SUBJECT: WIND RESOURCE IN BREVIG MISSION AND TELLER, ALASKA
To: Brent Petrie, AVEC; Doug Vaught, Vaught Consulting
CC: Reuben Loewen and Peter Crimp, AEA; Ian Baring-Gould, NREL
From: Mia Devine, NREL (not an official NREL report)
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AVEC is interested in utilizing wind energy in the Alaskan villages of Brevig Mission and Teller. This report serves as a summary of email correspondence, personal conversations, and publicly available data regarding the potential use of wind energy in the Brevig Mission/Teller region. As requested, a calculation of estimated energy production from the NW100, V-27, and FL250 wind turbines, given the wind regime in Teller, is provided.

Measured wind speed data for Brevig Mission is currently not available; however, according to consultant John Wade, Brevig Mission is not a good site for wind turbines because of turbulence caused by nearby mountains. Teller, located 5 miles across the bay from Brevig Mission, is a much better site for wind turbines, particularly on the Teller spit [1]. AVEC is considering a grid intertie between the villages, so wind turbines installed in Teller could potentially serve the combined load of the two villages.

An FAA met tower is located at the Teller airport, and hourly wind speed and direction data is available from May 21, 2002 – May 1, 2004 [2]. As shown in Figure 1, the airport is located 2 miles south of Teller and further inland than the spit. Therefore, it is reasonable to assume that the FAA tower will provide a conservative estimate of the wind resource at the prospective wind turbine site [1].

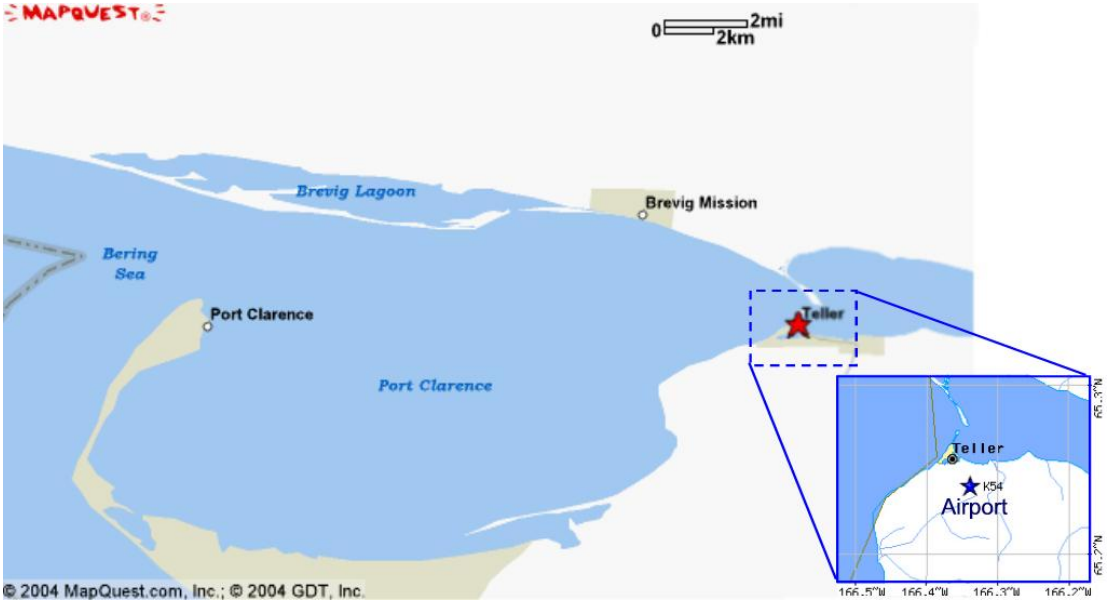

Figure 1. Location of the village of Teller and the Teller Airport

The draft Wind Resource Map of Alaska indicates that Brevig Mission has a Class 5 wind regime, Teller is Class 4, and Port Clarence is Class 6.

The FAA meteorological station is shown in Figure 2. It is a 10-meter guyed lattice tower with two propeller-type anemometers mounted on booms. The University of Alaska Fairbanks is responsible for collecting the data [2].

Figure 2. View NE from the Teller Airport [2]

The redundant sensors often recorded different wind speeds (up to 4 m/s), with sensor 2 consistently reporting higher values than sensor 2. A comparison of the wind direction with the times of greatest discrepancy indicated that sensor 1 might be in the wake of sensor 2 when the wind comes from the southeast quadrant; however, the directional layout of the sensors is unknown so this cannot be verified. The wind frequency rose is shown in Figure 3.

