Keezletown, VA

Project Summary
As part of Virginia's State-Based Anemometer Loan Program, an anemometer was placed in Keezletown, Virginia to assess the area's wind energy potential. Wind speed and direction were recorded from November 1, 2001 through October 31, 2002. Annual average wind speed during the monitoring period (66 ft. [20m] above ground level) was recorded to be 8.40 mph (3.75 m/s). Wind power density is calculated to be 66.52 W/m^2.

Project Location
The monitoring equipment was installed on private land in Keezletown, Virginia at an elevation of 1,462 feet. The site is located at N 38° 28.09', W 78° 47.43'.

Monitoring Equipment
The 20-meter NRG-NOW Systems – Wind Explorer kit includes one tower, one Wind Explorer data logger with shelter box, one #40 Maximum anemometer, one #200P wind direction vane, sensor cabling, one lightning rod with copper ground, and two data plugs.

Results

Average annual wind speed	8.40 mph (3.75 m/s)
Average annual wind power density	66.52 W/m^2
Month with greatest wind resource	February
Average wind speed during month with greatest resource	10.6 mph
Month with least wind resource	July
Average wind speed during month with least resource	6.3 mph

Monthly Variation

Figure 1 below shows the average monthly wind speed for each month throughout the recorded year. Above average months occur during winter and early spring, while below average months occur during summer and fall.

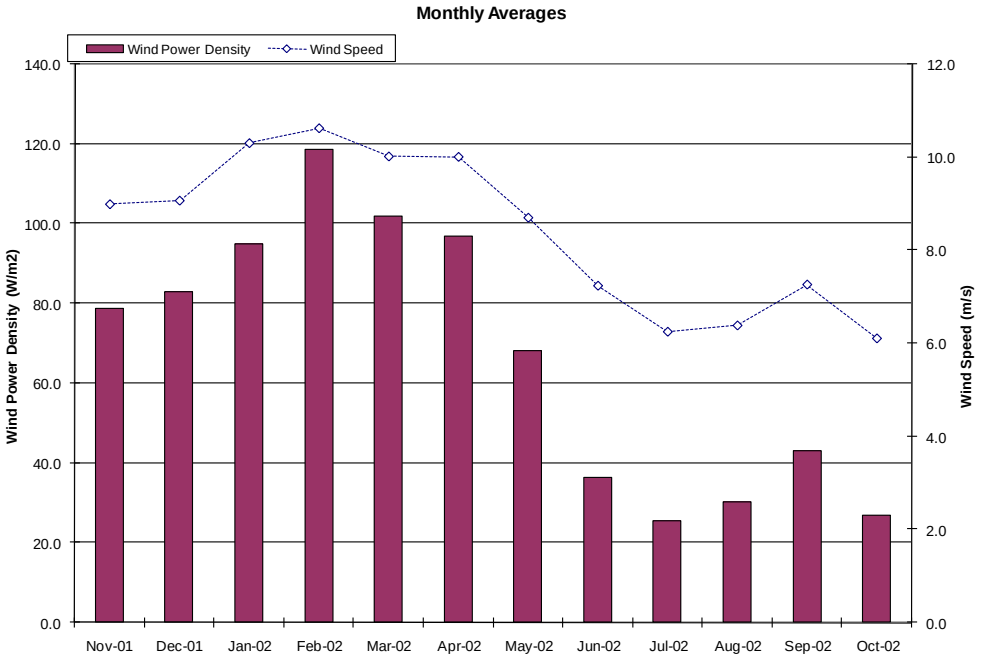

Figure 1. Monthly average wind speeds and power densities throughout the year.

Diurnal Variation

Figure 2 shows how wind speeds vary on an hourly basis. Stronger winds are more prevalent during midday and late evening hours. Slower winds more often exist after early morning and until late night hours.

