

University of Alberta Future Energy Systems

Prince Edward Island Energy Market Profile

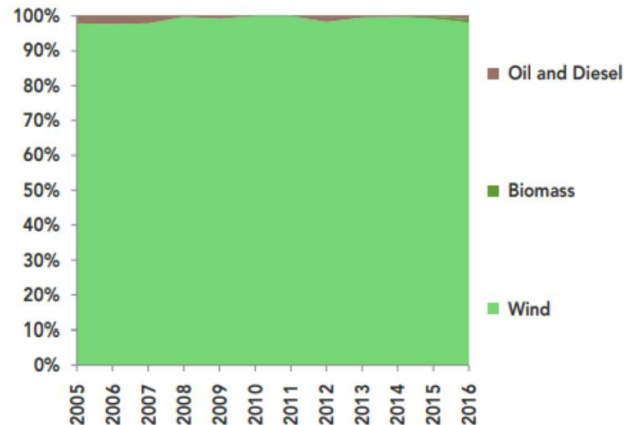
Measuring the Costs and Benefits of Energy Transitions

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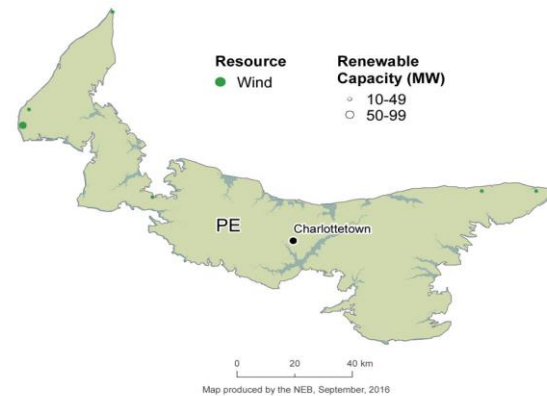
Context

In 2016, Prince Edward Island (PEI) generated 99% of its electricity from renewable sources, approximately 205 MW of capacity and 570 GWh of generation per year, almost entirely from wind, with minor quantities of biomass (NEB, 2018a). The province is rare in Canada in that it does not commercially produce any hydroelectricity. While generation in PEI is nearly all renewable, the province is often an importer of electricity (60% of demand in 2016), with recent amendments to lower the required share of renewables in these purchases, so consumption in the province is not quite as 'green' as it first appears (NEB, 2018b).



Prince Edward Island Electricity Generation by Source
Source: NEB, 2017

Generation, transmission, and distribution of electricity on the island are managed by one of two companies; Maritime Electric, a Private Utility owned by Fortis Inc and operated subject to approval by the Island Regulatory and Appeals Commission (IRAC), and the City of Summerside, a municipal utility that owns both wind and diesel generating stations, governing itself within city boundaries and subject to approval by IRAC for those customers serviced outside city boundaries (Maritime Electric, 2018a; City of Summerside, 2018). Maritime Electric generates ~145 MW from two generating stations, buying the balance of its electricity from both the province, through the PEI Energy Corporation, which owns and operates several wind farms, and from New Brunswick via submarine cables (Maritime Electric, 2018a).



Renewable Projects in PEI
Source: NEB, 2018c

Demographics

2016 Census Profile (Statistics Canada, 2017)

- **Population:** 142,907
- **Average age:** 42.7 years
- **Working age distribution:** 64.7%
- **Private dwellings:** 71, 119
- **Private dwellings occupied by usual residents:** 59, 472

Consumption & Trade

Prince Edward Island ranks 7th in Canada for energy consumption at 13.3 MWh/capita with energy demand growth of 44% since 2005 (NEB, 2018b). Industry is the highest energy consumer at 1.2 TWh annually, followed by commercial at 0.6 TWh and residential at 0.2 TWh (NEB, 2018b). Electricity rates are high, with residential rates at \$160/1000 kWh, \$30 above the Canadian average (NEB, 2018a).

Prince Edward Island is a net energy importer, with over half the province's energy demand (60% in 2016) met through trade with New Brunswick (NEB, 2018b).

Energy Generation Regulations

Small renewable generator connections have been allowed on Prince Edward Island since the 1970s, with a formal Net Metering program launched through the provinces *Renewable Energy Act* in 2008 (Maritime Electric, 2018b). This Net Metering program is managed through the Maritime Electric Company and offers participants a market rate credit, good for one year, on any electricity they feed into the grid. Customers who participate must first apply, then incur all associated installation and maintenance fees, along with meeting the programs individual project cap of 100 kW (Maritime Electric, 2018b). While the approximately 157 participants receive no actual cash for the value of their electricity generation, they are charged both HST and federal income tax, leading some to question the regulatory environment (Campbell, 2017).

Policy, Legislation, & Targets

The province's 2016 Energy Strategy centers around reducing the cost of electricity, reducing the demand for electricity, increasing renewable generation through wind, solar, and biomass, investigating energy storage solutions, electrifying its transportation systems, and meeting climate change mitigation targets (Dunsky Energy Consulting, 2016). Although these goals are well articulated within the report, they do not include many quantifiable targets, except a 10 year horizon for the strategy.

