

Wekweeti Wind Energy Pre-feasibility Analysis Summary

Summary of Wind Study

- Since 2005, the Aurora Research Institute (ARI) has been researching the potential for wind energy project in several communities in the Northwest Territories.
- In 2009, ARI chose the community of Wekweeti for a desktop pre-feasibility study to assess the wind climate and the economics of building a wind project in the community.
- Wekweeti 's electrical load is powered by a diesel-electric plant. The community has an average electrical load of 116 kilowatts (kW) and a reported peak load of 137kW.
- A hill directly northwest of the hamlet was identified as an ideal location for a wind project if one were to be proposed.
- Public wind maps, nearby weather station data, and wind modelling reveal that the wind speeds are around 6 m/s (22 km/h) on the hilltops next to the hamlet.
- An economic study of a wind project in Wekweeti found that wind energy would cost about \$0.60 to \$0.70 per kilowatt hour (kWh) to produce, and that subsidies would be needed to make it competitive with present diesel fuel prices.
- When the cost of diesel climbs to over \$2/litre the cost of electricity from a wind project will become cheaper than diesel-electric generation.
- A two-year wind monitoring program is recommended for Wekweeti.
- A meteorological tower with wind sensors are recommended for installation on top of the hill by the hamlet.

Assessment of Wind Speed

- Two hills near Wekweeti were identified as suitable sites for evaluating wind energy (Figure 1).

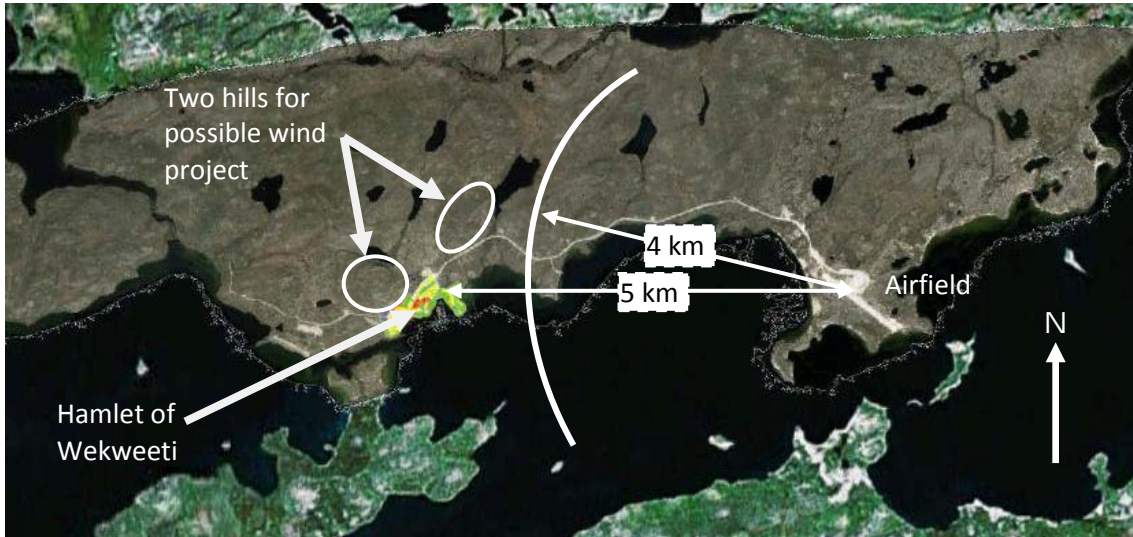


Figure 1: Map of Wekweeti Hamlet with legal boundaries. Note that the airfield is 5km from the Hamlet. Source: Municipal and Community Affairs, Northwest Territories Government.

- The nearest weather station to Wekweeti is Lower Carp Lake, which is 67 km due south. This station measured an annual wind speed of 3.7 m/s (13.3 km/h) at only 10 metres above ground level.
- Three publicly available wind maps were used to determine that the wind speeds at Lower Carp Lake are estimated to be the same in Wekweeti.
- A computer wind flow model was then used to project the wind speed estimate to the hilltops near Wekweeti shown in Figure 2.
- The annual average wind speed on the hilltops by the hamlet was estimated at about 5.8 to 6.1 m/s (21 to 22 km/h). These speeds are considered good for wind energy development.



Figure 2: Aerial image of Wekweeti overlaid with wind speed contours. No contours are shown for the areas with wind speeds below 5m/s and the contour interval is 0.2m/s.

How the Costs of Wind Power are Calculated

- Five different wind turbine models were used to calculate the cost of a wind project for the hamlet.
- The cost of installing a wind turbine includes the following:
 - costs to build a road to the site,
 - costs to build a new powerline to the site,
 - costs to construct the tower foundation(s),
 - shipping costs for the equipment, and many other costs.



Figure 3: Two of the five wind turbines considered in the economic study for Wekweeti. On the left is the Endurance 50 kW and on the right is the NorthWind 100 kW.

How much each Proposed Location will Cost

The table below shows costs and production subsidies that would be required to build a wind farm at each of the two preferred sites. This table uses the Endurance 50 kW turbine, as it is the least expensive of the five models investigated in the study.

Table 1: A summary of suitable wind energy development options for Wekweeti while using an Endurance 50 kW turbine, including wind speeds, project costs, energy production and costs. Also listed are the subsidies required to produce wind energy at a rate competitive to current diesel prices.

Site	Wind Speed (m/s)	Total Project Cost	Energy Produced in kWh/year	Energy Cost per kWh	Subsidy Required per kWh
Site #1	5.9	\$831,500	151,000	\$0.62	\$0.35
Site #2	6.1	\$963,500	158,000	\$0.67	\$0.40

- Site #1 is less expensive to build at because it is closer to the hamlet and power line.
- At Site #1 a 50 kW wind turbine will produce 151,000kWh of electricity and displace 44,000 litres of diesel per year.

