

WCA Wind Research Project Report

Steven Selvaggio

Hasz Consulting Company

Whitestone Community Association

Presented to: Alaska Energy Authority

September 2005

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Acknowledgements

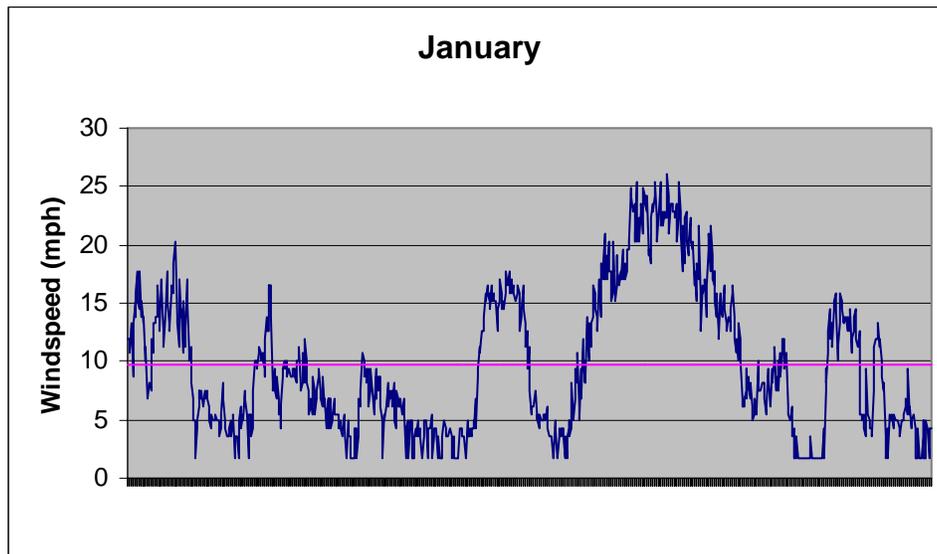
Special thanks in the writing of this report to Mia Devine and to Reuben Lowen and David Lockard for their assistance in all aspects of this project.

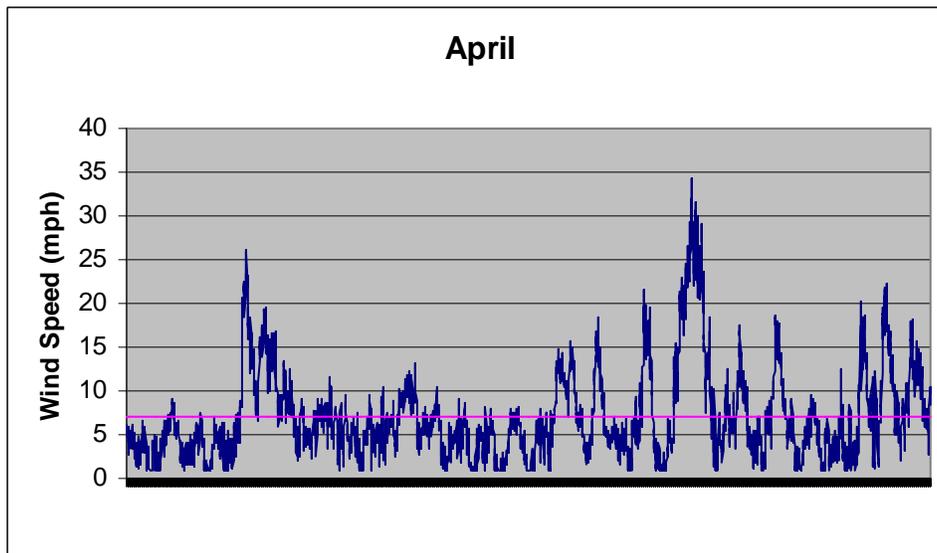
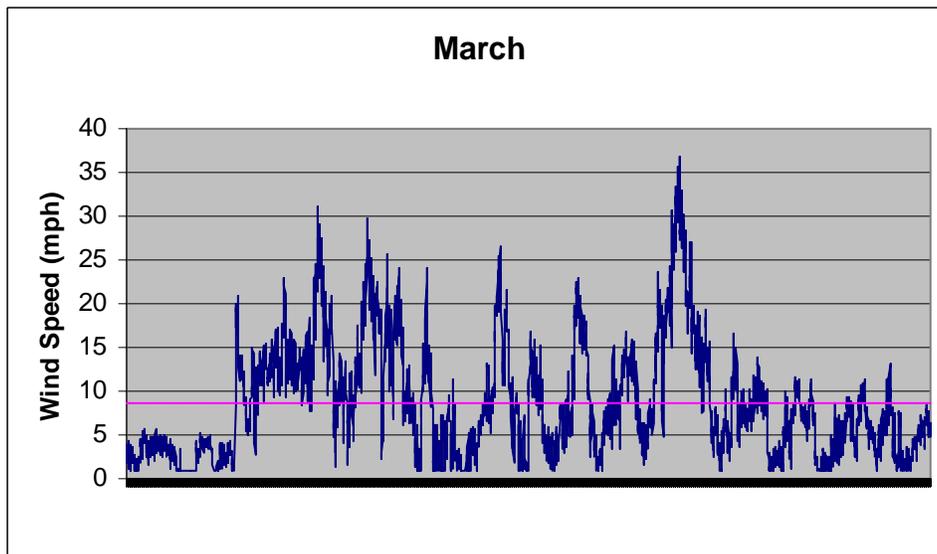
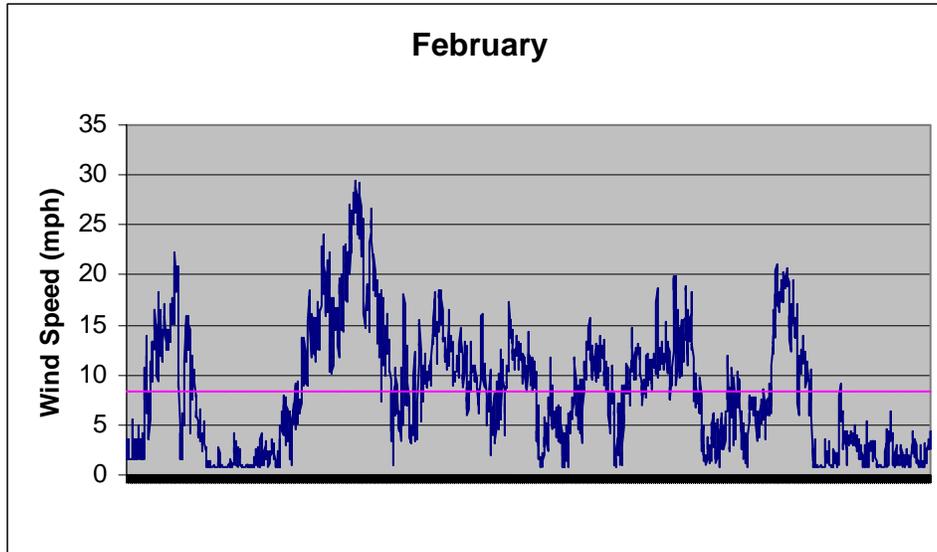
I. Project Overview

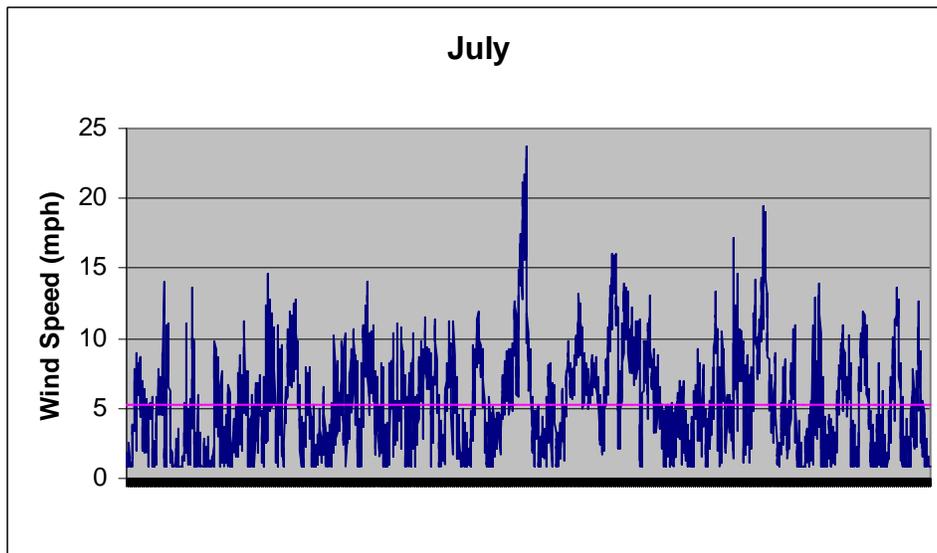
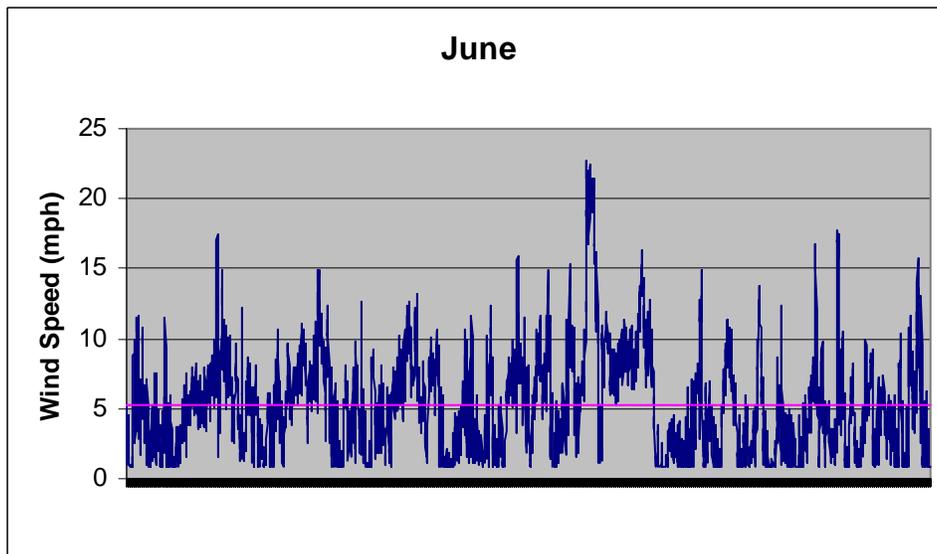
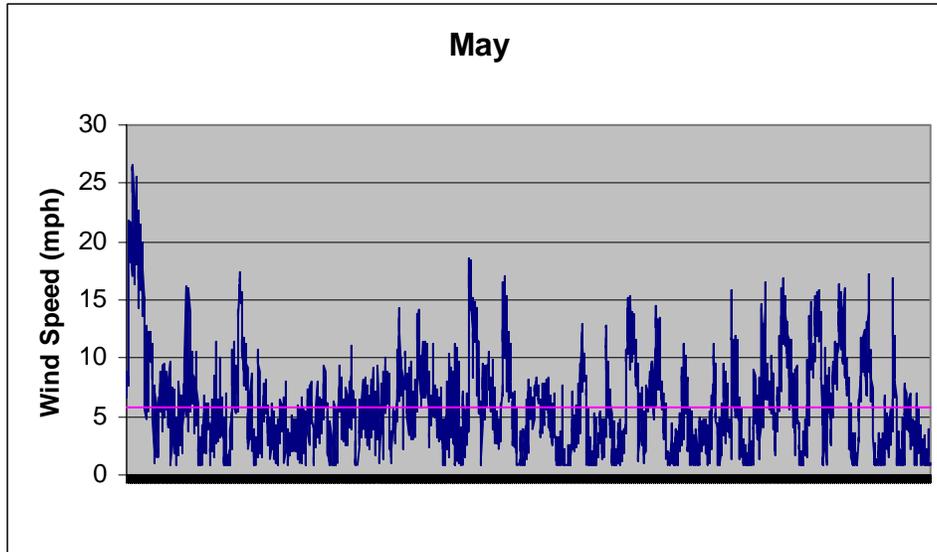
In the fall of 2004 Whitestone Community Association in partnership with Alaska Energy Authority (AEA) installed a 100-foot meteorological tower equipped with two anemometers, temperature sensor and recording device. The tower was installed on an island in the Tanana River just below the junction between the Tanana and Delta rivers. This report gives the results of one calendar year of data-taking at this site from September 1, 2004 through August 31, 2005. It also gives power projections as well as a cursory installation and maintenance feasibility report.

