institute of Canada. These testing services can be mobile but test beds for small wind turbine remain available at the Institutes North Cape site.



Wind Energy Institute of Canada's North Cape site

Raum Energy's 3.5 kW

Collaborative R&D work on the Raum 1.3kW resulted, in the Institutes contract to test the Raum 3.5kW. With installation and commissioning complete testing has commenced. Raum's 3.5 kW wind turbines direct-drive, gearless, brushless design allows continued performance in an extremely wide range of conditions. The turbine is designed so the end-user can install the turbine without cranes, harnesses or climbing, all that is required to lift the tower is a simple gin-pole and vehicle.

Zephyr Corporation's 1.1 kW

The Airdolphin, an ultra-light turbine rated 1.1kW is the result of a joint industry-government-academia initiative in Japan, it combines state-of-the-art technology with Japanese craftsmanship. The Institute has completed testing for the Zephyr Airdolphin GTO-Z1000 wind turbine. The test report has been issued to Zephyr for submission to SWCC for certification. Zephyr has now requested the Institute to do a power performance test on a new model of the 1.1kW.

Seaforth Engineering's 50kW AOC

Seaforth's 50kW AOC wind turbine has been installed and commissioned and is now under test. The AOC 15/50 is a state-of-the-art 50kW wind turbine, which provides emission-free electrical energy for off-grid village electrification, remote community wind-diesel integration and local grid support. The AOC 15/50 has been installed in numerous locations

around the world including in Canada, the United States, the Caribbean, Scotland and India.

BerMcControls Inc. 30kW

BerMc Controls Inc. has contracted with the Institute for testing leading to certification for BerMc's HC-30kW wind turbine. Over the past five years the company has been actively involved in the small wind turbine industry in PEI and has the experience required to develop control systems for the small wind industry. BerMc is proud to cooperate with its suppliers to integrate a complete 30kW turbine package utilizing their own designed and produced control system along with the Huaying Wind Generator, SMA(Canada) inverters, and Magnum Piering foundation system. BerMc also integrates 2kW, 5kW and 10kW variable pitch turbines using the same suppliers. Currently BerMc has ten HC-30kW (Huaying Canada) systems in operation at various farms across PEI, with more installations booked for the fall.

VBine Energy's 5kW VBine

VBine's 5kW Vertical Axis Wind Turbine has been installed, and testing has begun for power performance, safety and function, duration, and acoustics according to IEC and AWEA standards. The VAWT is a ring-shaped generator which rotates around the centre spindle with the aid of wind-catching blades. (Center spindle does not rotate which allows equipment to be installed above the turbine.) The rotor blades are coupled with a wheel of current-inducing magnets that revolve around a stator with fixed wound coils. As the rotating magnets pass over the stationary coils, the magnetic field is constantly changing, thereby inducing an electrical current. The current is conducted through the coils and can be directly distributed for use or stored in a battery.



VBine 5kW installed at the Institute

Research, Development and Demonstration (R, D&D)

Net Metering for Community Rinks

Community ice hockey rinks in Murray River, Crapaud, Kensington and Alberton Prince Edward Island will begin reaping the benefits of renewable energy through wind generation. With the installation of wind turbines at

these four arenas, the net metering initiative provides the arena associations with the means to take responsibility for their own power production and to lower their environmental impact. Support was provided from the Federal Gas Tax Fund, the Trust Fund for Clean Air and Climate Change, and each of the communities.

The Wind Energy Institute acted as Project Manager and guided the communities by produced technical assessments, and engaging with the successful facilities; helping them understand siting issues, technologies, applications, and permits. Installations are now complete and it is the hope that these projects become a template for other communities across Canada for similar net metering projects.

Sugen's 5kW VAWT

Sugen Research Inc., a Cape Breton based company, has developed a 5 kW VAWT in cooperation with Gaul Industries of France. The VAWT has a unique configuration which may be well suited for high wind environments, such as northern Cape Breton. WEICan has provided technical, engineering, and project management services to assist in the design of the VAWT. After verification at the Institutes test site, the VAWT was moved to Grand Etang, Cape Breton for further design verification and power performance testing.

Wind in Canada's North

The Institute has assisted the PEI Energy Corporation (PEIEC) in their Wind-Hydrogen Village project, a system deemed suitable for install in the North. Work also continues with Qulliq Energy (Nunavut power utility) on a Wind Resource Assessment project for Nunavut.

