



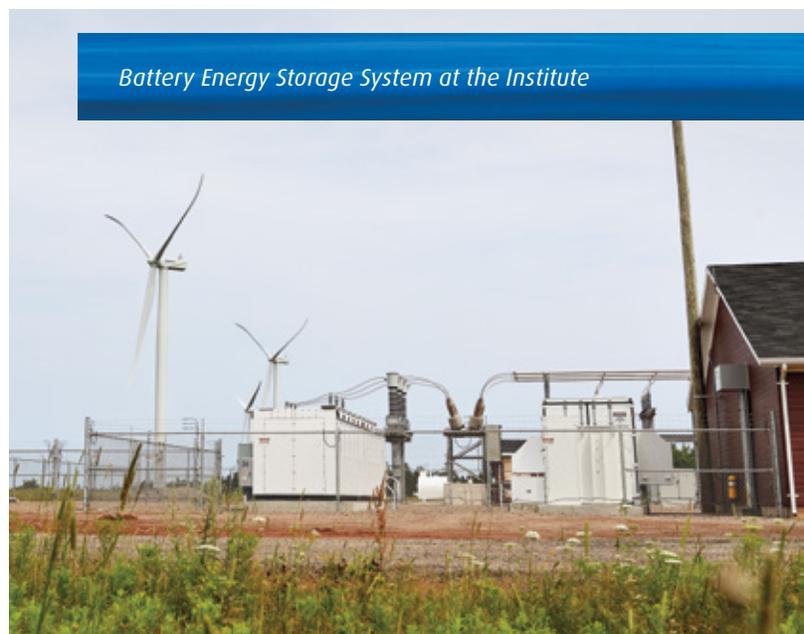
WIND R&D PARK AND STORAGE SYSTEM FOR INNOVATION IN GRID INTEGRATION (WIND R&D PARK)

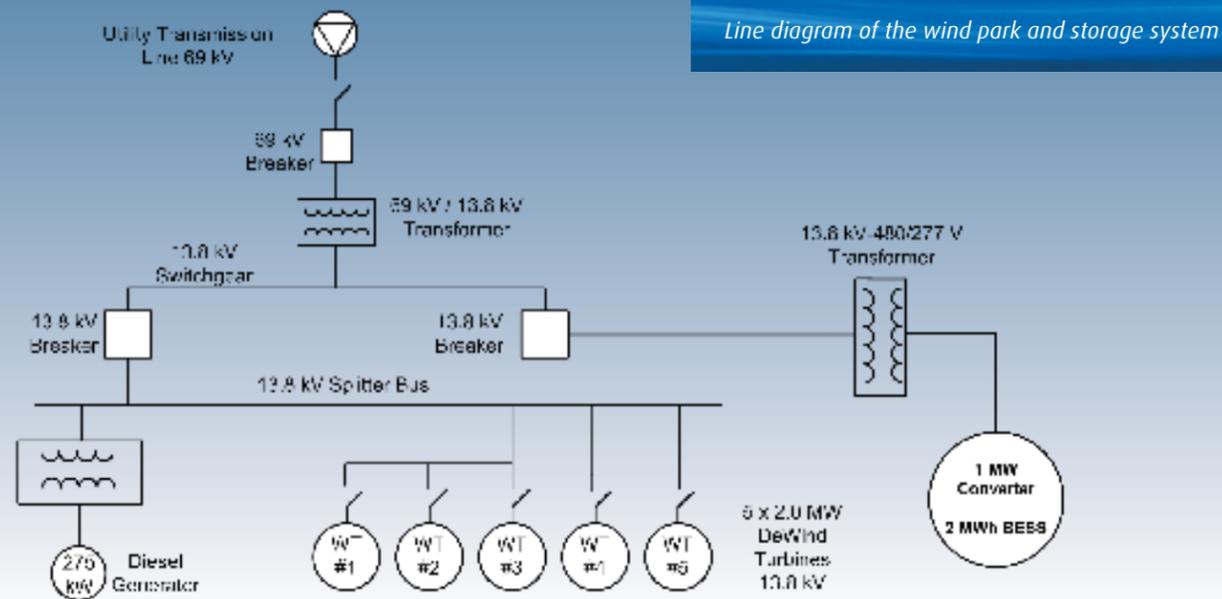
The Wind R&D Park, commissioned in April 2013, is projected to produce over 3.5% of Maritime Electric Company Limited energy for 2014. Along with five DeWind D9.2 wind turbines with a generating capacity of 10 MW, the R&D Park also incorporates a Battery Energy Storage System (BESS) from S&C Electric Canada Ltd. (S&C) and General Electric (GE), which was commissioned in March 2014. The BESS is currently being used to store night-time wind energy, which is used during PEI's evening peak load. The Wind R&D Park is demonstrating how wind energy's variability can be mitigated and that the Wind R&D Park can be relied upon to provide power when it is most needed. This grid integration project provides a storage facility to mitigate energy variability and enhance the power system by validating grid integration models.

