



Experience Using Wind Power on Small Islands: Challenges and Opportunities



Scott Harper
CEO

Wind Energy Institute of Canada



History of WEICan/AWTS

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1981

- The Atlantic Wind Test Site (AWTS) formed in 1981 in North Cape, PEI
- Through the 80's and 90's AWTS led Canada's research in wind energy

Late
1990's

- Began work with PEI government on developing a commercial wind farm

2001

- First MW sized wind farm east of Quebec opened (eight 660 kW turbines)

2003

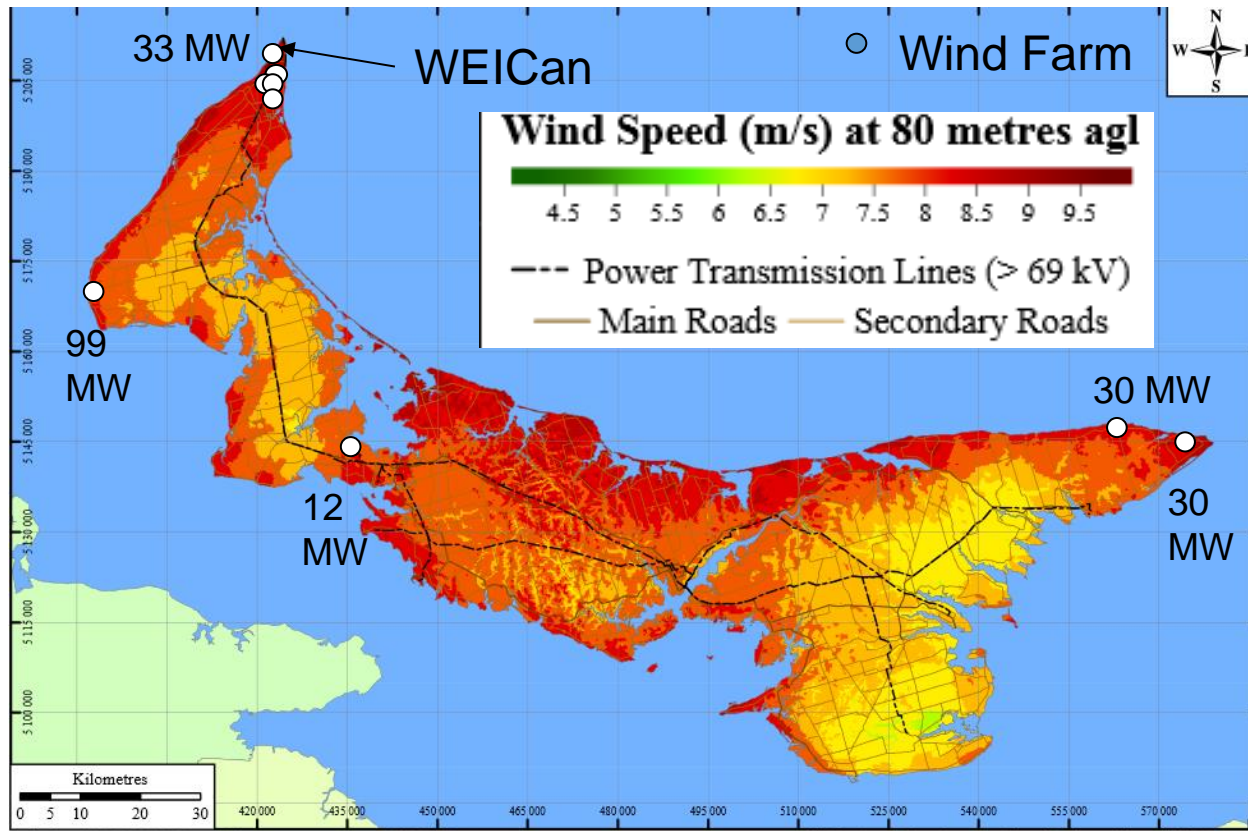
- Farm was doubled in size – a total of 10.56 MW
- Discussions began to expand AWTS's mandate and mission

2006

- WEICan officially formed

Wind Farms in PEI

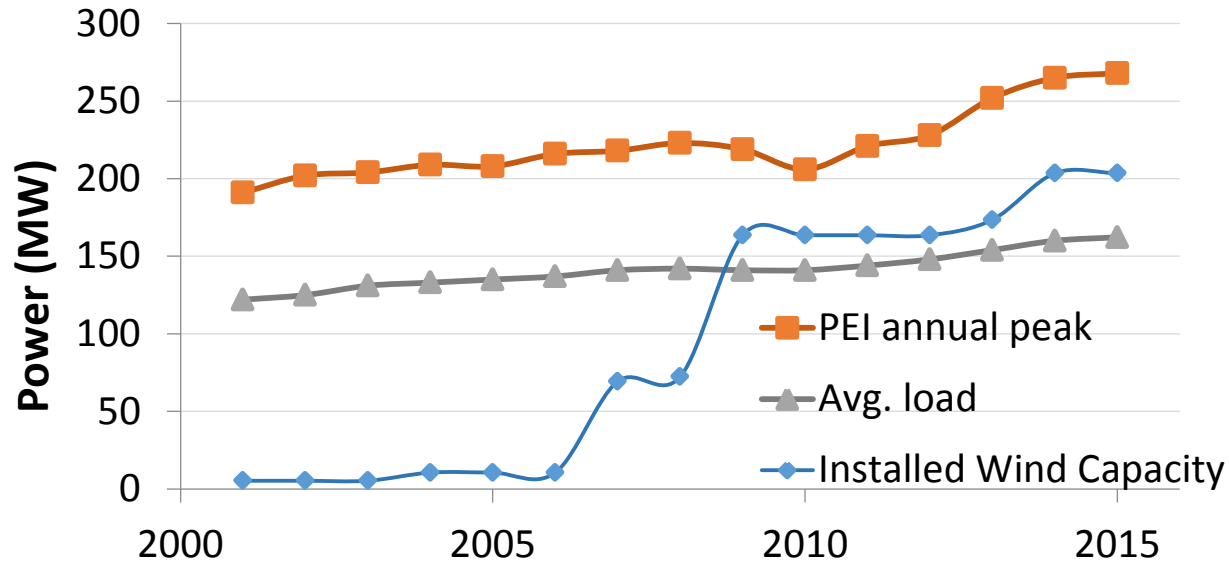
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- Most of PEI has average wind speeds >7 m/s at 80 m; many are above 8 m/s at 80 m
- Have shared historical wind speed data with UPEI's Climate Change lab
 - They found no statistically significant changes in wind patterns in the future