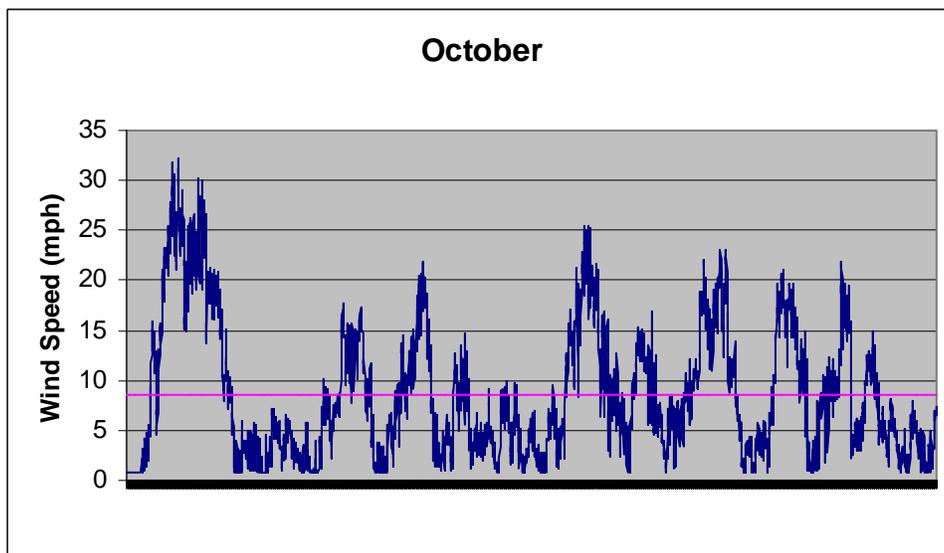
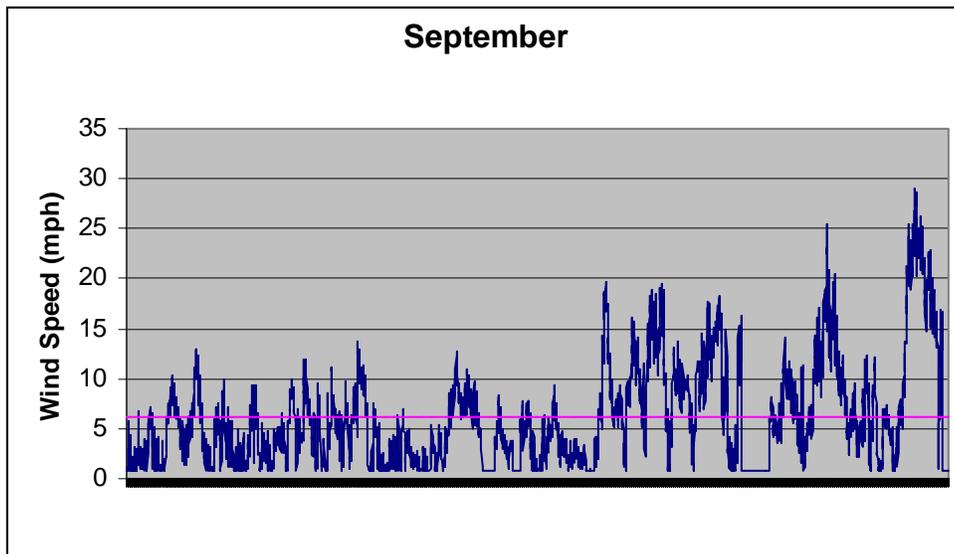
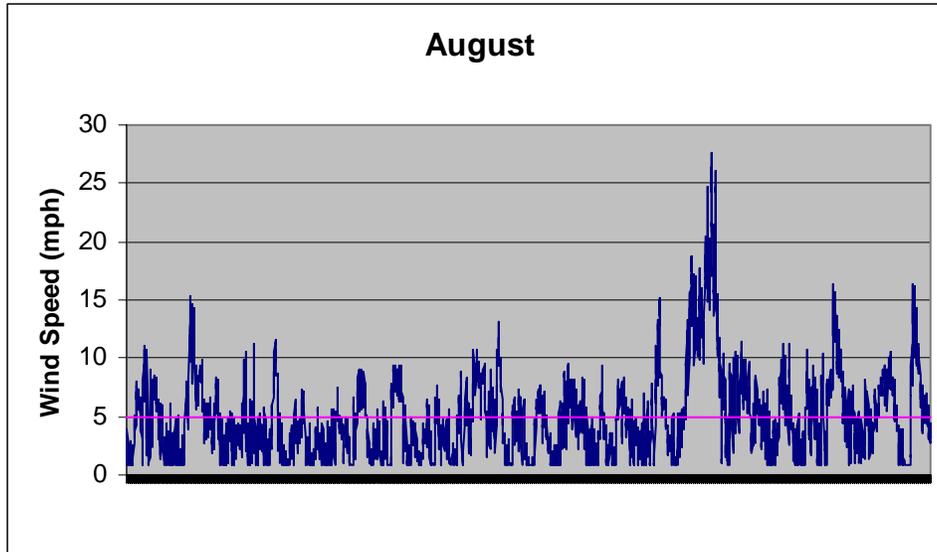
II. Results

The most important finding of this project is, of course, wind velocity levels. Following are charts showing wind speed levels for each month in 10-minute increments and with a straight line showing the average for that month.

