University of Alberta Future Energy Systems

Nunavut Energy Market Profile

Measuring the Costs and Benefits of Energy Transitions

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Context

As of 2016, Nunavut had less than 1 MW of renewable capacity and generated <0.1 GWh of renewable electricity. The territory is dependant almost entirely on diesel generators for both electricity and heat (NEB, 2018a). Qulliq Energy Corporation (QEC), the publicly-owned territorial utility provider responsible for generation, transmission and distribution, is hoping to change this by investing in research and development of solar, wind and biomass generation, with pilot projects dating back to the early 1990s (NEB, 2018b).

Demographics

2016 Census Profile

- **Population:** 35,944 (12.7% increase since 2011)
- **Average age:** 27.7
- **Working age distribution:** 22,895
- **Private dwellings:** 11,433
- **Private dwellings occupied by usual residents:** 9,819

Statistics Canada (2016). Census profile.

Consumption & Trade

As of 2015, the per capita electricity consumption in Nunavut was 5.1 MWh, which is the lowest in Canada, 65% less than the national average. Nunavut also has the highest electricity rates in Canada, accounting for the high cost of fuel transportation, at $319 per 1,000 kWh (NEB, 2018c).

Because there are no regional or territorial grids in the territory, there is no trade within Nunavut nor with other provinces and territories. No transmission lines connect the territory with adjacent provinces or territories, although a power line to Manitoba has been proposed (NEB, 2018c)

Energy Generation Regulations

Nunavut launched a Net Metering policy in 2018 which allows residential and up to one municipal corporation customer to subscribe in each community, to a maximum generation of 10 kW per customer, in return for credit on their account (QEC, nda). Credit is applied annually, there is no fee to apply, and meters are provided by the QEC, however no subsidy or incentive program is administered and subscribers are responsible for all installation, operation and maintenance costs (QEC, nda). The program is territory-wide, however approval is limited to community capacity and the program will suspend if these targets/limits are met (QEC, nd). Given the high cost of energy in Nunavut, there is a potentially strong financial incentive for adoption.

An Independent Power Production program was included in *Ikuumatiit*, the Nunavut Government's 2007 energy plan, but by March 31, 2017 the QEC had not yet developed this program and it continues to be deferred (Nunavut Government, 2007; QEC, ndb).

Policy, Legislation, & Targets

In accordance with the *Qulliq Energy Corporation Act* (2010), the Qulliq Energy Corporation is responsible for the generation, transmission, and distribution of energy in Nunavut. This crown corporation, wholly owned by the territory, is the only body that can engage in the retail supply of power. The company, and government, have established guiding principles based on Inuit societal values. The QEC is responsible for providing energy to 15,000 electrical customers, using entirely 25 diesel power plants. Energy rates are regulated through the *Qulliq Energy Corporation Act*. (QEC, 2016).

Future goals for the QEC are outlined in their 2017 annual report. Goals that refer to renewables include: working with Indigenous and Northern Affairs Canada, Natural Resources Canada, and Government of Nunavut's Climate Change Secretariat to encourage renewable energy development. (QEC, 2016). No quantifiable renewable goals have been specified, although a solar pilot project has been launched in Iqaluit.

Renewable Projects Overview & Dataset

No major renewable projects are currently in development on Nunavut, although a study on potential wind sites has identified at least five possible communities including Arviat, Baker Lake, Iqaluit, Rankin Inlet and Sanikiluaq, and solar is currently being tested on a QEC building in Iqaluit (QEC, ndc).

