AURORA RESEARCH INSTITUTE
AURORA COLLEGE

Sachs Harbour Wind Energy Study

Overview of Wind Study

- In 2005 the Aurora Research Institute established two wind monitoring stations in Sachs Harbour. One station was about 6 km west of the community and the other was at the site of the old wind turbine (Figure 1).
- The wind monitoring station located to the west of the community measured winds from 10 to 30 metres above the ground using wind speed measuring sensors called anemometers (Figure 2 and 3).
- The station at the old wind turbine site had heated wind sensors attached to a hut (Figure 4).
- These stations were monitored with the help of Bob Eldridge and Terence Lennie who collected wind speed data every month since 2005.
- After several years of measurements the wind data collected at the sites were analysed with a computer wind model to estimate the long term wind speed for several sites in the area around Sachs Harbour.
- An economic analysis was also made to determine the cost of developing a wind project for several sites in the area of Sachs Harbour.

Figure 1: Satellite image showing locations of the wind monitoring (WM) stations relative to the Hamlet. Image is from Google Earth.

Figure 2: An anemometer is a piece of scientific equipment that measures wind speed. These are placed on the wind monitoring tower shown in Figure 3.

Wind Monitoring Results

- The wind data analysis estimates that the station that is 6 km west of Sachs Harbour has a long-term annual average wind speed of 5.6 meters per second (m/s; or 20 km/h) at a height of 37 metres above ground level (AGL).
- The estimated long-term wind speed at the old turbine site is 6.6 m/s (24 km/h) at a height of 37 metres AGL.
- The dominant wind directions in the area are from the north and southeast.
- There is strong evidence that there is icing on the monitoring equipment in the wintertime.
- The measurements reveal that there is an excellent wind resource in the area. The winds may be strong enough year-round to consider a wind development as a source of energy for the community.