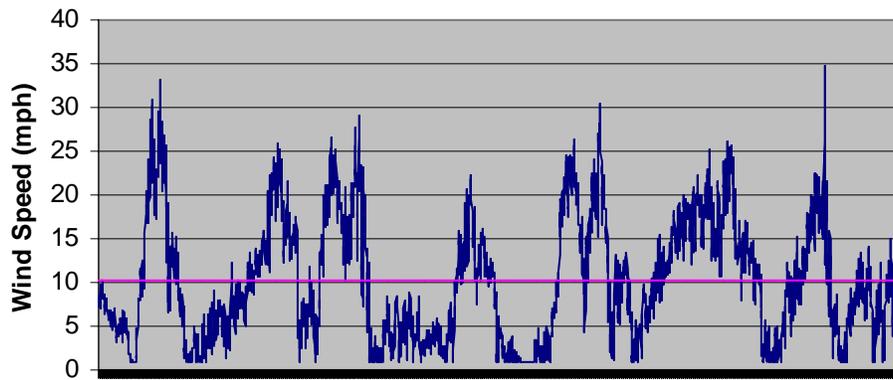




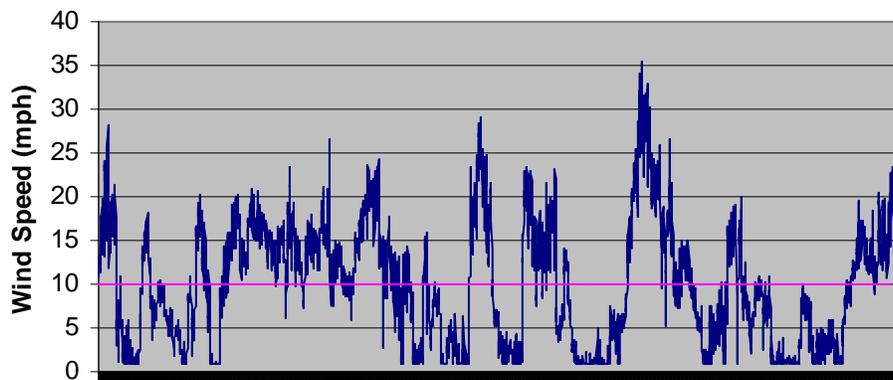




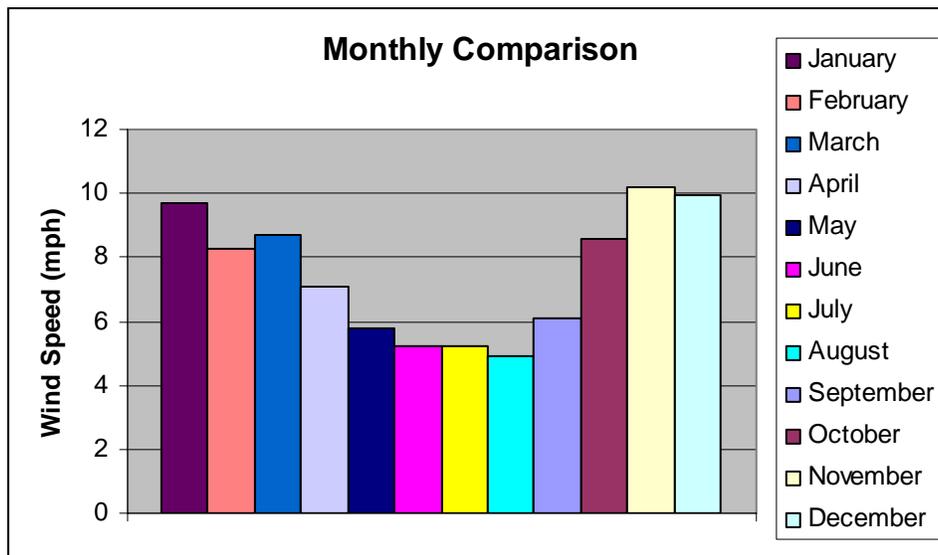
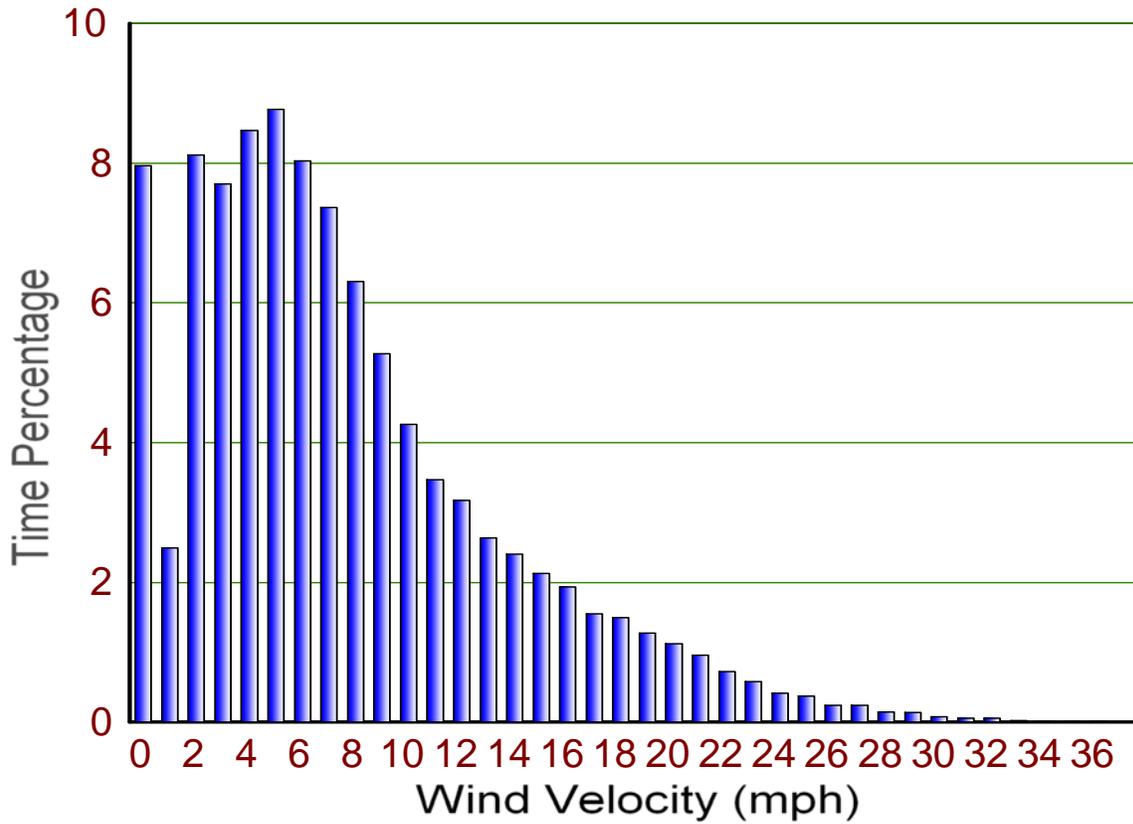
November



December



Wind Velocity Distribution

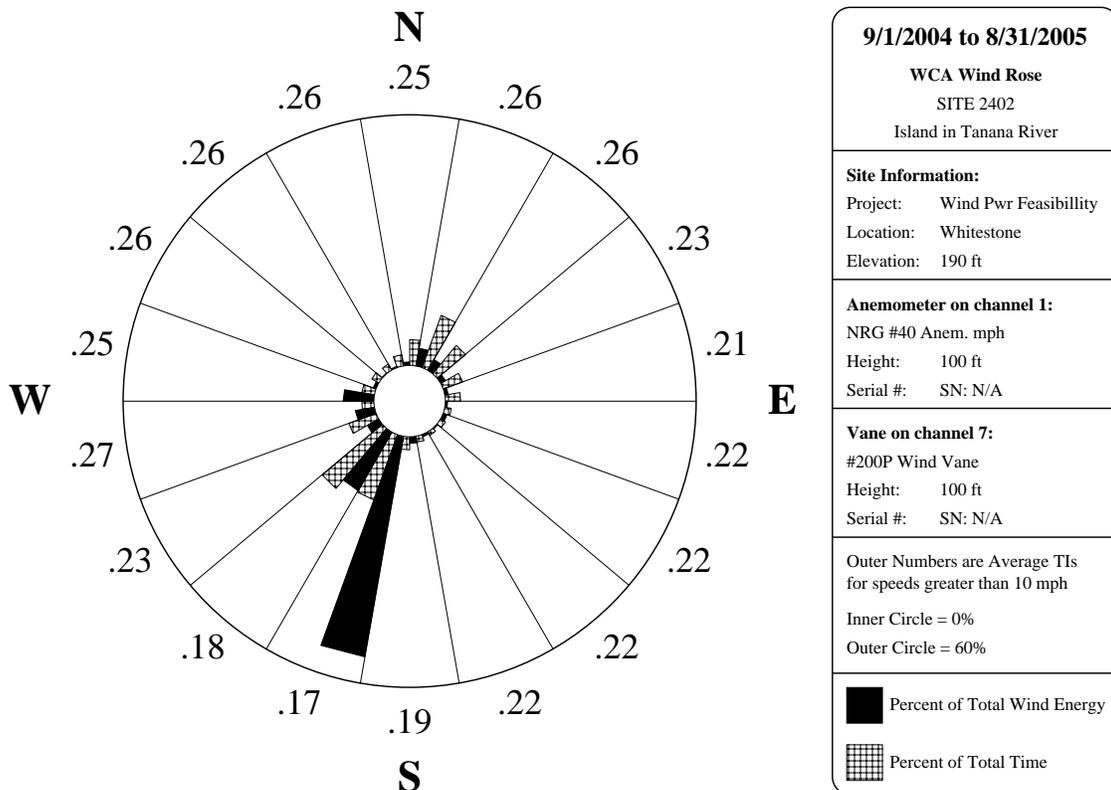


Very clearly there are not a lot of high winds in this area which is a positive thing for the longevity of a tower. However, this is definitely a low wind velocity site that would require either a tower taller than 30 meters or a low velocity turbine. One advantage of this area is that the preponderance of the energy is available during the winter, which is when the demand for electricity is at its highest.

All the data was taken directly from the test tower at the island site except for January 2005 and the first 10 days of February of that same year. During these months temperatures were lower than 40 degrees below zero, Fahrenheit. At temperatures below -40 degrees the logger unit shuts down. As a result any data we gathered from January 1, 2005 until February 10, 2004 was lost. For these months data was taken from the Allen Army Weather Station (AAWS) located at Ft. Greely, Delta Junction about 20 miles away. The NOAA identification number for this site is 26415.

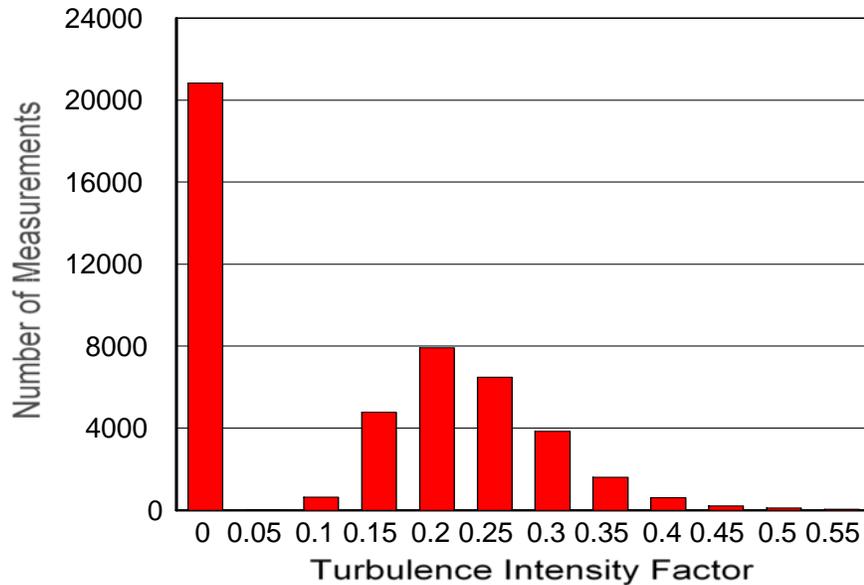
The data was taken from the AAWS for a total of six months. Correlation factors were calculated for each of the months when data was available for both sites. The average of these factors was taken and the data for the missing 41 days was calculated.

The following chart is a wind rose showing primary directions. As can be clearly seen from it the overwhelming majority of the wind here in the Whitestone area is from the south.

