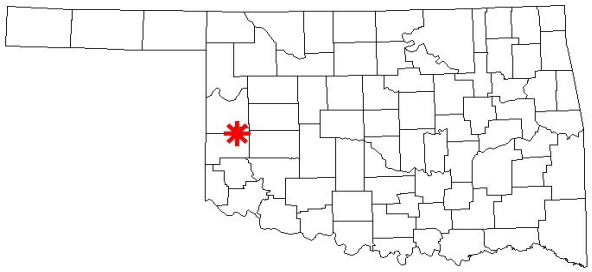
August 2005 Wind Summary
Elk City Dobson Cellular Tower
Sensors at 10, 40, 70, and 100 m*

Oklahoma Wind Power Initiative

Height	Average Wind Speed	Wind Power Density
10 m (33 ft)	4.11 m/s (9.20 mph)	65 W/m^2
40 m (131 ft)	5.71 m/s (12.8 mph)	145 W/m^2
70 m (230 ft)	6.53 m/s (14.6 mph)	231 W/m^2
100 m (328 ft)	6.90 m/s (15.5 mph)	297 W/m^2



BACKGROUND - On October 2nd, 2003 OWPI installed wind monitoring equipment on a Dobson Cellular tower located 8 miles west of Elk City in cooperation the Oklahoma Association of Electric Cooperatives (OAEC) and Dobson Cellular.

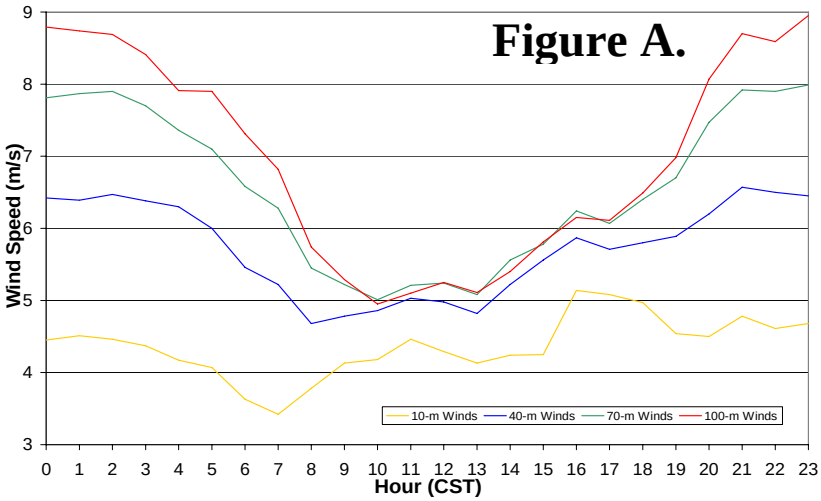
POTENTIAL ENERGY PRODUCTION - A 1.5 MW wind turbine with a 70.5-m rotor diameter (i.e., GE Wind's 1.5 MW turbine) at a hub height of 70 meters, could have produced roughly 453389 kWh of electricity over the 31-day period. Based on year 2000 statistics from the Energy Information Administration, 453389 kWh is equivalent to the average monthly amount of electricity used by 420 Oklahoma households.

SUMMARY - (Figure A) The average-hourly wind speed is plotted for the three heights. The line chart illustrates the variation of wind speed with height, otherwise known as wind shear. Large wind shear values are typically observed during the night. The **Average Wind Shear Exponent** between 10 and 100 m is 0.25 (1/4th). The exponent can be used in conjunction with Power Law Profile equation to calculate the average wind speed at other heights.

(More On Back)

Diurnal Wind Speed Pattern

Figure A.



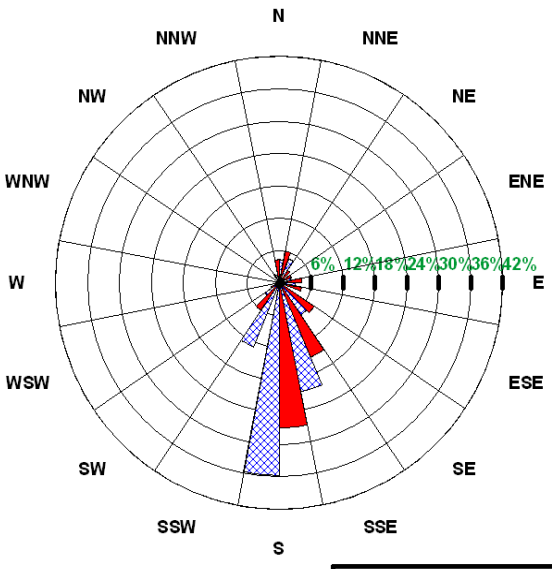
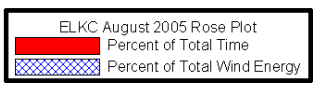
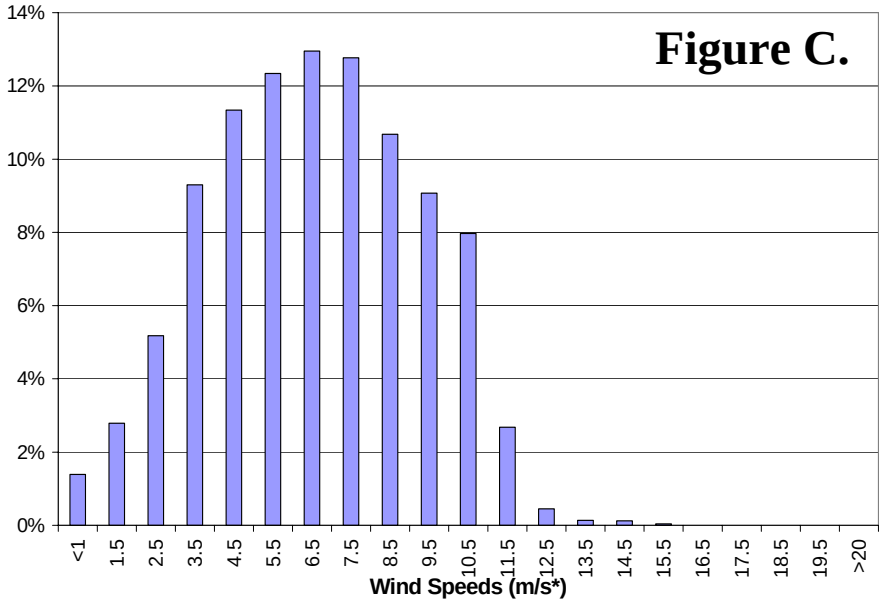


Figure B.



Frequency Distribution of Wind Speeds at 70 meters

Figure C.



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(Figure B) At the 70-meter level, the winds were from the south-southeast, south, and south-southwest directions 56% of the time, and these directions accounted for 69% of the total wind energy.

(Figure C) Categories or bins are labeled with the center point and have a width of 1 m/s. For example, the 6.5 m/s bin has a frequency of just over 12%, so wind speeds between 6.0 and 7.0 m/s occur just about 12% of the time.

The frequency distribution can be used to determine the performance of a wind turbine. For instance, a typical cut-in wind speed for a wind turbine is 3 m/s, while a typical cut-out wind speed is 25 m/s. Based on wind data for the time period at 70-m, an operational wind turbine would have generated electricity for 94% of the month.

NOTES:

*m – to convert meters to feet multiply value by 3.28.

*m/s – to convert meters per second to miles per hour multiply value by 2.24.

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