The BESS is composed of two primary components, namely, a Power Conversion System (PCS), supplied by S&C via its field-proven PureWave® Storage Management System (SMS), and the Durathon DC2MWh Battery System supplied by GE. The GE Durathon DC Battery System is based on GE's sodium nickel chloride battery modules and includes GE's Battery Management System and integrated outdoor enclosure with all required climate controls for temperatures ranging from -40 to +50 °C. This represents the first such project for GE Energy Storage in Canada. The PureWave SMS allows the energy generated by the wind turbines to charge the batteries and also allows the energy from the BESS to be released when it is needed to the utility, Maritime Electric Company Limited, for sale to retail customers.

The Institute's new asset base will allow the Institute to expand its research mandate; support manufacturers, government, and academia; and offer system operators and utilities a unique test bench for wind and storage systems. The Institute has expanded its research into:

- *optimization of wind forecasting using real-time data*
- *grid integration*
- *storage facilities to mitigate energy intermittency*
- *storage performance regarding reliability and economics*





Line diagram of the wind park and storage system WESNet Turbine



Université de Laval's ice-free anemometer

The Institute will examine how energy storage can improve renewable energy penetration and stabilize the grid; particularly examining the effectiveness of storage on a weak transmission network. As a demonstration project, the BESS will be operated in a number of ways to demonstrate the benefits of energy storage under varying scenarios, including:

- time shift mode
- power smoothing
- voltage control
- demand reduction

RESEARCH, DEVELOPMENT AND DEMONSTRATION (R, D&D)

Now that the Wind R&D Park and Storage System has been built and commissioned, the Institute is focusing on defining a research program to work within the overall goal of advancing wind energy in Canada. Towards this end, the Institute has hired a Scientific Director and Wind Integration Researcher, who will primarily concentrate on research efforts at the Institute.

In the spirit of collaboration and support of the research community, the Institute is interested in establishing collaborative relationships/ memorandums of understanding with research institutions including:

- University of Prince Edward Island (UPEI)
- TechnoCentre Éolien
- University of Western Ontario – WindEEE Research Institute (WindEEE)
- Dalhousie University

GTRenergy Ltd. 5 kW Virtual Blade (VB)

GTRenergy Ltd.'s VB Wind technology is based on an innovative wind turbine blade configuration. The Institute will conduct field tests on the VB technology.

Wind Energy Strategic Network

The NSERC Wind Energy Strategic Network (WESNet), Canada's nationwide wind energy research collective was a multi-partner alliance. Below is a list of research projects the Institute has played a role in with WESNet for this period.

1. *Université de Laval*
Researchers at Université de Laval have tested their ice-free anemometer on the Institute's meteorological mast. The harsh winter conditions at the Institute's North Cape site provide a real-world test bed for the technology.
2. *WESNet 10 kW Wind Turbine*
The Institute has tested a small wind turbine developed by the WESNet Team. The objective of the project is to develop, demonstrate, and evaluate an integrated small wind turbine package with advanced technologies available for transfer to the wind industry for commercial deployment.

Small Wind Turbine Inventory

The Institute maintains a small wind turbine inventory to have equipment available for testing, research, development, and demonstration purposes.