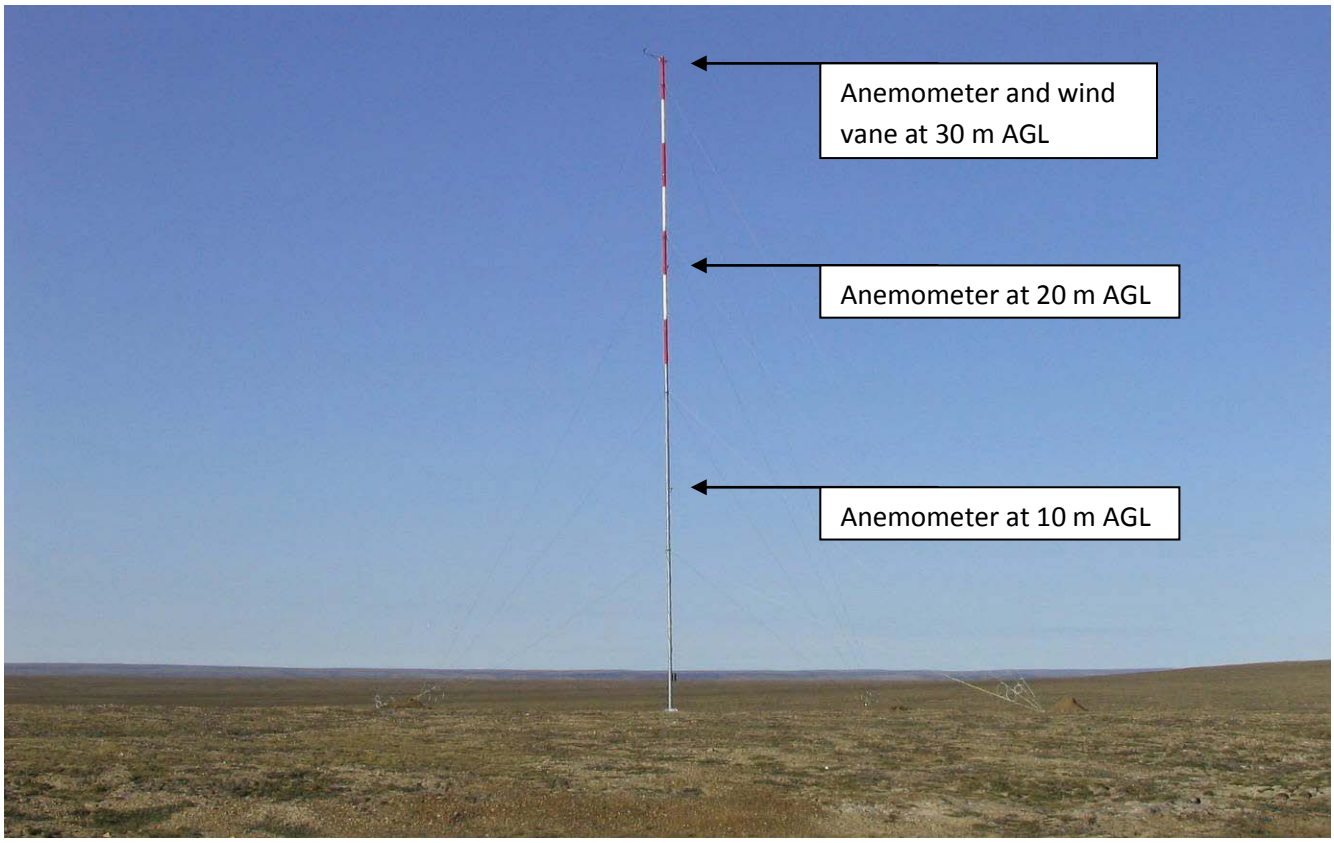

Figure 3: The wind monitoring tower installed west of Sachs Harbour. It has three anemometers at 10, 20, and 30 metres above ground level (marked as AGL in image) to measure wind speeds.

Figure 4: Site of the old wind turbine. The turbine foundation is to the left. The wind monitoring station here has heated wind sensors mounted on a post attached to the green hut on the right side of the photo.

Sites that could be Considered for a Wind Development

- To determine the wind speeds at several other locations in the area a computer wind flow model was used.
- The image below shows three sites that could be considered for a wind development.
    - At the old wind turbine site the long-term average wind speed is estimated to be 6.6 m/s (at 37 metres AGL).
    - Site #1 is by a gravel quarry northeast of the hamlet. The average wind speed here is estimated at 6.5 m/s (at 37 metres AGL).
    - Site #2 is located at another gravel quarry but closer to the hamlet. The estimated average wind speed here is 6.6 m/s (at 37 metres AGL).

Figure 5: Area north of the hamlet shows the locations where the wind parks are being proposed. The wind speeds shown are the estimated long-term average wind speed at 37 metres above ground level. The three proposed sites are between 75 and 80 metres above sea level, on the edge of the high plain above the hamlet. Image is from Google Earth.

How the Costs of Wind Power is Calculated

- The tallest tower available for a small scale wind development suitable for this community is 37 meters tall designed for the EW50 wind turbine made by Entegrity (see Figure 6)
- When calculating the cost of installing a wind turbine you need to consider the following costs:
    - costs to upgrade the road to the site,
    - costs to build a new powerline to the site,
    - costs to construct tower foundation,
    - shipping costs for the equipment and many other costs.

Figure 6: A EW50 wind turbine installed at Nome Alaska. This model is recommended for Sachs Harbour

- We estimate that the cost to borrow money is at 8% interest rate (repaid over 20 years) and the annual operating cost is $15,000 per turbine.

What the Utility will Pay for the Wind Power

- A utility company will purchase wind energy at the cost of displaced diesel. The current cost of displaced diesel in Sachs Harbour is $0.47/KWh when diesel is purchased at $1.50 per litre.
- A wind development must then be able to produce power at a cost that is lower than the avoided cost of diesel to make a profit, or it will require subsidies to compensate for the extra costs.

How much each Proposed Location will Cost

The table below shows all of the costs and subsidies that will be required to build a wind project at each site. A tower of 37-metre height is used for all sites except at the old wind turbine site where a 25-metre tower on the existing foundation was considered.

Site	Wind Speed (m/s)	Total Project Cost	Per kWh Energy Cost	Subsidy Required	Subsidy Paid if per kWh
Old Turbine Site (25m AGL)	6.2	$382,000	$0.46	Nil	Nil
Old Turbine Site (37m AGL)	6.6	$464,500	$0.46	Nil	Nil
Site #1	6.5	$786,500	$0.73	$315,000	$0.26
Site #2	6.6	$704,500	$0.65	$233,000	$0.18

- The old wind turbine site is the least expensive to build and will require no subsidies.
- If the original foundation is used with a 25 metre tall tower, the costs are less but the wind energy production will not be as much as for a 37 metre tower.
- Site #1 is the least attractive because it is farthest away from power lines.

Conclusions

- Of the locations studied the site of the old wind turbine had the best economy with its excellent winds, close proximity to power line, and easy access.
- A wind project at this site will cost $382,000 or $464,500 and require no capital subsidies.
- If the old turbine site is not selected, then subsidies will be required to build extra powerlines.

- Costs will be reduced if this project is carried out simultaneously with other wind projects in the Beaufort Sea, such as those being proposed in Tuktoyaktuk, Paulatuk, and Ulukhaktok.
- Results of a wind monitoring program reveals that Sachs Harbour could save 41,000 litres of fuel annually from installing a wind turbine near the hamlet, making Sachs Harbour one of the few Arctic communities to use sustainable energy.

The full report is at:

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

191 Mackenzie Road
P.O. Box 1450
Inuvik, NT CANADA
X0E 0T0
Phone: (867) 777-3298
Fax: (867) 777-4264

Printed March 2009