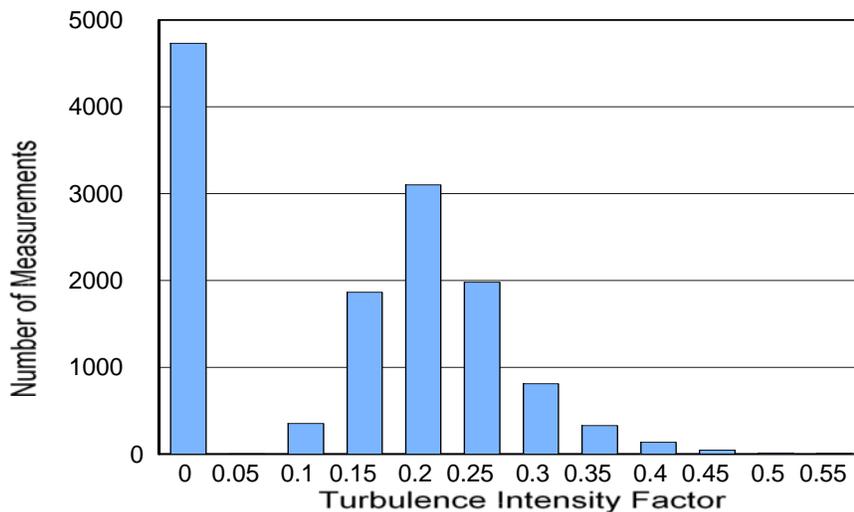


Another issue to be considered in terms of stress on any installation and the overall efficiency of a turbine is the Turbulence Intensity (TI). Not only does this phenomenon increase working stress on the tower, it also limits the efficiency of the turbine itself.

TI Distribution



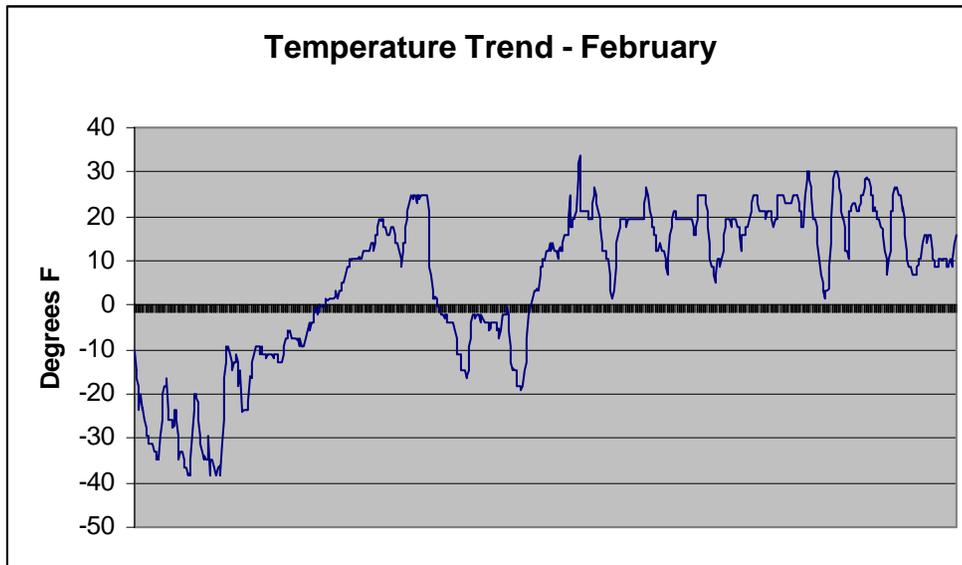
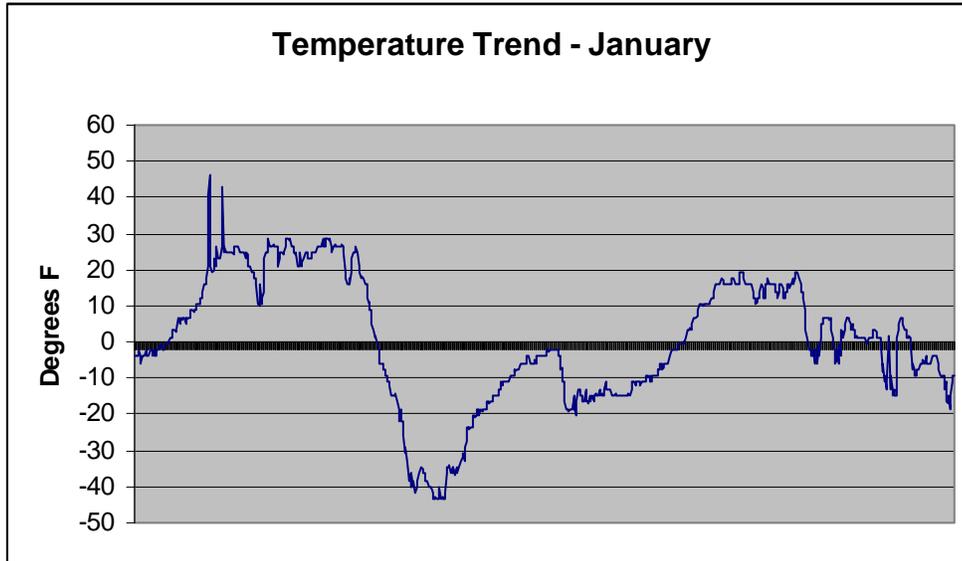
TI for Prevailing Direction



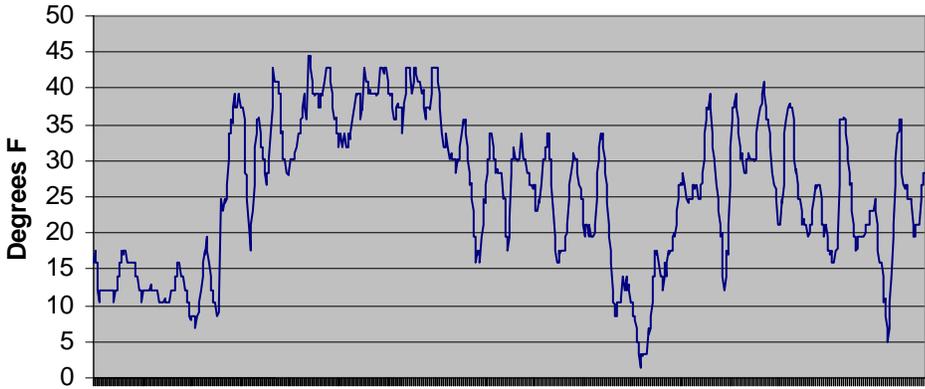
Here I have included a distribution for all the data collected and a separate one for the prevailing direction of the wind. In general a TI factor of more than 0.10 is considered to be too turbulent either for efficient output of power or for longevity of the tower. While

there is some of this, for the most part the turbulence is acceptably low (between 0.00 and 0.05).

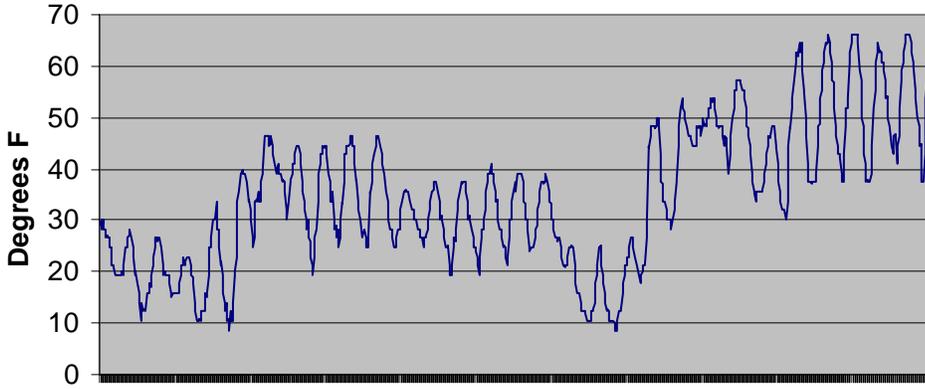
Finally, in the interest of completeness charts showing monthly temperature trends have been included. Also included is a histogram showing temperature distributions for the entire year.