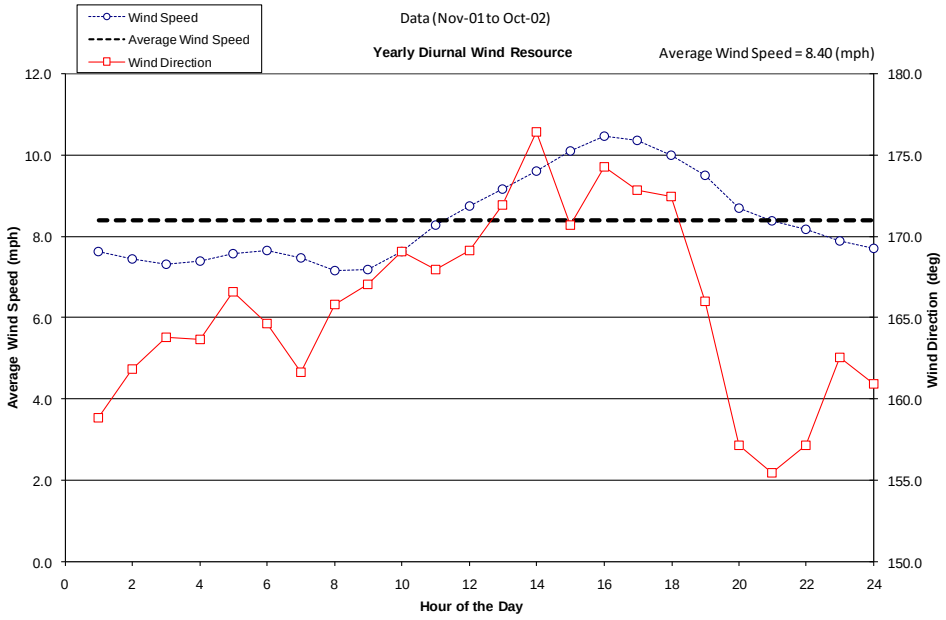

Figure 2. Average hourly wind speeds and directions throughout the year.

Monthly Diurnal Variations

Figure 3 shows the diurnal (hourly) variations of the wind speed over each month. The trends of each month follow one another.

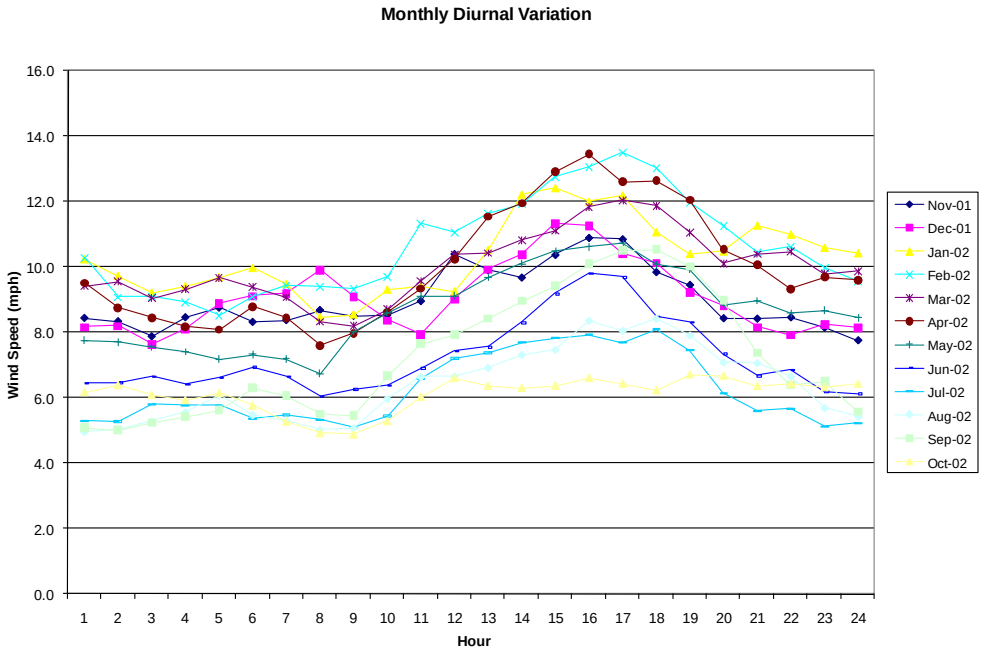

Figure 3. Average hourly wind speeds for each month.

Wind Speed Histogram

Figure 4 shows the occurrence in number of hours that each wind speed occurs. Typically this falls under what is called the Weibull distribution, with a high peak early, and a tailing off at higher wind speeds.

