McDowell, VA

Project Summary
As part of Virginia's State-Based Anemometer Loan Program, an anemometer was placed in McDowell, Virginia to assess the area's wind energy potential. Wind speed and direction were recorded from June 1, 2003 through May 30, 2004. Annual average wind speed during the monitoring period (66 ft. [20m] above ground level) was recorded to be 12.52 mph (5.6 m/s). Wind power density is calculated to be 190.05 W/m^2.

Project Location
The monitoring equipment was installed on private land in McDowell, Virginia at an elevation of 3,104 feet. The site is located at N 38° 22' 40.1376", W 79° 29' 28.5001".

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	12.52 mph (5.6 m/s)
Average annual wind power density	190.05 W/m^2
Month with greatest wind resource	January
Average wind speed during month with greatest resource	16.0 mph
Month with least wind resource	August
Average wind speed during month with least resource	8.1 mph

Monthly Variation

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

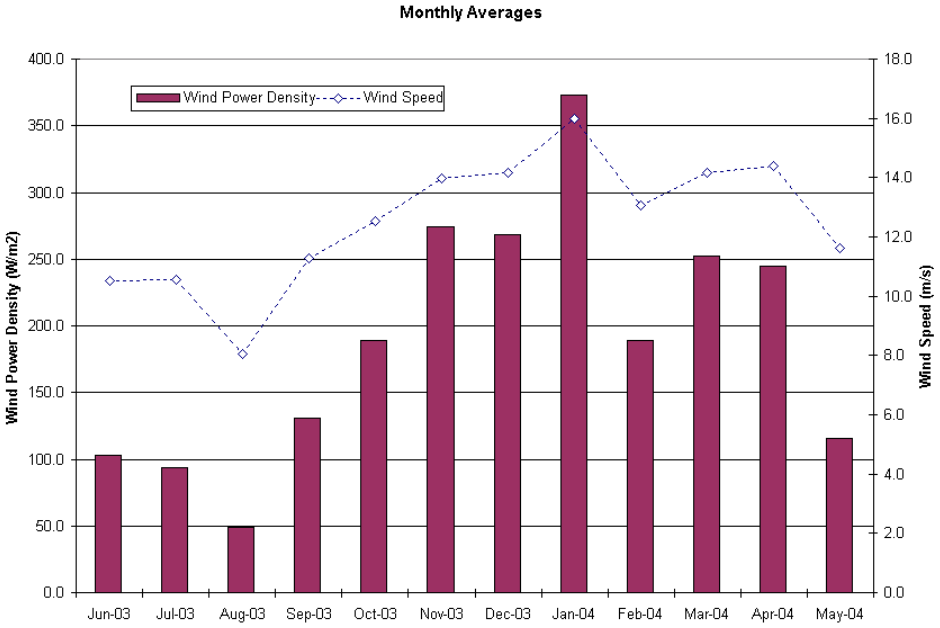

Figure 1. Monthly average wind speeds and power densities throughout the year.

Diurnal Variation

Figure 2 shows how wind speeds vary on an hourly basis. Stronger winds are more prevalent during afternoon and early evening hours. Slower winds more often exist after midnight and during sunrise. Typically larger variation is seen in wind speed between times than is seen at this site.

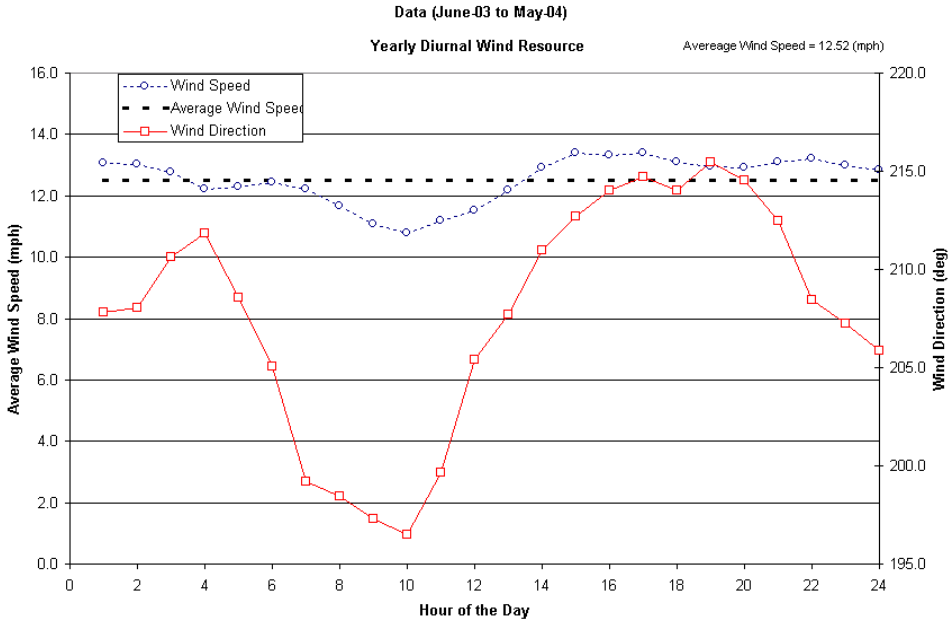

Figure 2. Average hourly wind speeds and directions throughout the year.