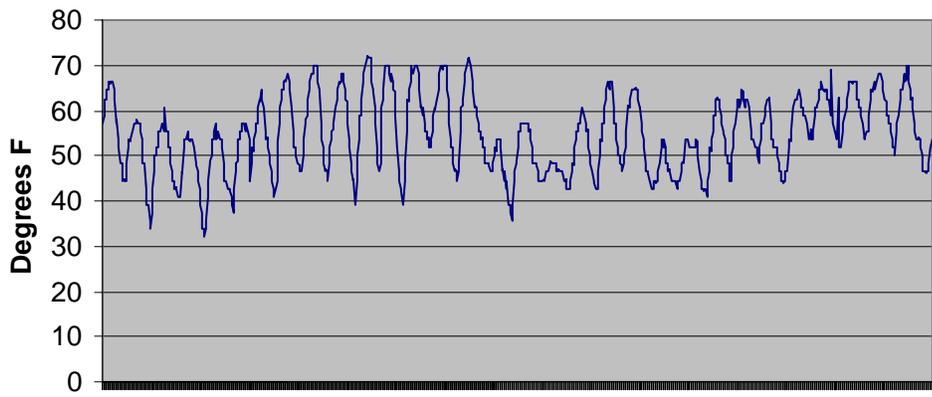
Temperature Trend - March



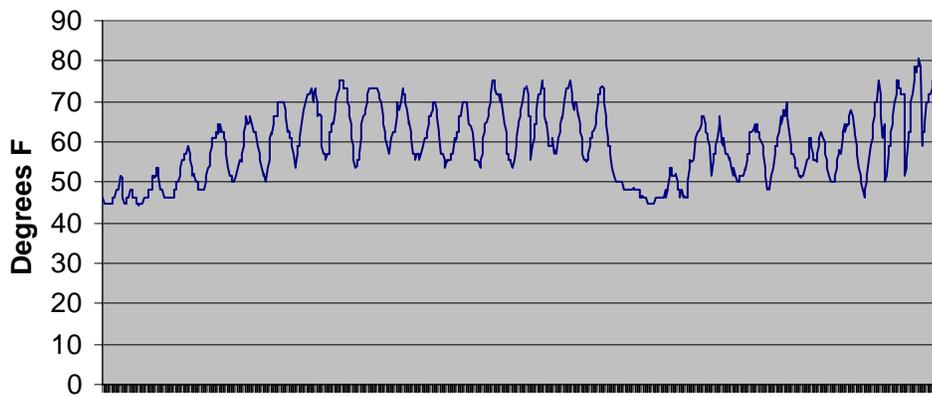
Temperature Trend - April



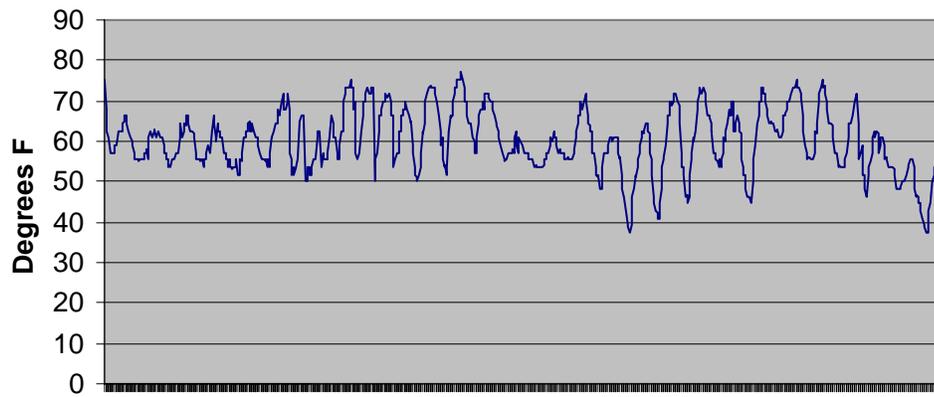
Temperature Trend - May



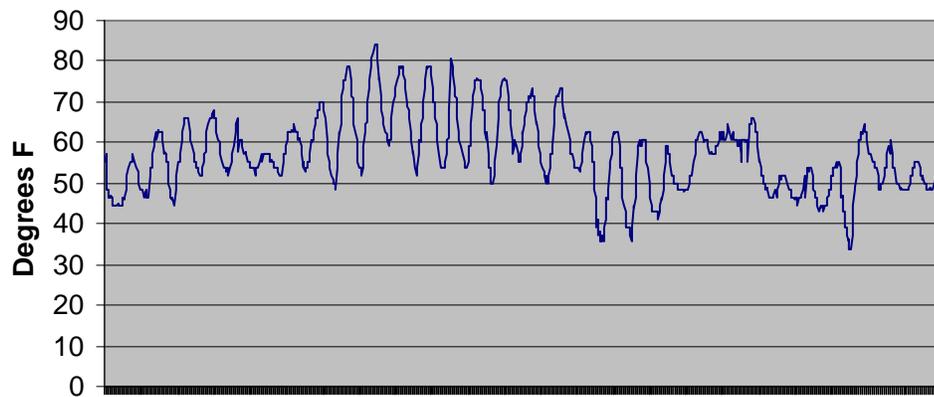
Temperature Trend - June



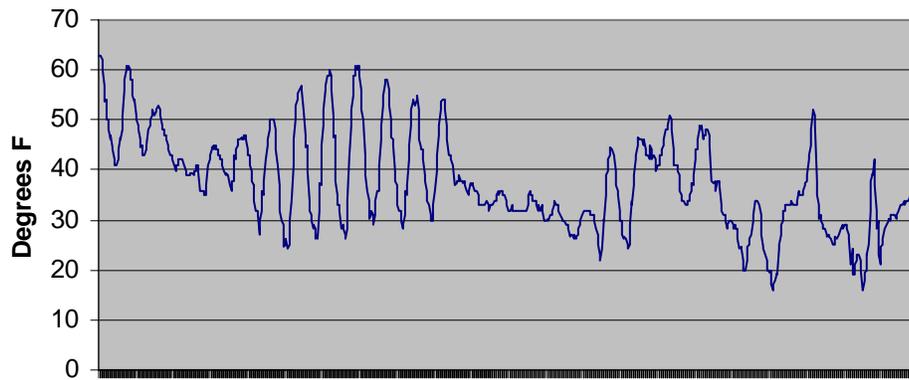
Temperature Trend - July



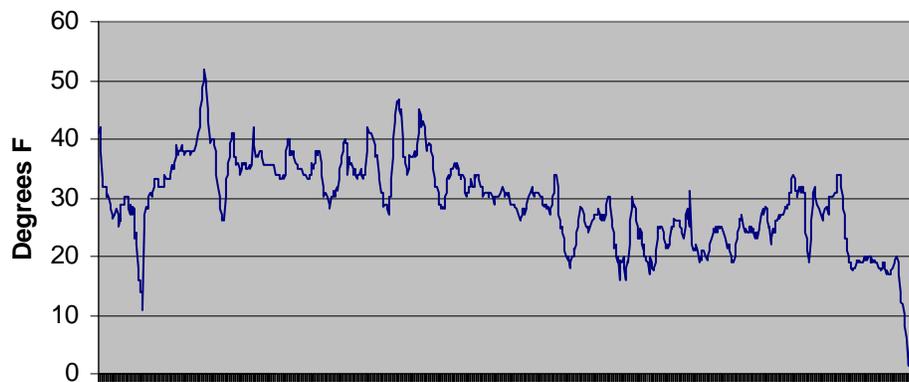
Temperature Trend - August



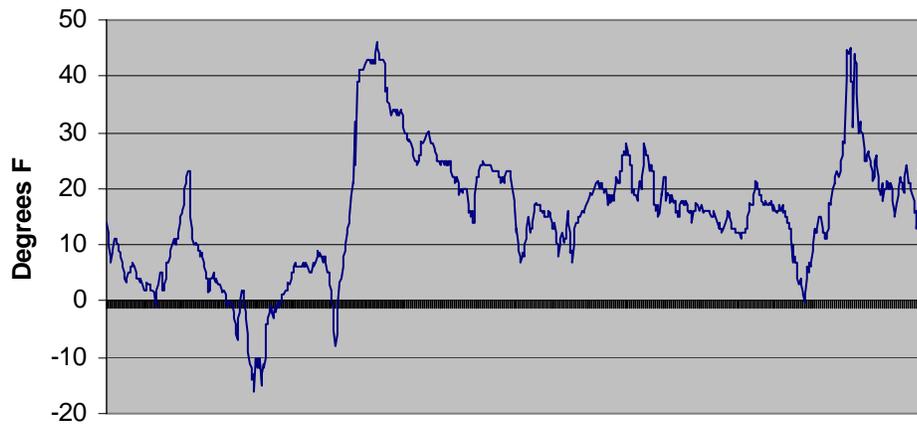
