University of Alberta Future Energy Systems

New Brunswick Energy Market Profile

Measuring the Costs and Benefits of Energy Transitions

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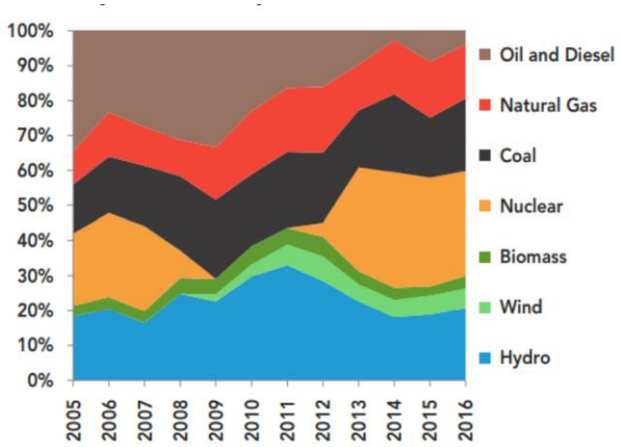
Context

According to the National Energy Board (NEB), in 2018, the Province retains a total electricity capacity of 4,520 MW. The province's electricity capacity by type is as follows:

- Fossil Fuels: 40% of total capacity
- Nuclear: 30% of total capacity
- Hydroelectricity: 21% of total capacity
- Biomass and Wind: 9% of total capacity



Electricity Generation by Source In New Brunswick
Source: NEB, 2017

Average Consumption

In 2015, New Brunswick consumed 16.9 MWh per capita, higher than the national average. Moncton, New Brunswick's largest city, has a residential energy cost of $125 per 1,000 kWh, close to the national average of $129 per 1,000 kWh. New Brunswick is a net exporter, trading electricity with Prince Edward Island, Quebec, and Maine (NEB, 2018).

New Brunswick Demographics

- **Population:** 747,101 (0.5% decrease from 2011)
- **Average Age:** 43.6
- **Working Age (15-64):** 487,820
- **Private Dwellings:** 359,721
- **Private Dwellings Occupied by Usual Residents:** 319,773

Statistics Canada (2016). Census Profile, 2016 Census.

Electricity Market

Since the latest Electricity Act in 2013, provincially-owned electrical utility New Brunswick Power Corporation (NB Power) is responsible for the generation, transmission, and distribution of energy in New Brunswick (Government of New Brunswick, nd). Electricity rates are set by the New Brunswick Energy and Utilities Board (NBEUB) (NBEUB, nd). NB Power owns and operates the transmission system and allows other generators to connect with the grid (NB Power, nd).

Embedded Generation and Net Metering

The Embedded Generation program allows small-scale, locally-owned generators to produce renewable electricity. In 2016, the province had a limit of 20 MW of new renewable energy from embedded generation, of which 7 MW have already been introduced (NB Power, 2017). Rather than be credited for energy provided to the grid, generators are paid a fixed price under the Feed-in Tariff (NB Power, 2017). In 2018, the tariff for embedded generation was 10.642 cents per kWh (NB Power, nda). Embedded Generation allows systems with capacity ranging from 100 kW to 3 MW to be connected to the grid (NB Power, 2017).

The Net Metering program allows energy consumers to produce renewable energy with a capacity under 100 kW. Residents are credited for excess energy produced and returned to the grid. Both programs are part of the Locally Owned Renewable Energy Projects that are Small Scale (LORESS). 80 MW of community energy projects are expected to be operational by 2020, with an additional 13 MW of Embedded Generation (NB Power, 2017)

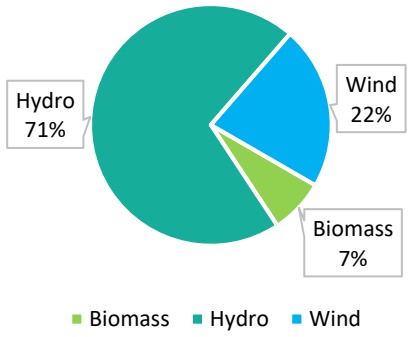
Goals

Under the Renewable Portfolio Standard (RPS), the Province of New Brunswick is attempting to achieve a minimum of 40% of total generation from renewable sources. Additionally, the Province is pursuing demand-side efforts to promote energy conservation and energy efficiency, including through projects like smart grid development (NB Power, 2017). The Province is also attempting to acquire 20 MW of energy through the embedded generation program (NB Power, 2017).

Renewable projects

The majority of New Brunswick's renewable energy is sourced from hydroelectric facilities, mostly from the 668 MW Mactaquac Hydroelectric Generating Station. As of 2018, New Brunswick contains 1,340 MW of renewable energy production. 889 MW of this is owned and operated by NB Power, with the remaining 451 MW being provided by private or municipal firms. The province has indicated they are not looking to develop generation capacity at the time of writing, with the exception of the remaining 13 MW (of the total 20 MW goal) of embedded generation and net metering projects (NB Power, 2016).