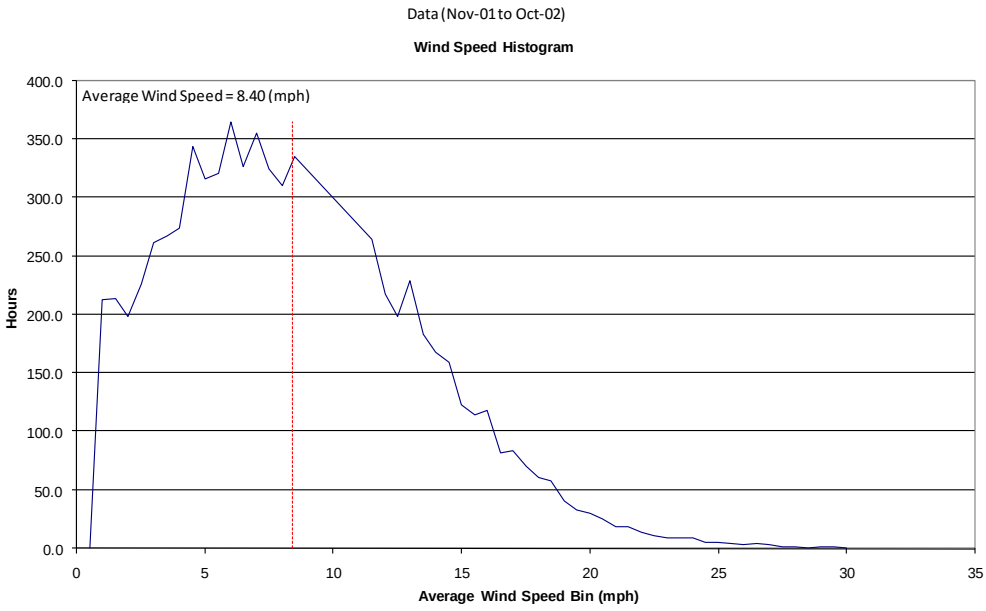

Figure 4. Wind speed frequency over the year by # of hours.

Wind Speed and Direction Trace

Figure 5 shows the wind speed and wind direction reading for every ten-minute average over the course of the data. The wind speed data is the blue line, and the directional data are the red lines.

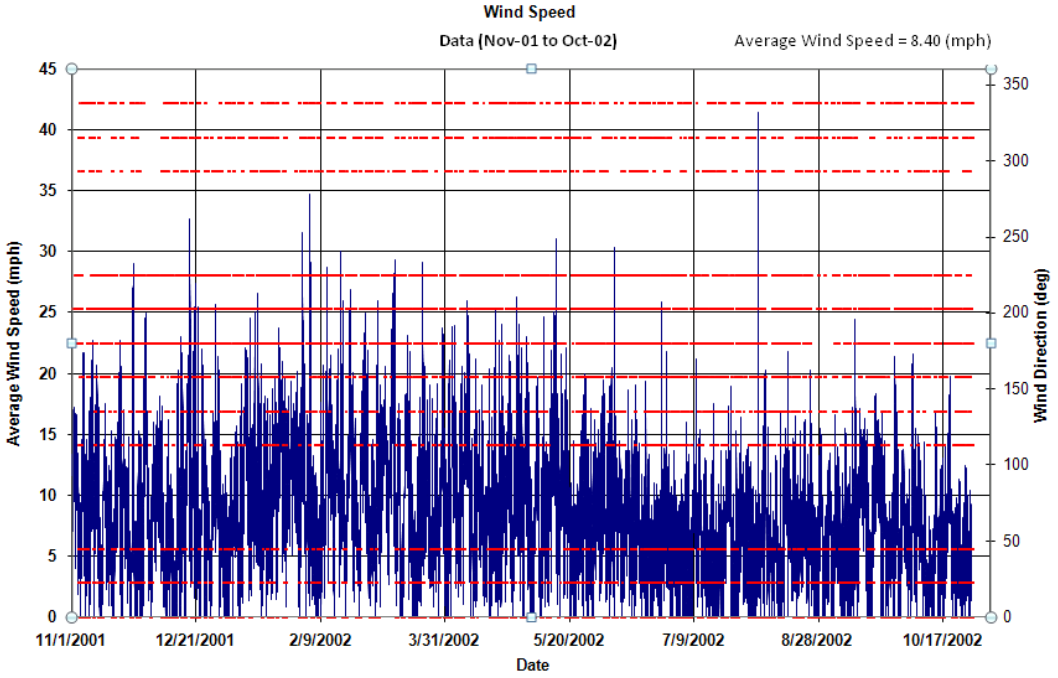

Figure 5. Wind speed and direction readings throughout the year.