Monthly Diurnal Variations

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

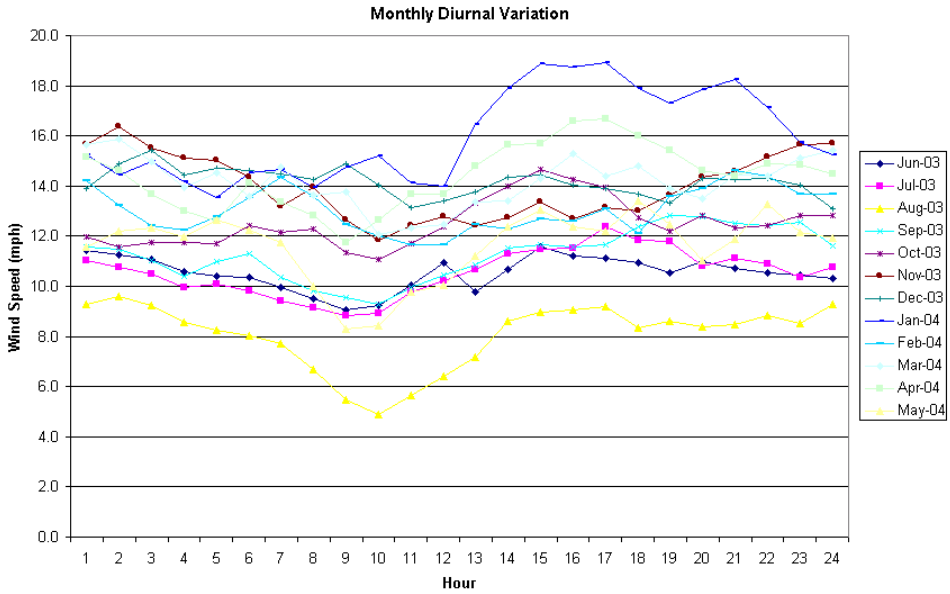

Figure 3. Average hourly wind speeds for each month.

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. This graph is slightly unorthodox with a distribution closer resembling the normal distribution than typical wind distributions.

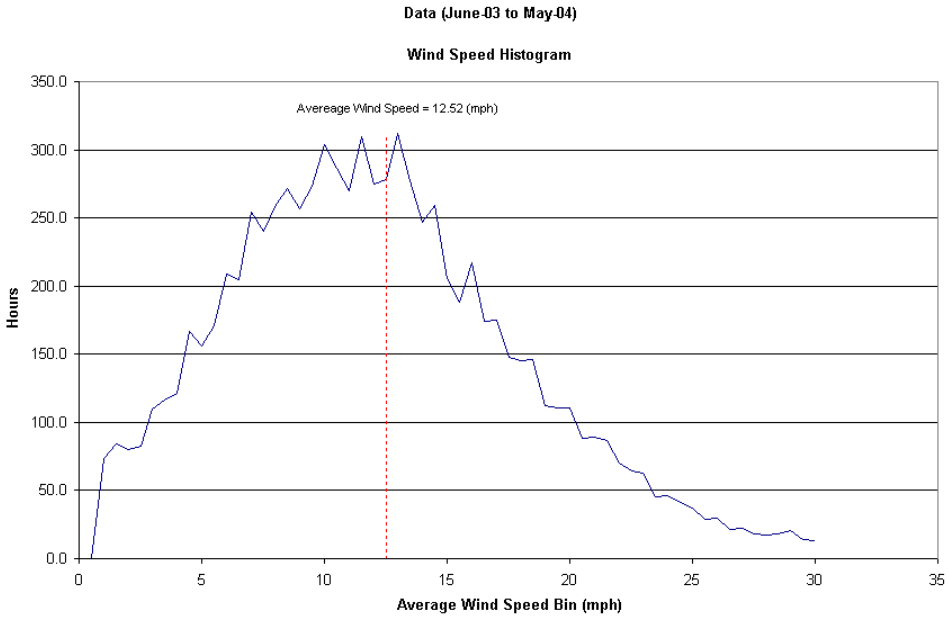

Figure 4. Wind speed frequency over the year by # of hours.

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 blue line represents the wind speed and the red lines are direction.