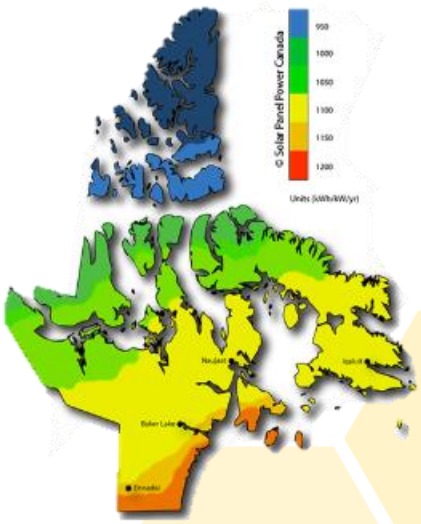
No dataset has been compiled for Nunavut as they have no projects listed in our primary reference source, the Government of Canada - Renewable Energy Powerplants, 1MW or more, nor are any commercial or community projects identified at 1 MW or more from the QEC or Government of Nunavut.

Potential Energy Summary

Nunavut is Canada's largest landmass with a varied geography that includes mountains, islands, fjords, plateaus, and a lot of ice, with seasonal freshwater lakes (World Atlas, 2018). This coastal environment suggests high renewable potential, but temperature and transmission issues pose a limitation.

Solar

Nunavut received a grade C for raw solar potential, with a 5 kW system able to produce an average 5,579 kWh annually with the high latitude being the main limitation on generation (EnergyHub.org, 2018). Energy is expensive in Nunavut and a net metering program has just been launched in 2018, so this potential may soon be captured at a higher rate.



Average Annual Solar Energy Generation Per kW Installed
Source: https://solarpanelpower.ca/solar-power-maps-canada/

Wind

Based on modeling in the 2016 Potential for Wind Energy in Nunavut Communities survey, the combined potential of the 25 communities surveyed equals ~158 MW, with annual wind speeds ranging from 5.2 to 8.0 m/s at 57 m height (the height of an Enercon turbine) (J.P. Pinard Consulting, 2016). The Canadian Wind Atlas (pictured below) seems to support the potential for feasible wind resources in Nunavut.

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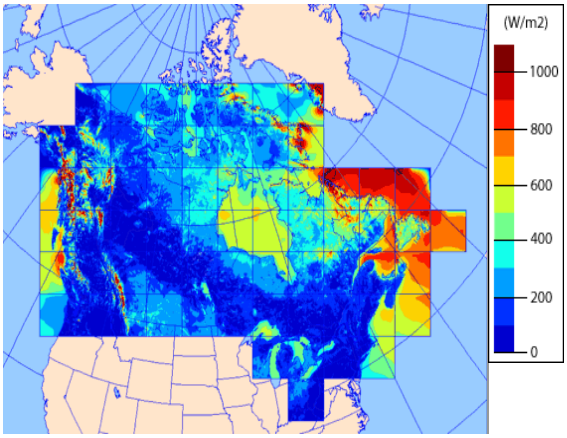

Annual Mean Wind Speeds at 50 m Height
Source: http://www.windatlas.ca/maps-en.php

Hydroelectric

One challenge that run-of-river projects in Nunavut face is the river must be sufficiently deep to not freeze all the way through in winter. Hydroelectric potential has been examined at various locations near Iqaluit and the Kivalliq region. Potential sites in the Kivalliq region are too far from population centres, creating significant transmission costs. The finding of the potentials study finds that the demand is not sufficiently high to justify hydroelectricity development. However, it is noted that mining activities that require power may make these projects economically feasible (Nunavut Climate Change Centre, nd).

Ocean

Energy from the ocean can be generated using tidal changes, waves, and thermal and saline gradients. The potential for tidal energy is high in Nunavut, but many feasible sites are in remote areas, bring additional distribution costs. Frobisher Bay, on Baffin Island, has tides amongst the highest in the country. In-stream turbines could provide enough energy for Iqaluit (Nunavut Climate Change Centre, nd). It is estimated that Nunavut has the potential for 30,000 MW of tidal power, without accounting for technical challenges (A Northern Vision, nd).

Biomass

Existing above the tree line, Nunavut has no forest biomass resources and already uses limited waste wood to offset heating (NEB, 2018c). Waste-to-energy and biofuel systems could theoretically be developed, but there is concern these might impact food costs or disrupt existing use streams (Nunavut Climate Change Centre, nd)

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