Temperature Trend - September



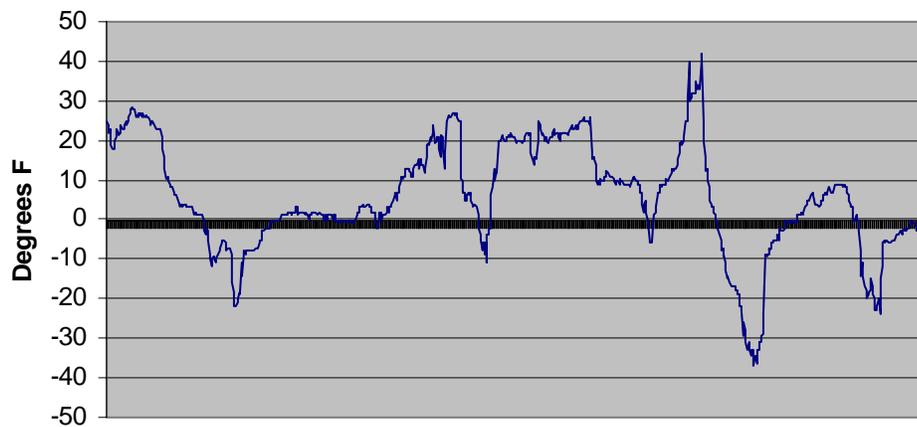
Temperature Trend - October



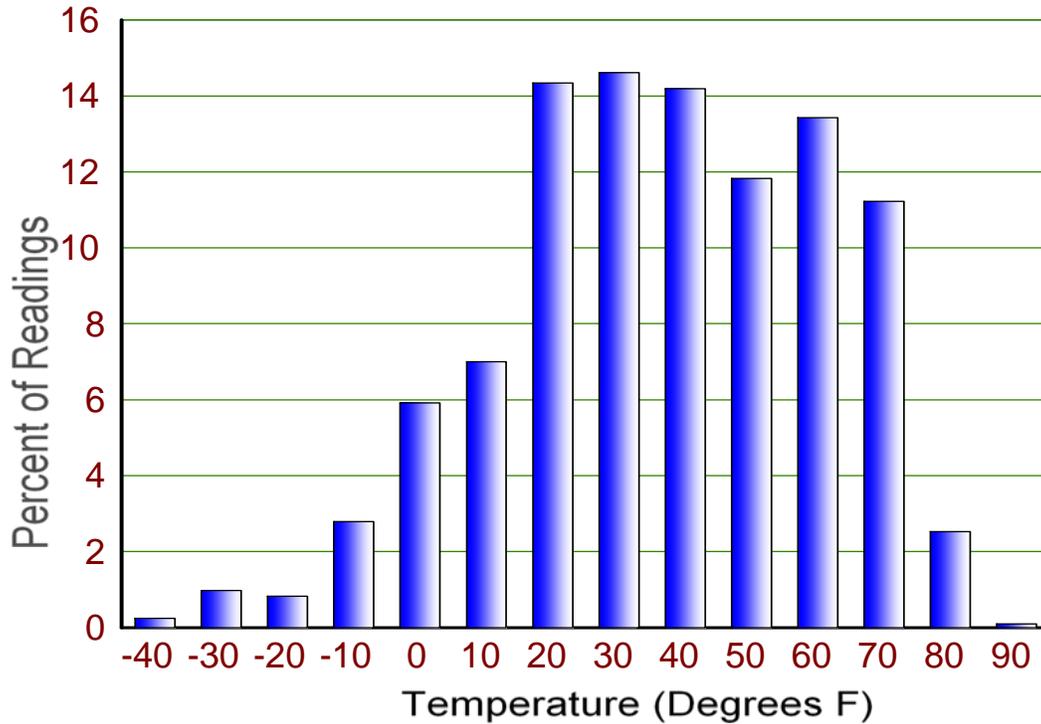
Temperature Trend - November



Temperature Trend - December

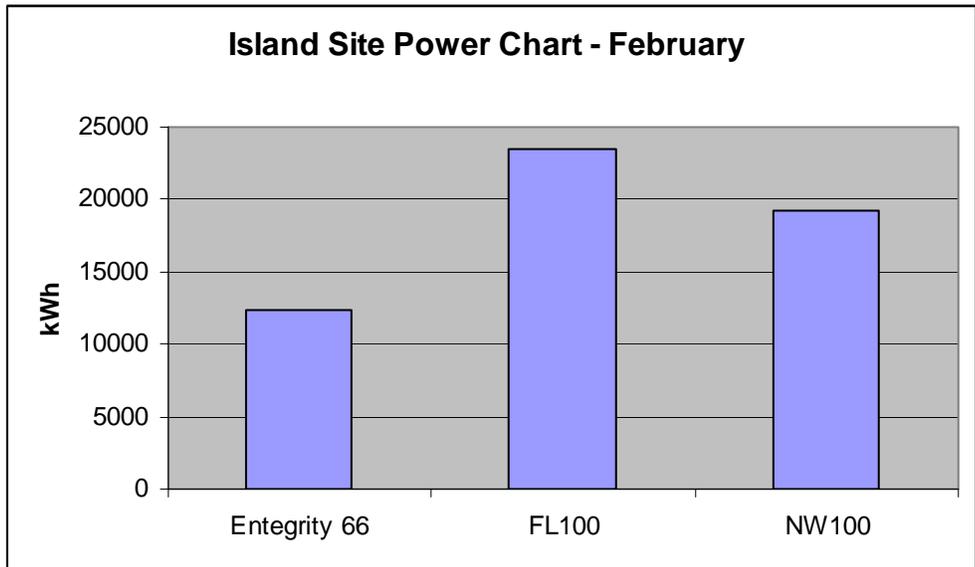
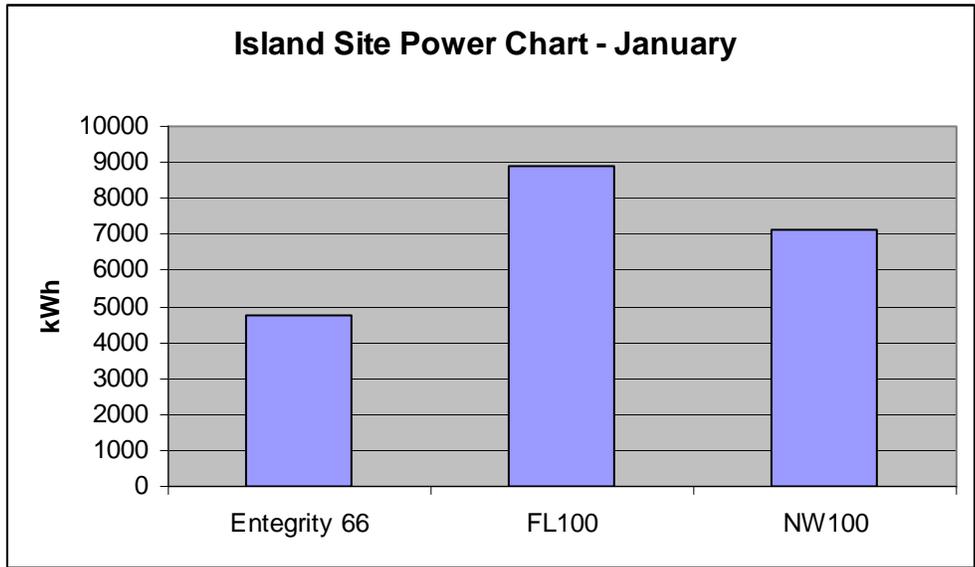


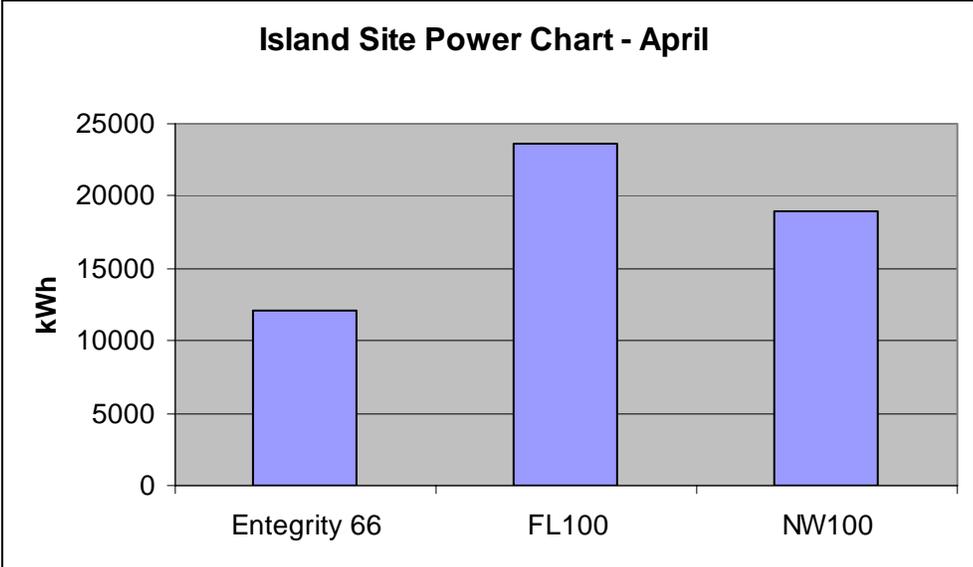
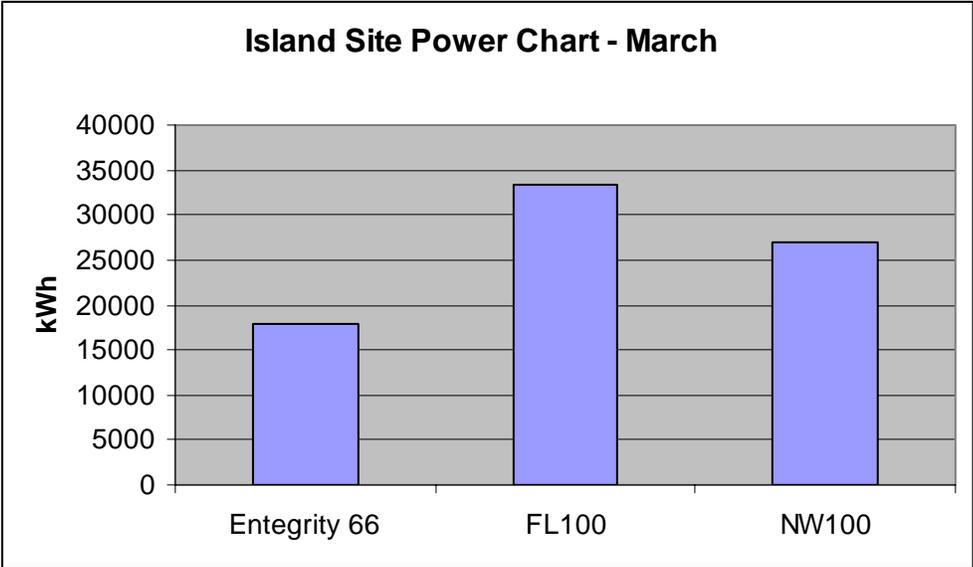
Temperature Distribution

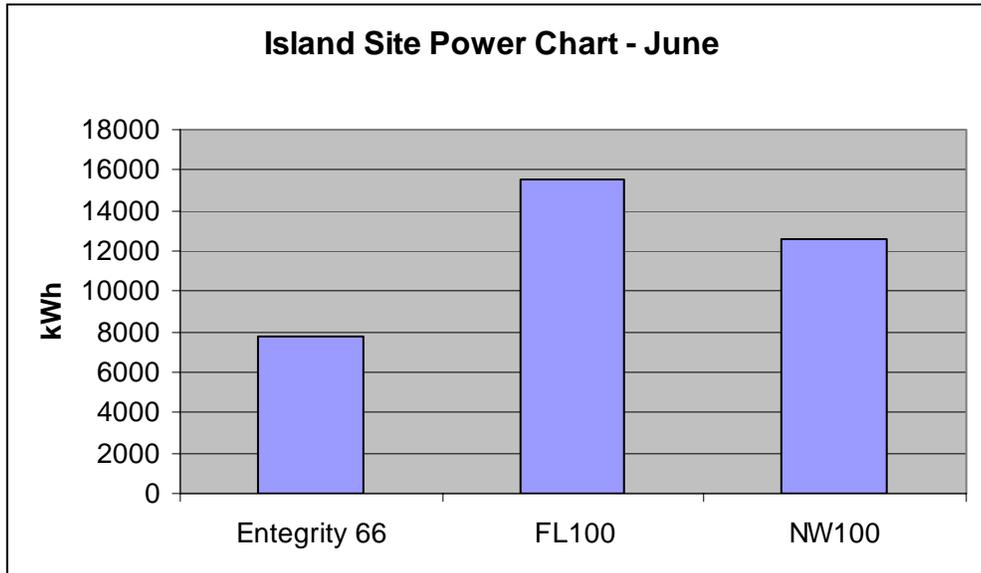
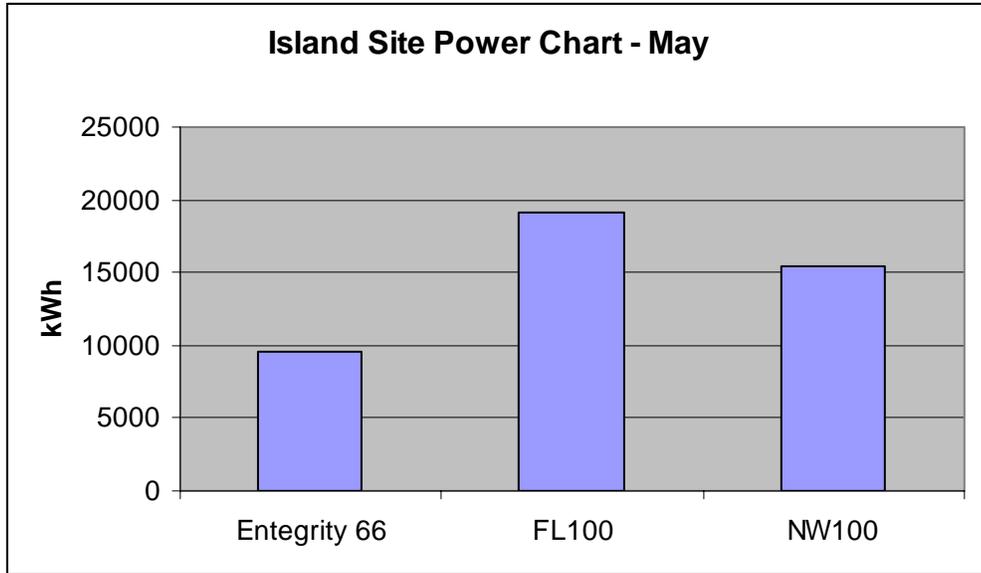