Wind Daily Averages

Figure 6 shows the average wind speed and direction by day of the month. Notice there is no particular trend here.

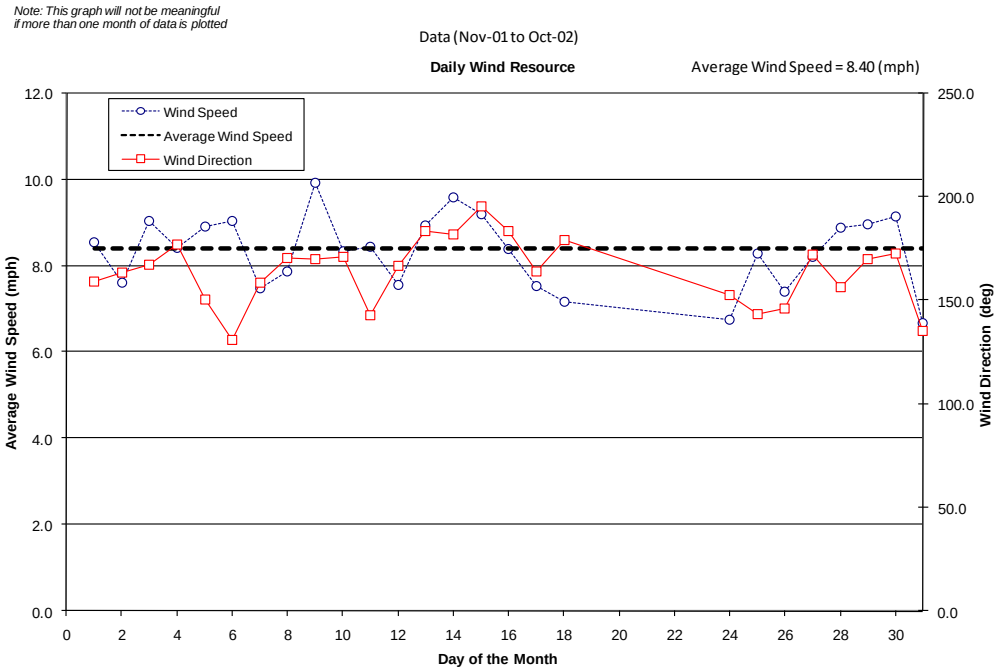

Figure 6. Wind speed and direction averages by day of the month.

Wind Speed Occurrence by Direction

Figure 7 displays the average wind speed for each direction the wind comes from. It also shows the percent of time in that direction bin. The highest wind speeds come from the south-southwest for this site.