While the Energy Strategy lays out how energy will be managed now and into the future on Prince Edward Island, it is the *Electric Power Act* and *Energy Corporation Act* which regulate energy in the province, empower the province to take public ownership of power generation, and create and regulate the PEI Energy Corporation, which owns most of the Islands wind farms. The 2005 *Renewable Energy Act*, which governs Net Metering and other programs, originally mandated all utilities generating or selling to the Island source a minimum 15% of the electricity from renewable sources, but this was amended in 2015, with the province stating it had achieved its goals of increasing renewable energy so the policy was now unnecessary (NEB, 2018b).

Interestingly, a community economic development business, known as Solar Island Electric, has sprung up offering incentives and education to support solar adoption on the Island (Renewable Lifestyles Ltd, 2018).

Renewable Projects Overview

A dataset of 9 operational energy projects have been compiled for Prince Edward Island from one primary source: Government of Canada - Renewable Energy Powerplants, 1 MW or more. All of these projects are wind farms, with no commercial solar, biomass, or hydro identified. However, net metering participants are not included.

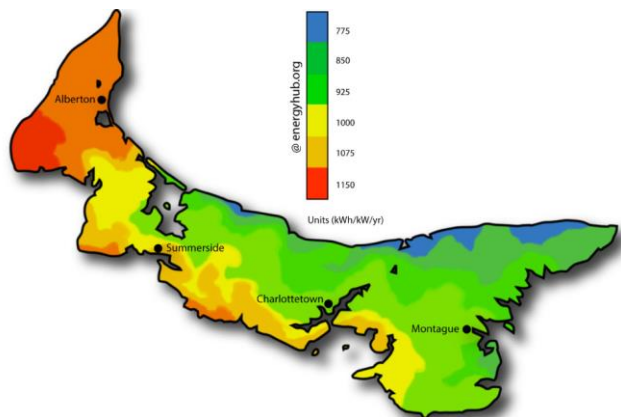
While no major projects are currently under construction in Prince Edward Island, the province has begun consultation around a 30 MW expansion of the Eastern Kings/Kings County wind farm in 2019, with the 2016 Energy Strategy calling for construction of another 40 MW wind farm by 2025 (PEI Energy Corporation, nd). In addition to its public and private wind farms, the Island is also host to the Wind Energy Research Institute of Canada, a wind energy innovation center (Government of Prince Edward Island, 2015).

Potential Energy Summary

Prince Edward Island is a mostly-flat, forested, low-lying land mass with a few hills, making it ideal for wind energy and potentially biomass and ocean energy while a lack of large lakes or rivers make hydroelectric facilities impossible in the province (Atlas of Canada, 2018).

Solar

Prince Edward Island earns a C for its raw solar potential with a 5 kW system producing an average of 5543 kWh per year. This decent solar potential combined with high energy costs is encouraging, but the province does little currently to incentivize solar at the residential or commercial level, besides offering a 100 kW Net Metering program that provides customers with an annual credit. However, Solar Island Electric, a Community Economic Development Business, is working to change that through education, incentives, and leasing solar panels (Solar Panel Power Canada, 2018).



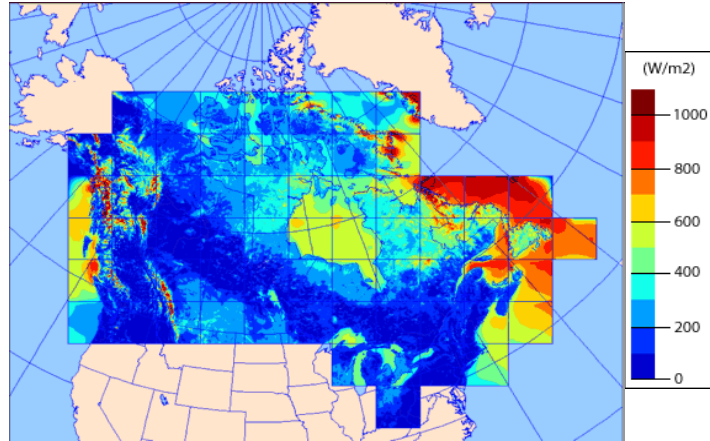
Average Annual Solar Energy Generation per kW installed capacity

Source: <https://solarpanelpower.ca/prince-edward-island/>

Wind

Wind is the most extensively developed source of renewable energy on Prince Edward Island, accounting for ~25-30% of energy on the Island. The province does suggest it is storage capacity and not raw potential that limits further integration, with an ideal 50% integration target (Dodge & Thompson, 2016).