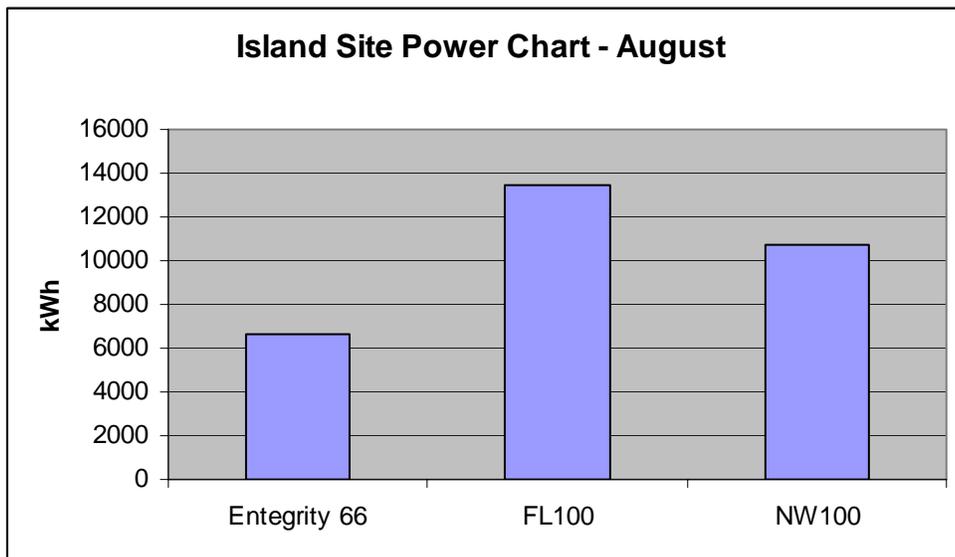
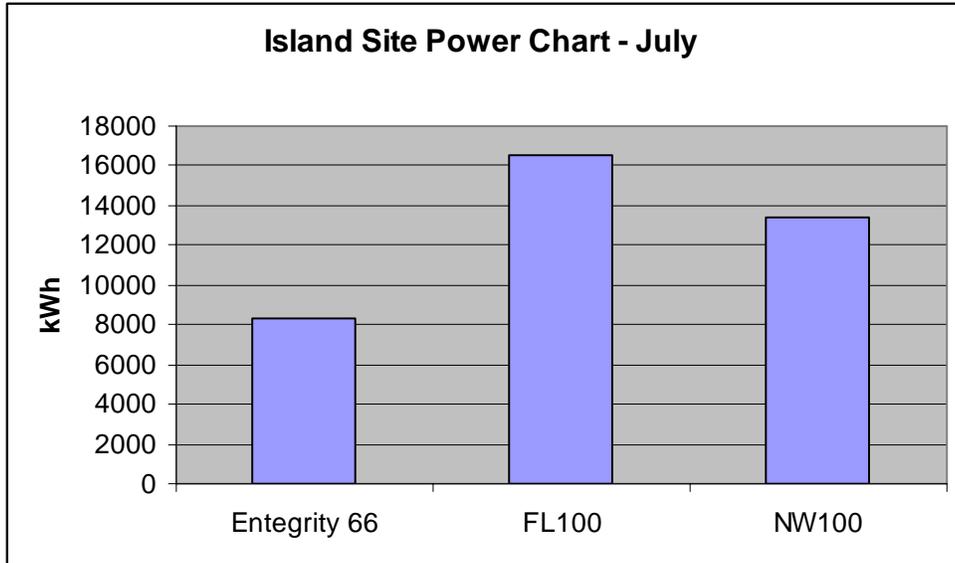
III. Power Projections

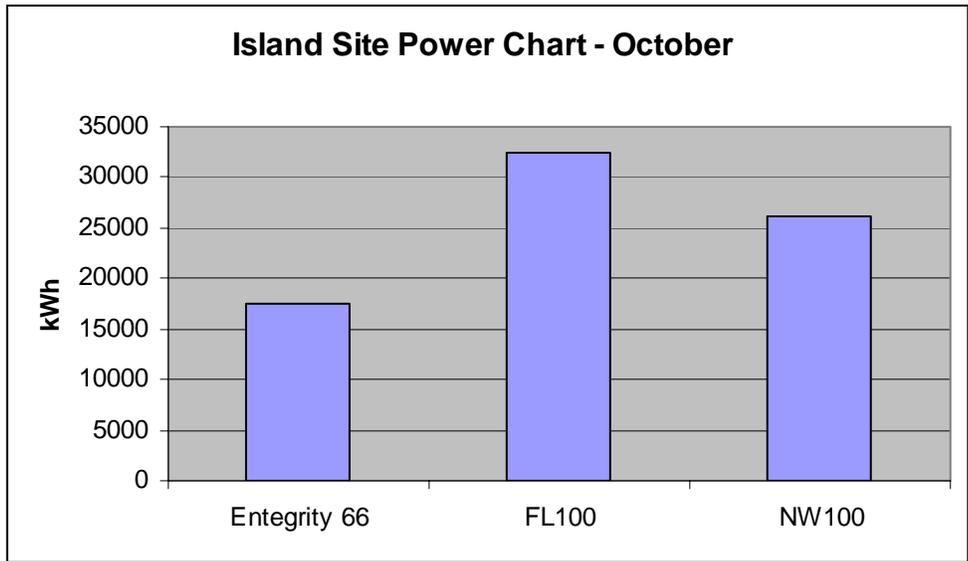
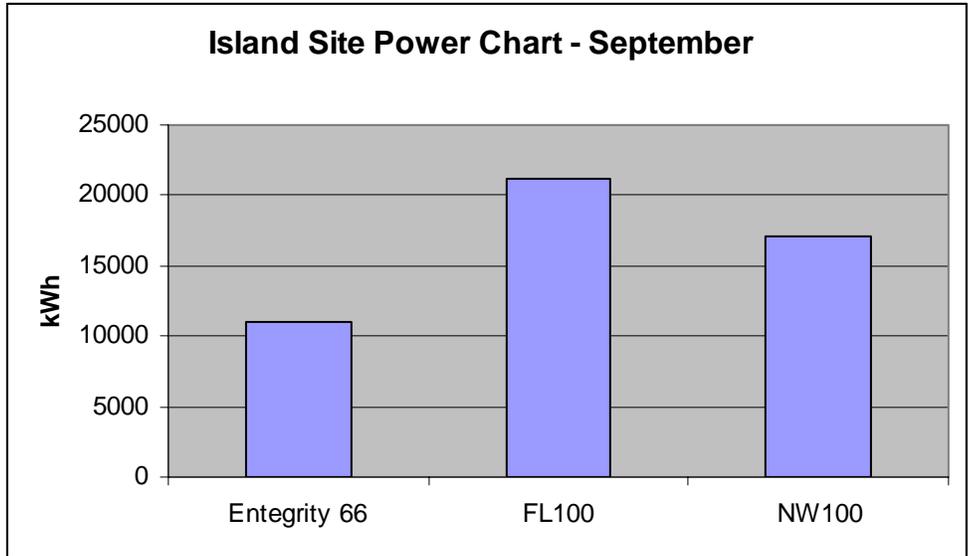
These power projections include three different turbines: a Northern Power 100 kW unit, a Fuhrlander 100 kW unit and an Entegrity 66 kW unit. Also included is an estimate of power production on a nearby bluff based on an observed shear factor of 0.50. The following charts are estimates based on exactly how much power would have been realized over the last year given the wind conditions.

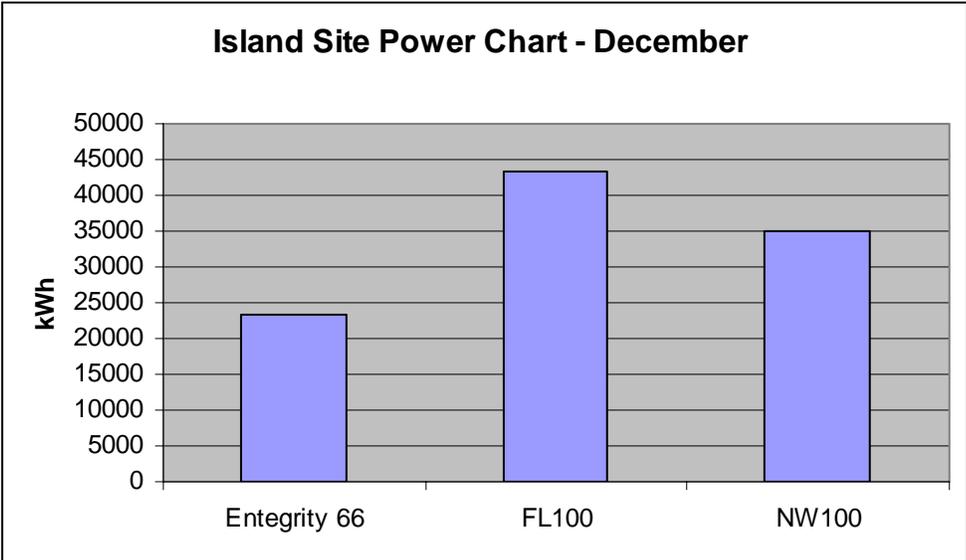
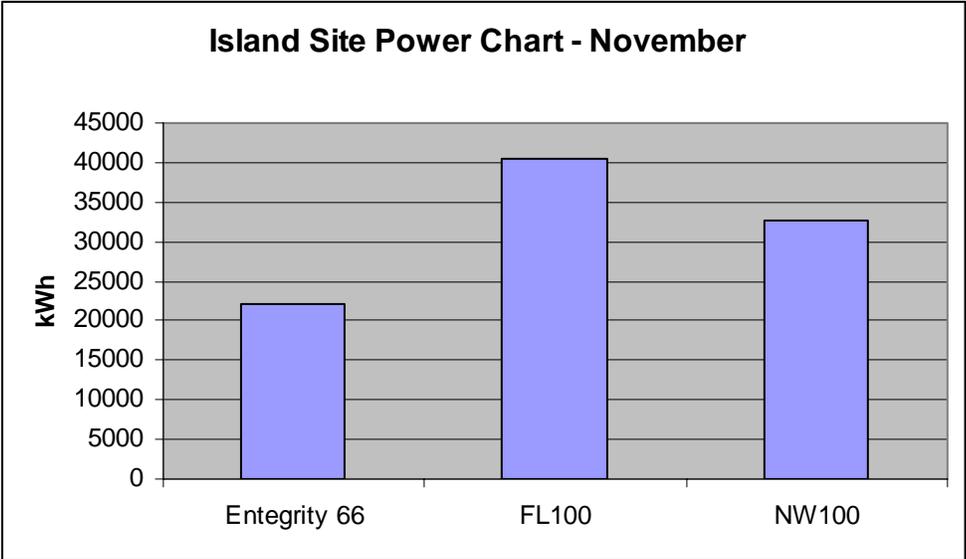