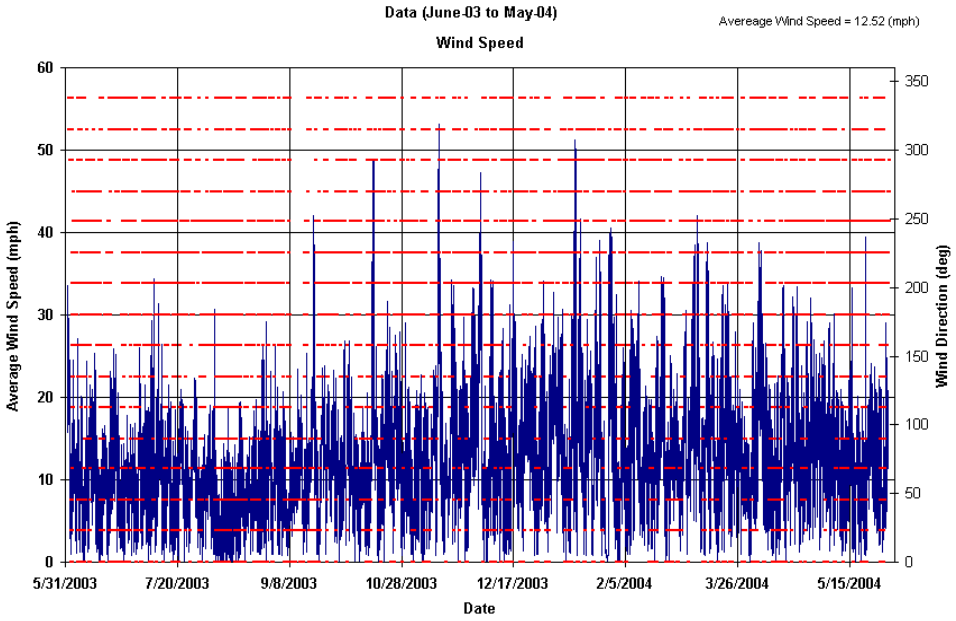

Figure 5. Wind speed and direction readings throughout the year.

Wind Daily Averages

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

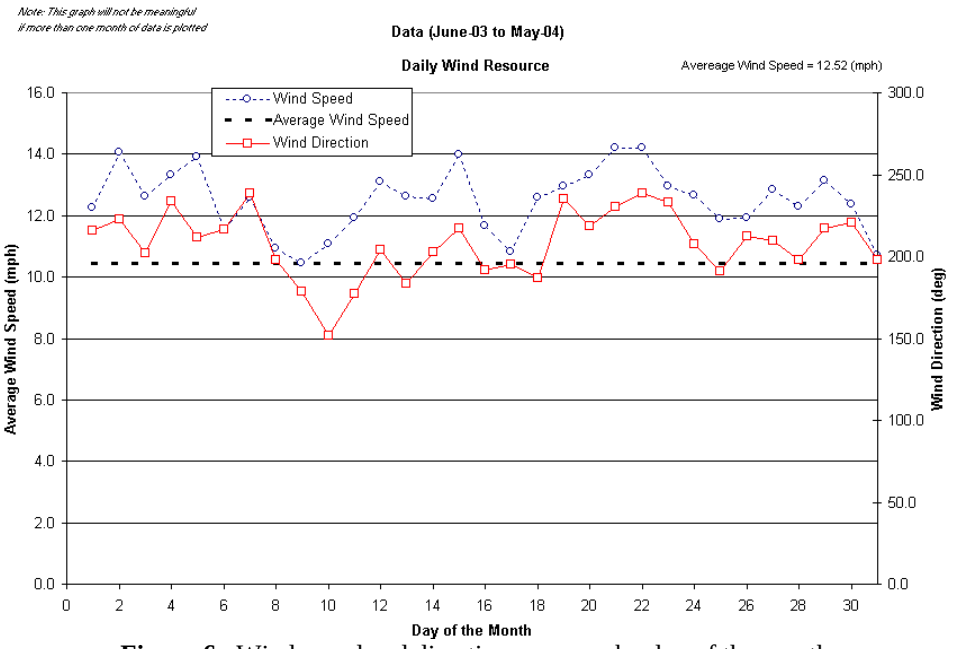

Figure 6. Wind speed and direction averages by day of the month.

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. For this site the higher wind speeds came from the west-northwest.

