# Wind Energy Institute of Canada

***Leading the development of wind energy across Canada through research, testing, innovation, and collaboration.***

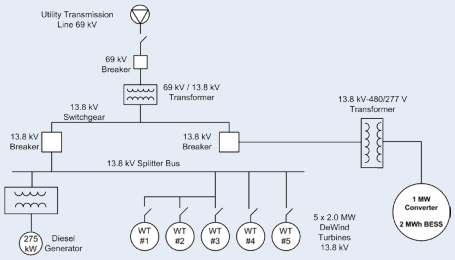
*The Wind Energy Institute of Canada (Institute), located in North Cape, Prince Edward Island (PEI), has been active in the development of wind energy through technical testing and consultation; research, development and demonstration; and outreach since its formation in 1981. As a national research facility and independent wind farm and battery energy storage system operator, with strong industry ties, the Institute is well-positioned to lead research in the advancement of wind energy.*

*The Institute received funding through NRCan's Clean Energy Fund and a loan from the province of PEI to own and operate a Wind R&D Park that features five 2 MW wind turbines and a storage system with a 1 MW/2 MWh capacity. The Institute views this infrastructure as a laboratory that is available for research and is open to collaboration with interested parties.*

## IMPACT OF WAKES AND CLIFFS ON WIND SPEED AND TURBULENCE

### WIND R&D PARK CHARACTERISTICS

| | |
|---|---|
| Wind R&D Park Capacity | *10 MW* |
| Number of Wind Turbines | *5* |
| Model | *DeWind D9.2* |
| Storage Capacity | *2 MWh* |
| Storage Rating | *1 MW* |
| Inverter Model | *S&C Purewave* |
| Battery Model | *GE Durathon* |
| Temperature Range | *-30°C to +27°C* |
| Topography | *10 m cliffs and 300° ocean exposure* |




### WIND R&D PARK PERFORMANCE STATISTICS (APR'14 TO MAR'15):

- 41.7 GWh energy produced
- 95% + Availability
- 47% + Capacity Factor

### BATTERY STATISTICS (MAR' 14-JUL'15):

- 3 services tested
- 230 MWhs delivered
- Up to 76 % AC-AC efficiency for month long scenario


## BACKGROUND

Cliffs can result in increased wind speeds, which makes them promising sites for wind turbines. However, the increased turbulence that can result from cliffs lead to the potential for unbalanced loads across the wind turbine rotor. In addition, turbine wakes can also result in turbulence as well as reduced flow. Four of the Institute's Wind R&D Park's five turbines are placed on a 14 m cliff in a relatively straight line. The Institute is interested in the impact of the cliff and wake effects of the wind turbines on wind speed and turbulence and how this affects wind turbine performance and longevity.

## METHODOLOGY

In May 2015, researchers from three universities: Cornell University, University of Western Ontario, and York University came to the Institute's site to collect wind speed and turbulence data. Met masts and lidar units were placed in strategic locations throughout the site and data was collected for several weeks. This data is being analyzed by the academic researchers to determine the extent of the cliff and wake effects.

## NEXT STEPS

This work will lead to a greater understanding of wake characteristics and the impacts of cliffs on wind speed and turbulence. Wind speed and turbulence data from this study will be correlated to turbine performance and turbine component condition monitoring results to determine.

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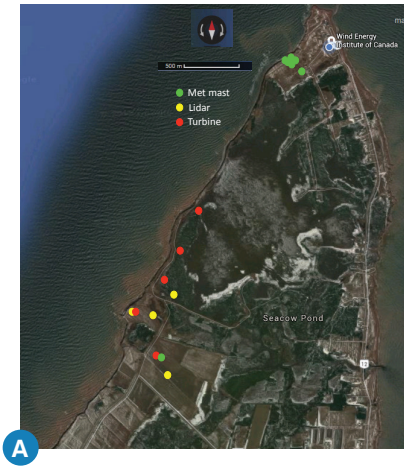


A

B

C

**PHOTOS:** A: Locations of turbines, met masts, lidars; B: IEC compliant met mast; C: Lidar unit. *Photo credits: Sara Pryor*

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