New Brunswick System Operator (NBSO)

Wind power systems are a major contributor to renewable energy; however, difficulty exists in the accurate prediction of the average cost of energy over the installed lifetime. The Institute provided NBSO data which they will use to evaluate the cost effectiveness of a wide variety of wind power system designs while considering component efficiency, cost, and reliability. Several models were developed, one to determine the losses experienced in system components, one to determine the cost of components, and one to determine the reliability of the components. The results of these models were combined into a Monte-Carlo based comprehensive model used to simulate the operation of a wind power system over its lifetime. This comprehensive model was used to determine the most cost effective system configuration to couple to a 30kW wind turbine for both fixed and variable speed operation.

Wind Energy Strategic Network

The NSERC Wind Energy Strategic Network (WESNet), Canada's nationwide wind energy research collective is a multi-partner alliance which includes leading researchers from 16 Canadian universities in six provinces, NRCan and Environment Canada, the Canadian Wind Energy Association, utility companies, wind sector businesses, and the Institute. Following is a list of research projects for this period.

1. Memorial University of Newfoundland (MUN)

The Wind Energy Institute in collaboration with Dr. Tariq Iqbal of MUN is conducting research into the effects of power factor variations on small wind turbine performance. An undergraduate student performed a literature review and initial investigation of WESNet data. A report titled, "Wind turbine output: the impact of power factor upon output at varying wind speeds", summarizes the findings. A masters student from MUN is currently working with the Institute to review the data collected and study the electrical setup in order to develop a test plan for further research of power factor variations.



*André displaying his prototype and a commercial anemometer
Photo courtesy of Eric McCarthy, Journal Pioneer*

2. Université de Laval

NSERC has approved supplementary funding to WESNet to support research interns. This funding is supporting André Bégin-Drolet, Université de Laval, on a 4 month internship that will support his research into ice free anemometers which were tested in North Cape over the winter.

3. University of New Brunswick (UNB)

UNB has a 30kW Wenvor wind turbine installed at the Institutes site in North Cape which is utilized for inverter research and development.

UNB is also developing a wind forecasting tool comprised of three models: physical, computational and statistical. The physical model forecast is based on Environment Canada information and the computational/statistical is based on wind data provided by the Institute.

Small Wind Turbine Inventory

WEICan maintains a small wind turbine inventory in order to have equipment available for testing, research, development, and demonstration purposes.

Training, Outreach and Public Education

International Electrotechnical Commission (IEC) Standards

Small wind certification is being driven by market expansion and incentive programs for small wind (primarily in the US and UK) and net metering. As chairperson for the Canadian Standard Association (CSA) working group for Design Requirements for Small Wind Turbines, the Institute con-

tinues to participate in IEC and International Energy Agency (IEA) meetings to address Canadian concerns. Through these meetings a committee draft of IEC 61400-2 Ed3 has been produced and is currently awaiting comments from National Committees before voting on acceptance.

Training Tower Project

PEI's Wind Turbine Service Technician training program is now underway at Holland College (www.hollandcollege.com). As such, the Institute in collaboration with Holland College has installed a training tower at their North Cape site. This training tower marketed as a tower for Fall Arrest/Safety/Rescue training is available for educational training programs as well as private sector companies on a fee for service basis.

Public Outreach Activities

The Institute hosts numerous groups each year at their site in North Cape; these include political leaders, professionals, academics, and clients, from all over the world. In addition, the Institute has participated in industry conferences in Canada, United States, UK, and Caribbean; and other wind related seminars. These activities have been an important part in the process of educating key decision makers about the technical and economic capabilities of wind energy; as well as allowing WEICan staff to remain current on the status of the industry.

Visiting Professors and Academics Program (VPAP) / Co-op Engineering Students

The "Visiting Professors and Academics Program" provides an opportunity for scholars in the field of wind energy to work at WEICan. For more information on this program please visit our website: www.weican.ca.

In order to provide the opportunity for engineering students to explore the wind energy field, the Institutes participates in Co-op work terms. The Institute has hosted students from Memorial University of Newfoundland, Dalhousie University, Concordia University, University of Waterloo, McGill University, University of Regina, University of Saskatchewan, University of Prince Edward Island, University of Laval, University of New Brunswick, and University of Toronto and also international students.



Site Engineer and UNB student receive new equipment for the Wind R&D Park

Technical Consultation and Assistance

Saskatchewan Research Council (SRC)

SRC contracted the Institute to provide verification of small wind turbine performance in Saskatchewan. The purpose of this study was to compare actual small wind turbine electricity production against the turbine manufacturer's predictions. There have been two reports issued to date and discussions are underway for the third phase.

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WEICan also employs students/interns on a regular basis.

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