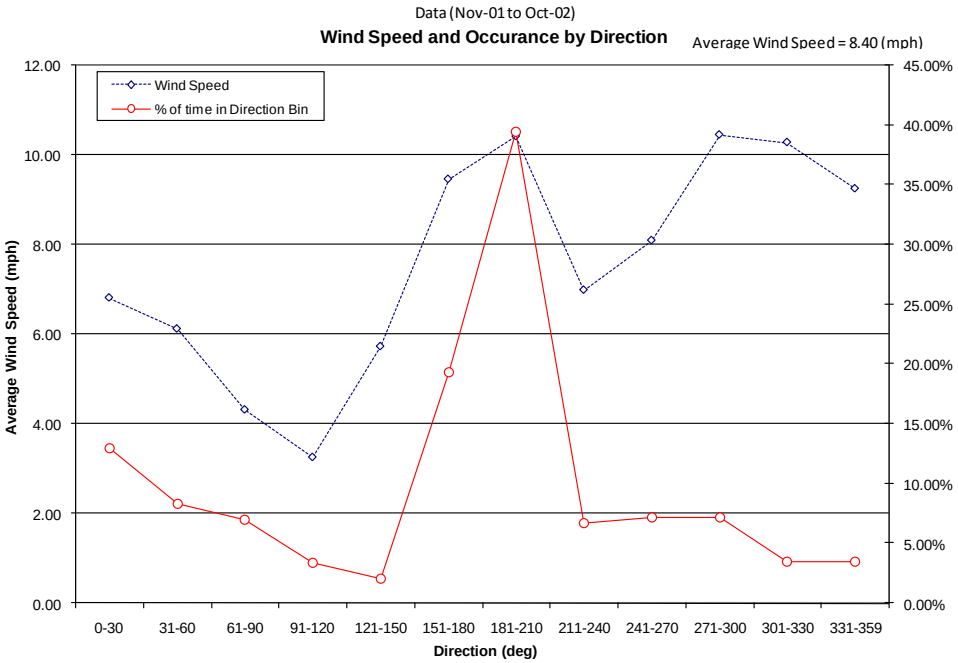

Figure 7. Average wind speed for each direction bin and % time in that bin.

Frequency Wind Rose

Figure 8 displays a frequency wind rose. It can be seen that the majority of the wind comes from the south-southwest direction.

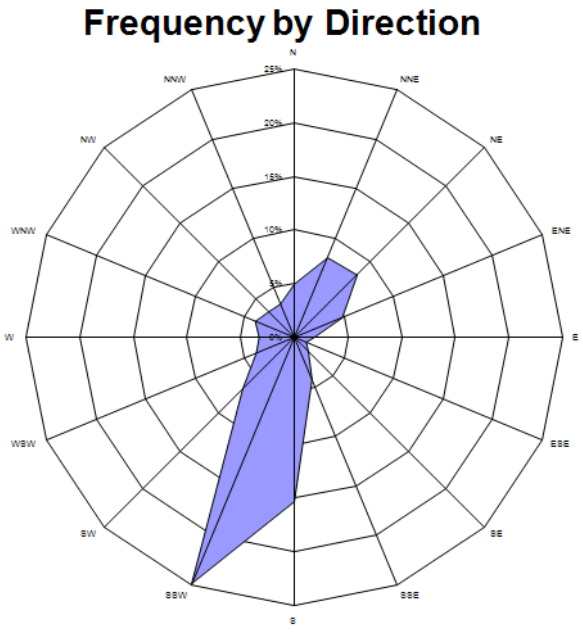

Figure 8. Wind rose displaying wind direction frequency.

Energy Rose

Figure 9 is an energy wind rose, showing the number of kWh/m^2 available from 16 compass-point directions. The largest portion of energy comes from the south-southwest due to the significantly higher wind speeds from this direction as compared to other directions.

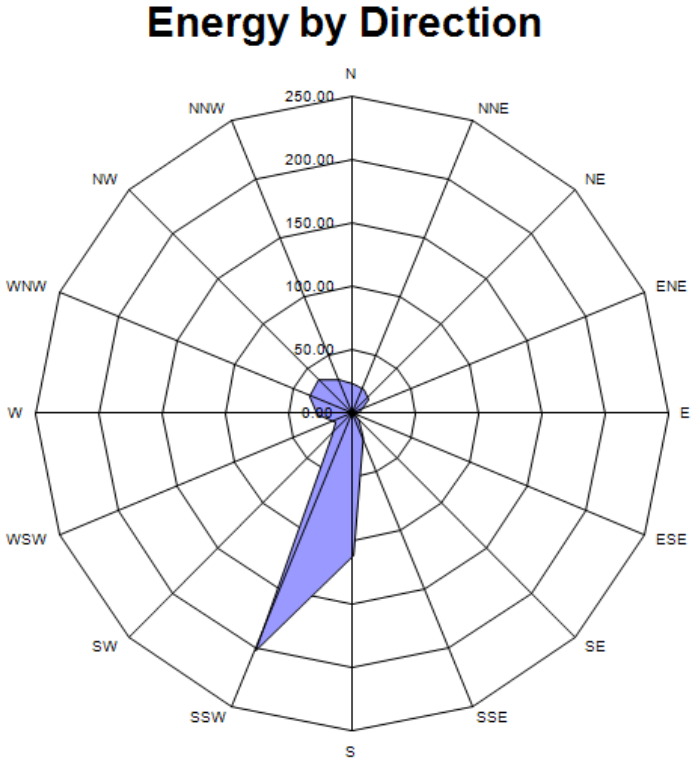

Figure 9. Energy wind rose with units in kWh/m^2.