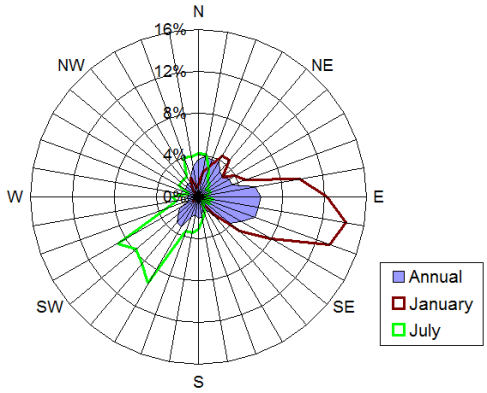

Figure 3. Wind Frequency Rose for Teller Airport Station

For this analysis, if different wind speeds were reported, the greater of the two values was used, based on the assumption that one sensor is in the shadow of the other during these times. The resulting data set is shown in Figure 4 and is also available in an Excel spreadsheet as an attachment to this report.

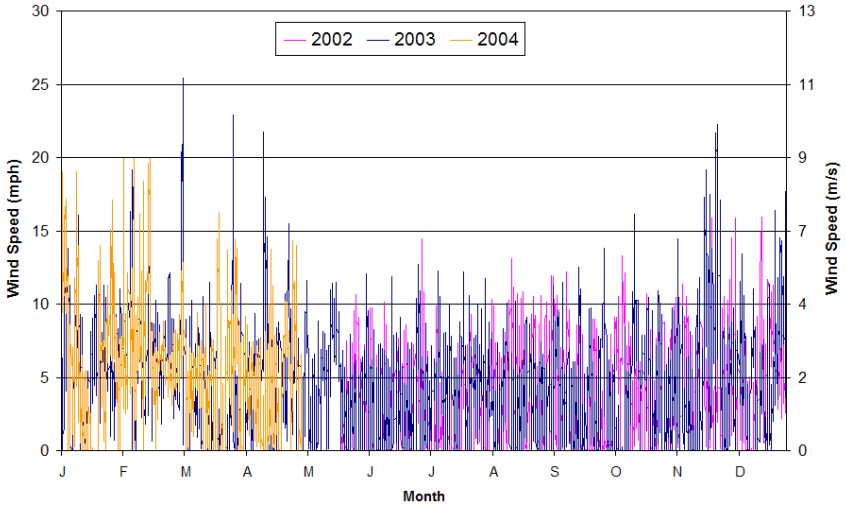

Figure 4. Hourly Average Wind Speeds Measured at Teller Airport (10-meter height)

Since the entire year of 2003 data is available, it is used in this analysis. Long-term data for this site is not available, so it is unknown whether or not 2003 was a typical year; however, the partial years of 2002 and 2004 do not vary significantly from the 2003 data in terms of monthly averages. The closest weather monitoring station with long-term wind speed data is located about 5 miles across the bay at Port Clarence, where monthly average wind speeds from 1973 to 2002 are reported. The data indicate that the long-term wind speeds in Port Clarence are greater than what was recorded in Teller; however, concurrent data between the two sites is not available, so a direct relationship cannot be confirmed. Year 2003 data from the Port Clarence station have been requested but have not yet been received and it is unclear whether or not the station is still in operation [3]. Therefore, for this analysis, it is assumed that the year 2003 data recorded at the Teller airport represents a typical year.

Table 1. Average Annual Wind Speeds

Location	Port Clarence	Teller
Long-term average	14.9 mph	-
Year 2003	-	10.9 mph

In order to calculate the wind speed at the various wind turbine hub heights, the standard logarithmic wind profile is used, which is based on the assumption that the Teller landscape resembles a rough pasture with a surface roughness length of 0.010 meters. The resulting annual average wind speed is 12.6 mph at a height of 30 meters and 13.2 mph at 42 meters.

The hourly wind speed values in Teller are compared to the power curve of each wind turbine model, and the resulting annual power production is calculated. Results are shown in Table 2.

Table 2. Estimated Energy Production From Wind Turbines in Teller, AK

Turbine Model	Northern Power NW100	Vestas V-27	Fuhrlander FL250
Rated Capacity	100 kW	225 kW	250 kW
Hub Height	30 meters	30 meters	42 meters
Average Output	25 kW	55 kW	65 kW
Energy Production	222,000 kWh/yr	477,600 kWh/yr	570,200 kWh/yr
Capacity Factor	25%	24%	22%

Based on a year of measured wind speed data at the Teller airport, the annual average wind speed is about 11 mph at a 10-meter height. With this wind resource, wind turbines in Teller would operate with capacity factors up to 25%. The wind resource map and measured data from nearby stations indicate higher wind speeds around Teller, and it is believed that the Teller spit would provide a better location for wind turbines.

Attachment:

Teller-FAA-windspeeds.xls

References:

[1] Personal conversation between Doug Vaught and John Wade.

[2] Water & Environmental Research Center. "Alaska Airport Wind Studies." University of Alaska Fairbanks. URL: < http://www.uaf.edu/water/projects/dot&pf/airport/teller/current.html> Accessed Dec 2004.

[3] Email correspondence between Mia Devine and Ray George (NREL) and between Mia Devine and the Alaska Climatic Data Center.