In a 2015 national study by Barrington-Leigh & Ouliaris, wind potentials across the nation were measured to determine the feasible generation. Using GIS, high wind potentials were identified using wind speeds of 7 m/s at a height of 80 m. The study excluded protected lands, inland water bodies, First Nations land, and a 5 km buffer around population centres. The remaining lands were then amended to only include lands near transmission lines (Barrington-Leigh & Ouliaris, 2015). Assuming that 25% of the remaining high potential areas are utilised, which accounts for competing land uses, Prince Edward Island could generate 7 TWh per year. Of PEI's total 2015 energy demand of 7 TWh per year, onshore wind energy could account for 98% of PEI's total energy generation, leaving ample ability to export energy to meet demand in the neighbouring provinces connected by transmission lines (Barrington-Leigh & Ouliaris, 2015).



Annual Mean Wind Energy at 50 m Height Source: <http://www.windatlas.ca/maps-en.php>

Prince Edward Island also has some potential for offshore wind energy as well. Barrington-Leigh & Ouliaris (2015) evaluated the potential for offshore wind across the nation. Offshore wind benefits from higher wind speeds, but is challenged by higher construction costs, higher maintenance costs due to seawater corrosion, and higher transmission costs (Barrington-Leigh & Ouliaris, 2015). Most commercial offshore wind occurs at shallow depths. When examining feasible lands for offshore wind, areas near the shore and water bodies near population centres or transmission lands were considered feasible. Areas with high potential were off the coast of British Columbia, on the Great Lakes, on the Gulf of St. Lawrence, and Bay of Fundy. High potential sites do not account for shipping lanes and environmentally sensitive areas. Assuming a 50% utilization of high potential areas, it was determined that offshore wind farms in Prince Edward Island could produce 18 TWh per year, meeting 258% of the total energy demand in PEI of 7 TWh per year (Barrington-Leigh & Ouliaris, 2015). PEI has capitalised on its significant onshore wind potential to generate the majority of their electricity.

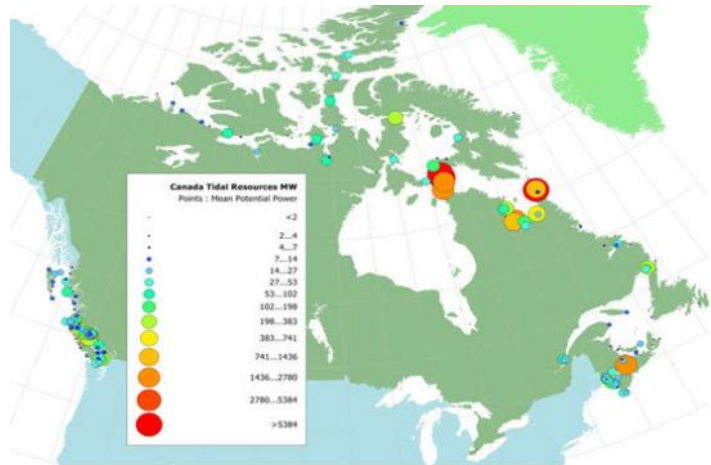
Ocean

Prince Edward Island does appear to enjoy some of the estimated 146,500 MW of ocean energy resources on the Atlantic coast, however specific estimates for raw potential could not be found. The province does allude to alternative forms of energy in its 2016 Energy Strategy, suggesting tidal resources do exist and have development potential in Prince Edward Island.

Tidal energy is still in its infancy, and technology is still in the process of being developed. As such, it is hard to have a realistic estimate of how much energy can be feasibly generated from tidal sources. Barrington-Leigh & Ouliaris (2015) assumed 15% of the tidal potential on the shores of PEI can be

realistically captured. Under this parameter, PEI could generate 0.03 TWh per year, or 0.34% of the total energy demand of 7 TWh per year.

Wave energy is another growing technology and is also difficult to determine the true potential of wave powers. Waves are faster further from the shore, but floating wave converters have high transmission and maintenance costs. In an attempt to estimate the wave energy potential of Nova Scotia, Barrington-Leigh & Ouliaris (2015) assumed wave power facilities would have to locate near the coast. Using the 500 km of coastline on the Atlantic Ocean divided amongst the four provinces with Atlantic coasts and assuming a 10% efficiency of conversion between theoretical potential and electricity generated, it was determined that PEI could generate 5 TWh per year, or 77% of the total 7 TWh per year PEI energy demand (Barrington-Leigh & Ouliaris, 2015).



Tidal Energy Resources in Canada

Source: <https://www.nrcan.gc.ca/energy/renewable-electricity/marine-energy/7371>

Geothermal

While geothermal heating and cooling seem common on the Island (given the large number of geothermal heating and cooling businesses), there is no mention of geothermal energy generation in the province's 2016 Energy Strategy.

Biomass

Biomass generation currently accounts for a nominal share of Prince Edward Islands electricity market, at only 0.9% in 2016, with little suggestion that this share will rise due to a lack of feedstocks, as identified in the provinces 2016 Energy Strategy (NEB, 2018a; Dunsy Energy Consulting, 2016).

Hydroelectric

Given a flat geography with no major lakes or rivers, the hydroelectric potential on Prince Edward Island is well known to be non-existent (NEB, 2018a and Barrington-Leigh & Ouliaris, 2015).

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