Renewable Projects in Operation by Type

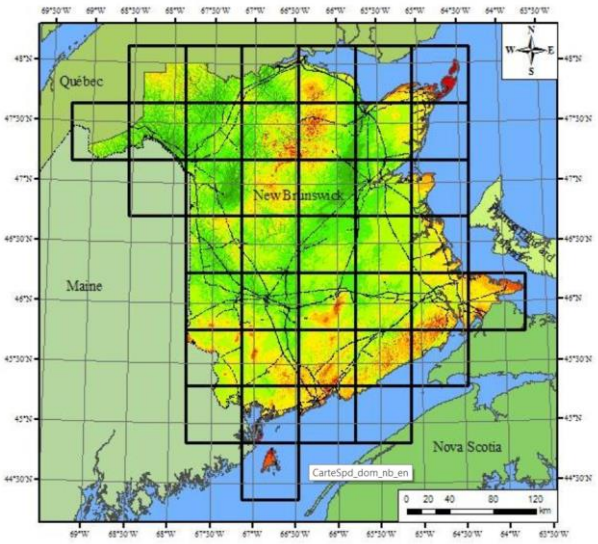


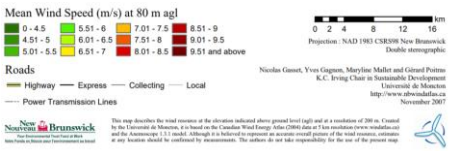
Renewable Potential Summary

Wind

The Pan-Canadian Integrated Wind Survey evaluated the potential for additional wind development across Canada. This report identified the wind energy potential for the Maritime Provinces and found that 50% of the demand for electricity could be met using wind energy. Wind energy would also serve as a suitable complement to hydroelectricity, which can provide energy when wind speeds are not slow.

The map adjacent, provided by the Government of New Brunswick, shows mean wind speed at 80 metres. Red to orange areas indicate wind speeds exceeding 7 m/s, which is considered feasible for commercial energy generation. The greatest potential is along the shore of the Atlantic Ocean, and south, along the Bay of Fundy.





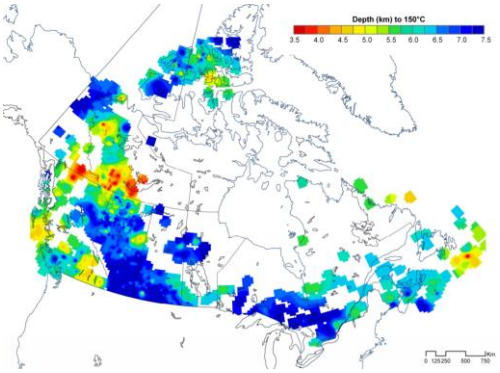
Mean Wind Speed in Canada at 80m Height
Source: http://www2.gnb.ca/content/gnb/en/departments/erd/energy/content/resource_maps/wind.html

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, New Brunswick could generate 10 TWh per year using onshore wind. Of New Brunswick's total 2015 energy demand of 51 TWh per year, onshore wind energy could account for 20% of New Brunswick's total energy generation (Barrington-Leigh & Ouliaris, 2015).

Barrington-Leigh & Ouliaris (2015) also 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). 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 New Brunswick could produce 74 TWh per year, meeting 146% of the total energy demand in New Brunswick of 51 TWh per year (Barrington-Leigh & Ouliaris, 2015).

Geothermal

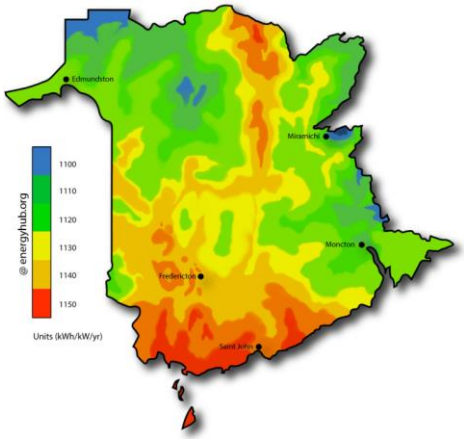
The map to the right shows the depth at which temperatures of 150°C occur, which is considered suitable for electricity generation. It appears there is limited potential for geothermal energy in south central New Brunswick, where temperatures of 150°C occur at 5.5 km. New Brunswick is not considered to have significant potential for geothermal electricity (Grasby et al., 2012).



Depth at which temperatures of 150°C occur
Source: Grasby et al., 2012

Solar

Because of how cloudy New Brunswick is, solar power potential is limited. The southern portions of the province, along the Bay of Fundy, exhibit the highest potential. However, solar power would be highly intermittent depending on cloud cover. New Brunswick encourages solar development with its net metering program but lacks a rebate program (Solar Panel Power, nd). The map adjacent displays the average annual solar panel energy production per kW installed.



Average Annual Solar Panel Energy Production per kW installed
Source: https://solarpanelpower.ca/solar-power-maps-canada/

Hydroelectric

Barrington-Leigh & Ouliaris (2015) used the technical potential for hydroelectric sources and assumed a 60% capacity to generation factor and 60% of feasible sites would be developed, to determine a realistic hydroelectric potential. In New Brunswick, this value totalled 5 TWh per year, which accounts for 10% of New Brunswick's total 51 TWh per year demand (Barrington-Leigh & Ouliaris, 2015).

Tidal

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 New Brunswick can be realistically captured. Under this parameter, New Brunswick could generate 0.44 TWh per year, or 0.96% of the total energy demand of 51 TWh per year.

Wave

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 New Brunswick, 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 coastline and assuming a 10% efficiency of conversion between theoretical potential and electricity generated, it was determined that New Brunswick could generate 5 TWh per year, or 6% of the total demand of 51 TWh per year (Barrington-Leigh & Ouliaris, 2015).

Bioenergy

Barrington-Leigh & Ouliaris (2015) provided the existing utilization of bioenergy in New Brunswick as a realistic expectation for what the potential energy for biomass would be. This value was provided as 4 TWh per year, or 7.9% of the total 51 TWh per year (Barrington-Leigh & Ouliaris, 2015).

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