TESTING LEADING TO CERTIFICATION

With the completion of site audits, the Institute is now a recognized testing laboratory by:

- TUV-NEL for Microgeneration Certification Scheme (MCS) certification for the United Kingdom
- Nippon Kaiji Kyokai for Japan
- Small Wind Certification Council (SWCC) and Intertek for small wind testing and certification for North America

The Institute's Type Testing program for wind turbines is in accordance with the International Electrotechnical Commission (IEC) 61400 standards; and for small wind testing conforms with American Wind Energy Association (AWEA) and British Wind Energy Association (BWEA) standards. Specific tests performed include; power performance, load measurement, power quality, acoustic noise emissions, duration and safety. The Institute has a collaborative agreement with DEWI, part of Underwriters Laboratories (UL), for prototype testing of large wind turbines.



The Institute's Wind R&D Park and Storage System

Demonstration of these practical applications for energy storage systems will increase the acceptance and utilization of such systems and allow for integration of more renewable energy by utilities into their generation mix.

This project was made possible when the Natural Resources Canada's Clean Energy Fund awarded the Institute a \$12 million federal contribution, to demonstrate the economic and technical feasibility of wind energy storage in Canada. The project has also been supported through a \$12.6 million loan with the Government of PEI, which is being repaid from the sale of power produced by the Wind R&D Park.



The Institute's Wind Turbine Test Site



Riamwind Co.'s Wind-lens 2 kW Turbine

These testing services are mobile, but test beds for small wind turbines remain available at the Institute's North Cape site. Listed below are wind turbines that were tested at/by the Institute in the past year.

Eocycle Technologies' 25 kW direct drive wind turbine

Eocycle Technologies 25 kW direct-drive wind turbine was successfully tested in accordance with the AWEA and BWEA standards.

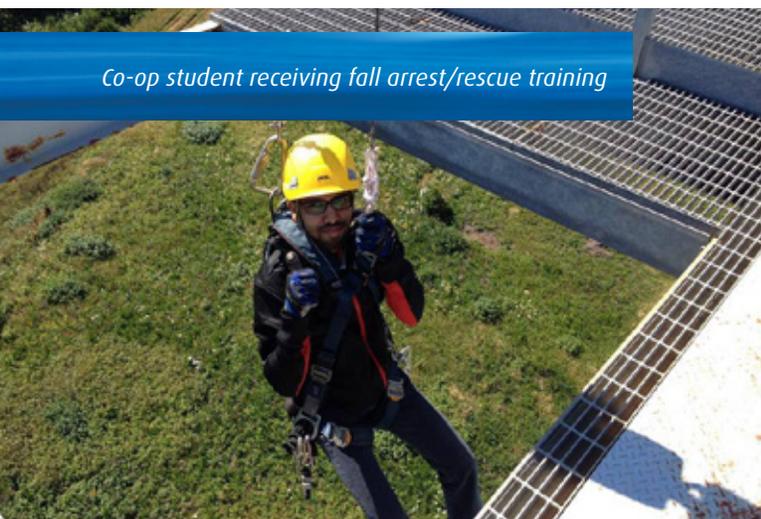
Zephyr Corporation's 1.1 kW

The Airdolphin's 1.1 kW turbine was successfully tested at the Institute in accordance with the BWEA standard.

Riamwind Co.'s Wind-lens 2 kW

The Riamwind Co. and Kyushu University's 2 kW Wind-lens turbine was tested in accordance with the Japanese Small Wind Turbines Association (JSWTA) standards.

Co-op student receiving fall arrest/rescue training



TRAINING, OUTREACH AND PUBLIC EDUCATION

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 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 the Institute's staff to remain current on the status of the industry.

Visiting Academics and Students

The Institute provides the opportunity for scholars and summer and coop students in the field of wind energy to work at the Institute.

TECHNICAL CONSULTATION AND ASSISTANCE

Wind Resource Assessment (WRA) in the North

The Institute continues to perform WRAs in Northern Canada. As these communities rely on expensive imported fossil fuel supplies to meet electricity needs, it is expected that these WRAs may be the first step to a decreased dependency on fossil fuels. The Institute's recent work includes:

1. Qulliq Energy Corporation - Cape Dorset
2. Cambridge Bay

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The Institute's Wind Turbine Test Site