Electricity in PEI Today

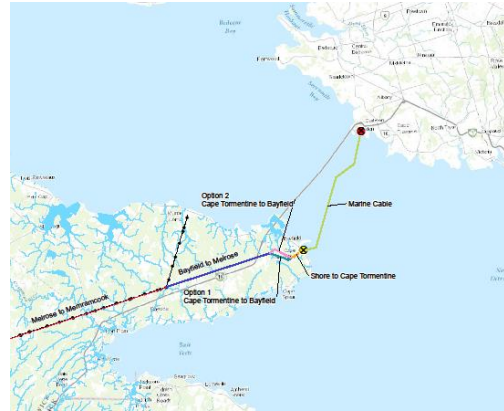
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- Electricity mainly supplied through two submarine cables from New Brunswick (200 MW capacity)
- 150 MW capacity of fossil fuel generators supply electricity when needed
- 9 wind farms operating in PEI, 104 turbines, 204 MW
 - 90 MW is currently sold off-island
 - Over 26% of PEI's electricity comes from wind generation (over 40% including that sold off-island)
 - We have already made great advancements in renewable energy generation

Electricity in PEI Today (Interconnection)

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- Integrating this amount of wind has been made possible because of our interconnection to the mainland
- Upgrades and expansion of this electrical infrastructure continues to be a priority and a major project is now underway (currently 200MW, expanding by 360MW).
- WEICan is excited about the opportunities this infrastructure brings, including;
 - Increasing the % of renewables into the Island grid.
 - Opportunities to export more renewables from PEI
 - Good interconnections allow for more economic options to balance the Island Load, Ancillary services, etc.



- Mission: Advancing the development of wind energy across Canada through research, testing, innovation, and collaboration
- Not for Profit organization – governed by a volunteer Board of Directors
- Team of 11 permanent full-time staff plus students and interns
- Funding from Wind Park and external contracts
- Areas of strategic focus:
 - Research, development, and demonstration
 - Technical testing and consultation
 - Outreach

WEICan's location offers:

- 38 acres
- 300° exposure to the Gulf of St. Lawrence
- Strong wind resource (8.9 m/s @ 80 m) with relatively low turbulence
- Harsh marine, highly corrosive environment
- Icing events during winter months
- Large winter/summer temperature differences
- Adjacent to North Cape Wind Farm:
 - 10.56 MW facility owned by the Province of PEI
- 2 km from WEICan's 10 MW Wind R&D Park



WEICan's Wind R&D Park

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- WEICan received funding through Natural Resources Canada's Clean Energy Fund and a loan from the province of PEI for a wind park and storage system
 - 5 DeWind 2 MW Turbines commissioned spring of 2013
 - 1 MW / 2 MWh S&C/GE Battery commissioned winter of 2014



Research at WEICan

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- As a national research facility and independent wind farm and battery energy storage system operator with strong industry ties, WEICan is well-positioned to lead research in the advancement of wind energy
- The Wind R&D Park is open to other institutes, academia, and industry to be used as a test laboratory
- WEICan is currently performing research in four areas:
 - **Wind Energy Storage and Grid Integration**
 - Data Analytics for Turbine Component Service Life
 - Impact of Wakes and Cliffs on Wind Speed and Turbulence
 - Investigating Underperformance in Small Wind Turbines

Wind Energy Grid Integration

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- Although PEI's renewable energy level is high, it could be pushed higher
- Methods for improved grid integration of wind:
 - Improved interconnections
 - Demand side management
 - Use turbines for ancillary services
 - **Energy storage**
- WEICan uses its energy storage system to demonstrate its ability to integrate wind



Options for Energy Storage for Grid Integration

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- Examples of options for the battery system include:
 - Time shifting
 - Store inexpensive nighttime-generated electricity for use during peak times when electricity is more expensive
 - Power smoothing
 - Ensure the power output changes gradually so production and demand match
 - Demand reduction
 - Reduce turbine peak consumption to reduce the station service demand bill
- We focus on technical capabilities of the technology, but also economic realities today, and future trends/opportunities as best we can.





Summary and Outlook

Wind Energy: Power for Canada

- WEICan has a Wind Park and BESS that is available for research and demonstration
- A major research area is wind energy grid integration
- We are open to new collaborators and continuing research with current and previous collaborators in performing research that follows our mandate
- Our “Island” is an Asset (in our view) for WEICan that we need to take better advantage of, and we look at discussions such as those being held here today as an opportunity to learn, and generate new ideas moving forward



Questions?

Contact:

Scott Harper
CEO

902-882-2746 ext. 204

Scott.harper@weican.ca

www.weican.ca