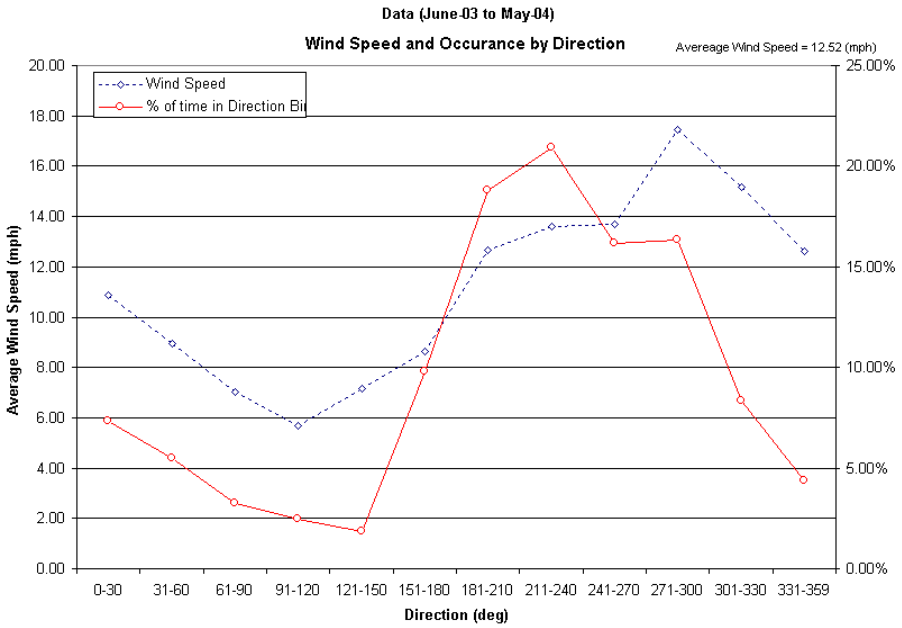

Figure 7. Average wind speed for each direction bin and % time in that bin.

Frequency Wind Rose

Figure 8 displays a frequency wind rose. The majority of winds come from the southwest region at this site.

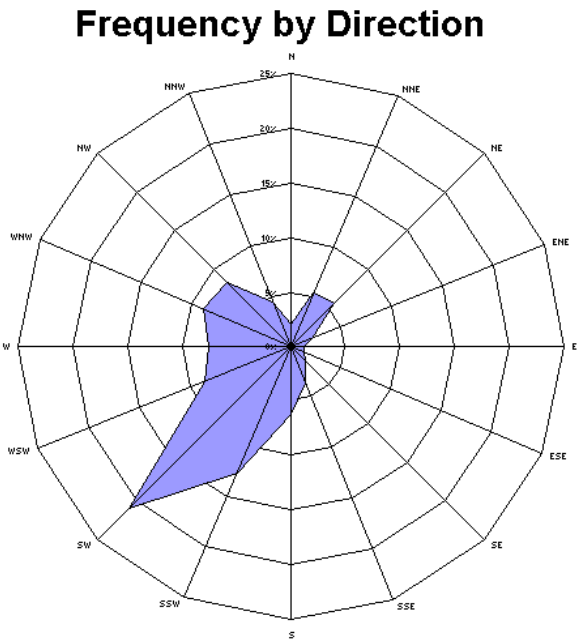

Figure 8. Wind rose displaying wind direction frequency.

Energy Rose

Figure 9 is an energy wind rose, showing the number of kWh/m^2 available from 16 compass-point directions. The majority of energy comes from the west-northwest and southwest. This is due to the high wind speeds out of the west-northwest and the high occurrence of wind from the southwest.

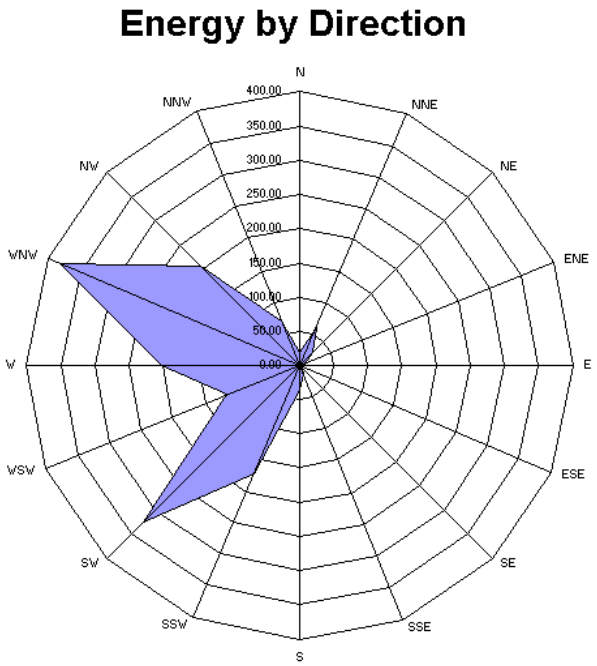

Figure 9. Energy wind rose with units in kWh/m.