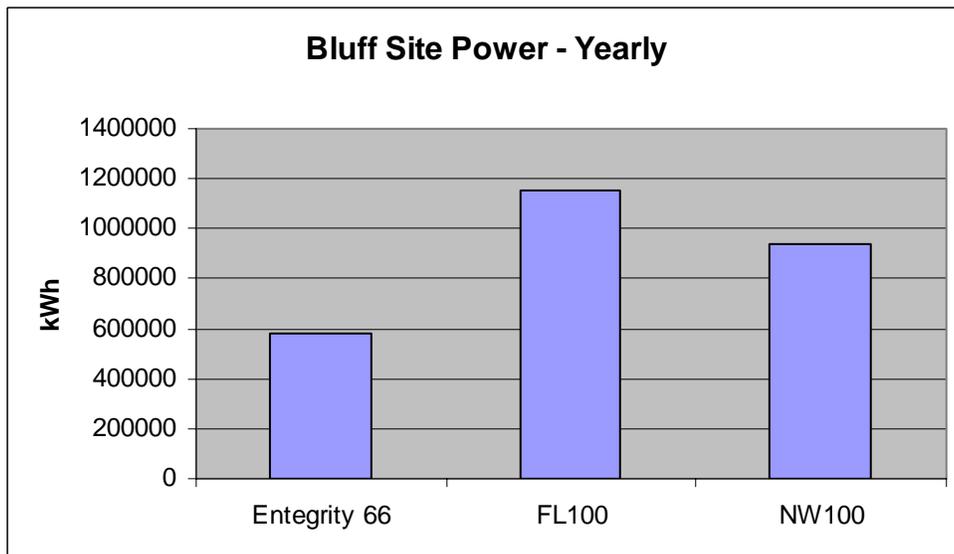
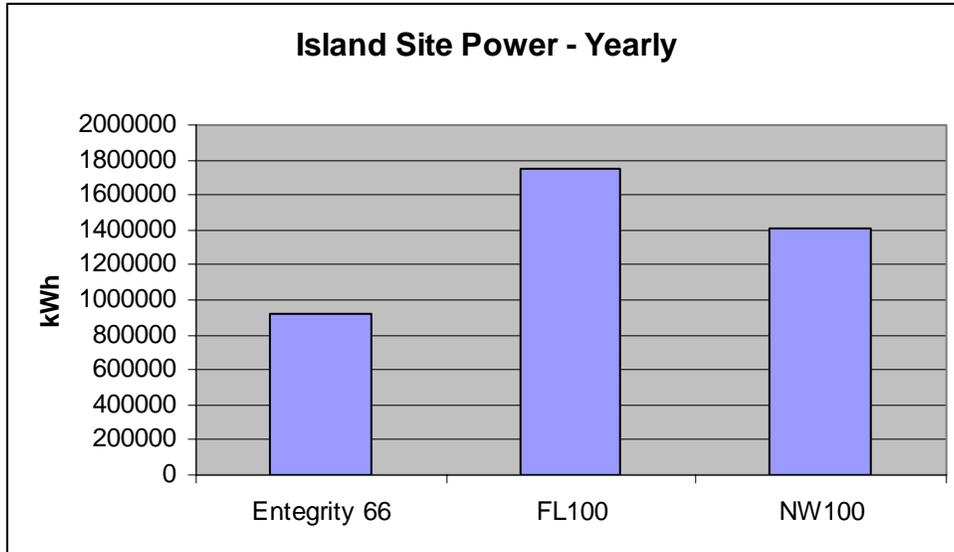












It is important to remember that the numbers from the bluff site are purely theoretical. The roughness of the estimate does not warrant monthly figures, however, given the shear factor observed over the course of a year, the numbers are more conservative than otherwise.

IV. Executive Summary

Whitestone Community Association wishes to offer its sincerest thanks to the AEA for their assistance and interest over the last year. Specifically Mr. David Lockard, Mr. Reuben Lowen and Miss Mia Devine for their help in the use of the 30 meter

meteorological wind tower as well as their technical assistance during the year the tower was used.

The project provided valuable wind data for a potential sight along the Tanana River. At current costs of 15 cent per kilowatt-hour using diesel generating systems, current wind turbine technology offers little advantage when one considers installation and maintenance costs. However, if the cost of diesel fuel continues to climb and new turbine technology comes to fruition, this conclusion will change. Furthermore there is a potentially better wind source at a nearby bluff that may increase the amount of energy available.

It is recommended that the wind energy at the nearby bluff be investigated with a small 20 meter tower to determine if this is a better location. Using the wind shear data from the Tanana River suggests sufficiently improved energy to warrant such an investigation.

The cost of installation in this area would be relatively small. Not only is road transportation well developed making the shipping of materials easy, but the ground is very stable with very little overburden above gravel in most places. In addition to this the light precipitation in the area and very dry winters lend themselves to less icing of moving parts and, hence, lower maintenance costs.

Whitestone Community Association is committed to reduce the use of fossil fuels through the use of renewable energy wherever possible. We are indeed grateful to AEA and other programs that assist in making this a reality.

**Met Tower Site Description for
 WHITESTONE, ALASKA
 Site # 2402**

Date last modified: 10/6/2005
 Prepared by: Mia Devine



Latitude: (NAD27)	64° 9' 36" N 64° 9.6
Longitude: (NAD27)	145° 52' 54" W 145° 52.9

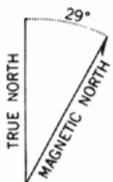
Elevation:	310 meters
Tower Type:	30-meter NRG Tall Tower
Monitor Start:	8/24/2004
Monitor End:	9/01/05

Table 1 lists the channel of the data logger each sensor is wired into and where they are mounted on the tower.

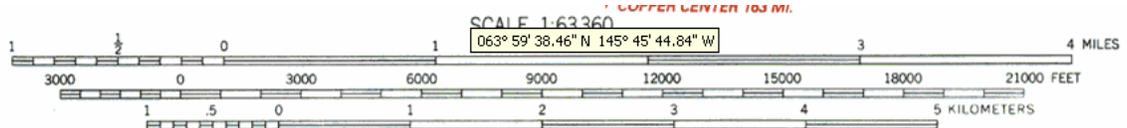
Table 1. Summary of Sensors Installed on the Met Tower

Ch #	Sensor Type	Height	Offset	Boom Orientation
1	#40 Anemometer	30 m	NRG Standard	East
2	#40 Anemometer	30 m	NRG Standard	Southwest
7	#200P Wind Vane	30 m	90° True	West
9	#110S Temperature	4 m	NRG Standard	-

Whitestone Farms is located off the Alaska Highway, about 5 miles northwest of Delta Junction. Figure 1 shows the location of the met tower relative to the surrounding terrain.

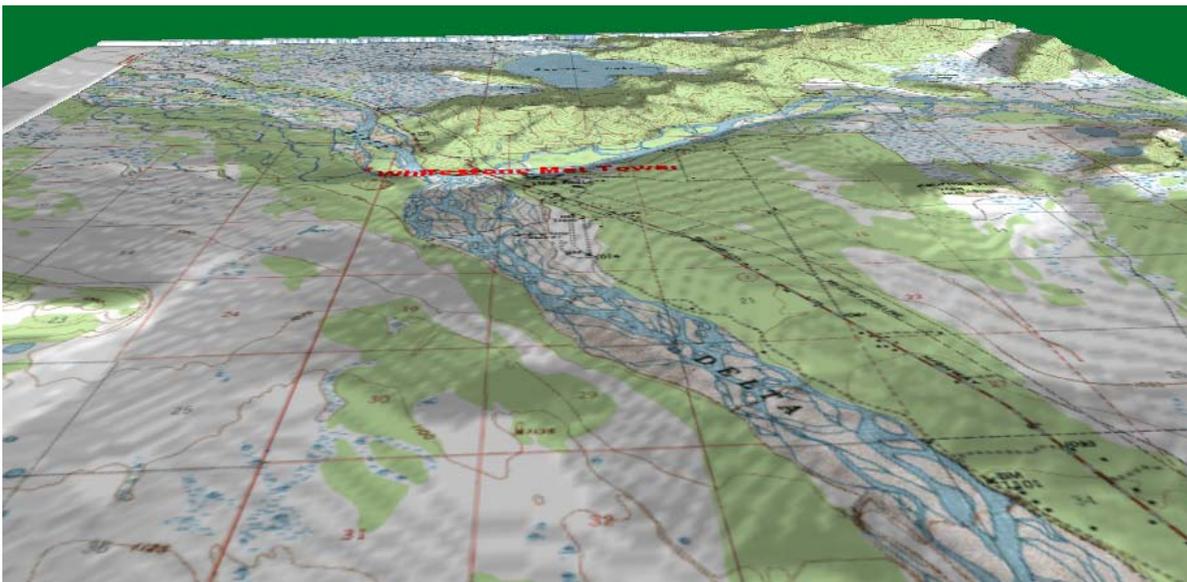


APPROXIMATE MEAN DECLINATION, 1975



CONTOUR INTERVAL 50 FEET
DOTTED LINES REPRESENT 25-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM 1929

Figure 1. Topographic Map of Met Tower Site and Surrounding Area



The photos below illustrate the surrounding ground cover and any major obstructions, which could have an effect on how the wind flows over the terrain from a particular direction.



Facing NW from tower base



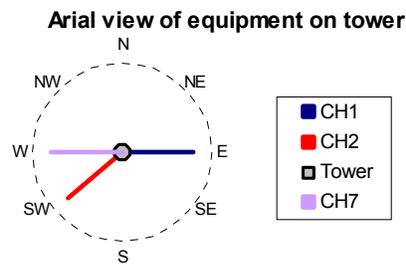
Facing North from tower base



Facing NE



Facing West from tower base



Facing East



Facing SE from tower base



Facing South



Facing SW