- A wind project at this site would cost \$831,500 and require \$558,200 in capital subsidies in order for it to happen in a cost-effective manner.
- A utility company would purchase wind energy at the cost of displaced diesel. The current cost of displaced diesel in Wekweeti is \$0.27/KWh, based on diesel purchased in 2009 at \$0.94 per litre.
- A wind farm must then be able to produce power at a cost that is lower than the avoided cost of diesel to make a profit.
- In 2008, the cost of diesel reached \$1.70/litre. When the cost of diesel climbs to over \$2.00/litre, a wind energy project in Wekweeti will become competitive with diesel-generated electricity (\$0.58/kWh does not include operation and maintenance costs). The wind project will require very little subsidies at this new price for diesel.

Conclusions

- A meteorological tower with wind monitoring should be installed on the hilltop behind the community to obtain accurate measurements of the community's wind resources.
- Of the locations studied site #1 has the best economy for the installation of a wind turbine with its moderate winds, close proximity to the power line, and easy access.
- Costs would be reduced if this project were carried out simultaneously with other wind projects in the Beaufort region, such as those being proposed in Ulukhaktok, Tuktoyaktuk, and Sachs Harbour.
- By installing a wind turbine near the hamlet, Wekweeti would become one of the few Arctic communities to use sustainable energy. A 50kW turbine would save the community at least 44,000 litres of fuel and reduce its greenhouse gas emissions by over 450,000 kg every year.

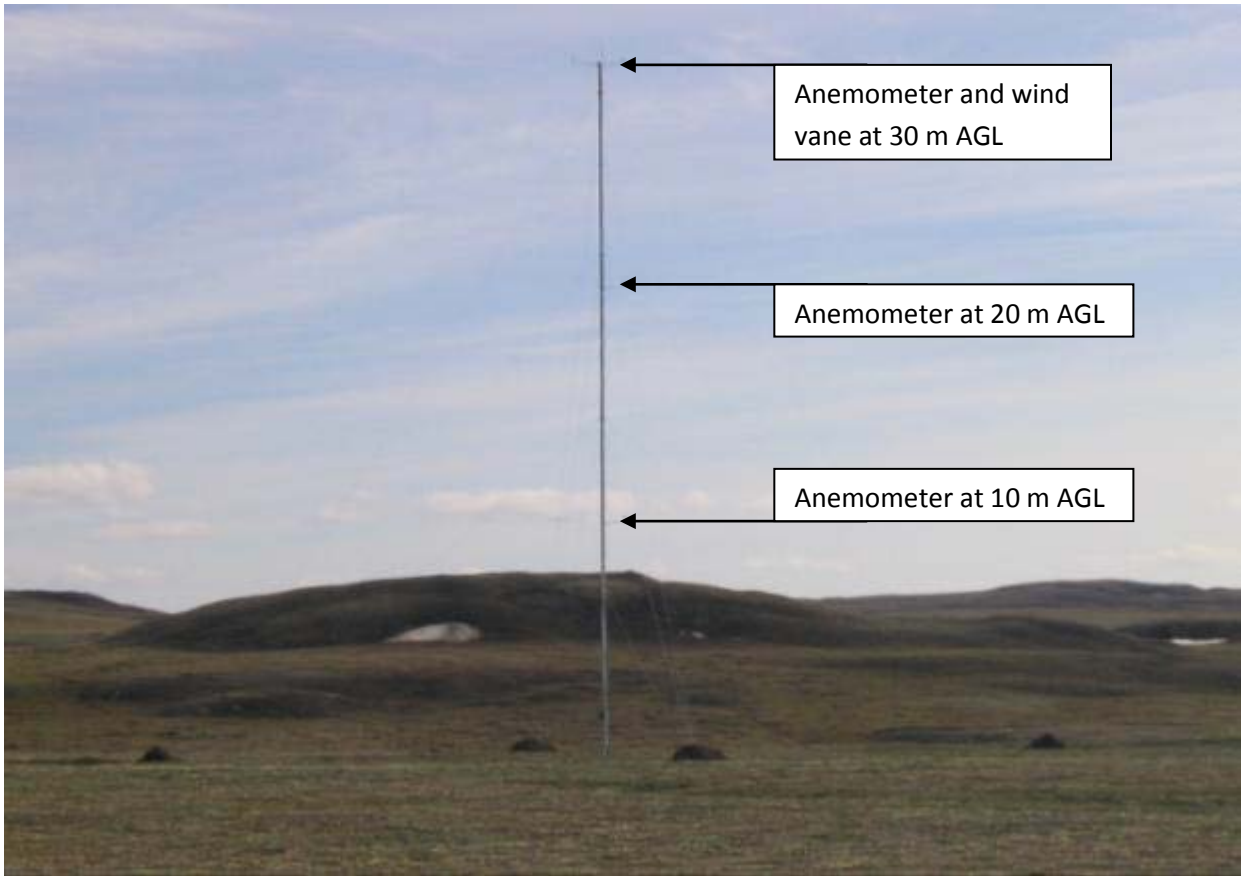


Figure 4: The wind monitoring station proposed for Wekweeti will look like this tower that was used in Paulatuk. It has three wind speed sensors (anemometers) at 10, 20, and 30 m above the ground level (marked as AGL on image) to measure wind speeds.

The full report is at:

<http://www.nwtresearch.com/resources/publications/wind.aspx>

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