Wind Speed Monitoring for small wind turbine using NRG WindWatcher

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This is a document illustrating the steps to monitor a site for a small wind turbine, small is defined as under 10 kW. It is recommended to monitor wind speed at a height as close to the installed height of the wind turbine as is possible. Many people do not have the time or resources to install a tip up wind measurement tower, but are willing to spend $400 and a few hours installing a simple anemometer and datalogger, at a reduced height. The wind speed average can be extrapolated for a higher elevation. There is some error in this extrapolation, but the error may be acceptable for a small wind turbine application (which is often installed for reasons other than strict financial return).

This NRG WindWatcher Anemometer was purchased and installed in the Spring of 2004. The anemometer was bolted to a 12’ long aluminum pole, and the pole was fastened to a telephone pole in the middle of the farm field at an anemometer height of approximately 33 feet above ground

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Nearest trees are approximately 400 feet away, to the East. This site is 800’ from the house and electric meter, that 800’ will be expensive for the electric cable purchase and installation, but will also keep the generator noise away from the home and keep the generator away from trees and buildings.

The anemometry package includes the datalogger, anemometer and 100’ of cable. The datalogger operates on one D cell battery, for up to a year. The datalogger must be mounted inside a rain tight enclosure.

The wind data collected to date is summed in the Table below. Note that this instrument gives an average wind speed, and a density speed. The density speed is adjusted for actual conditions providing a number that can be used with turbine manufacturer’s power curves to give a more accurate prediction of performance. The Table below also has a column showing estimated production from an AWP 3.6 turbine, and a Bergey 1kW, that’s what the turbine would produce on a 33 foot tower. If the site is assumed to have a standard shear of 0.14, those numbers improve by a multiplier of 1.5 for an 80 foot tower, or if it’s a shear of 0.2, the multiplier is 1.8. Towers of 80 feet or greater height are recommended.

Table 1.1 Wind data from Osceola, WI

Month	Wind Speed (mph)	Density Speed (mph)	Power Density (W/m^2)	Max. Gust (mph)	Bergey* Expected Production (kwhrs)	AWP 3.6* Expected Production (kwhrs)
April	8.2	9.1	80	55	90	110
May	7.8	8.1	56	41	60	80
June	6.4	7.3	41	42	40	60
July	5.7	5.7	20	40	10	20
August	5.7	6.5	28	40	20	30
September	7.1	8.1	55	44	60	80
October	6.9	7.6	45	36	45	65
November	6.0	6.6	36	33	35	55
December	8.6	9.1	80	49	90	110
Annualized	7.2	7.9	56.8		Total 720	Total 950
Annual 80ft	9.0	9.9			**1145	***1500
Annual 100ft	9.5	10.5			**1290	***1700

** Rough numbers for general comparison*
Annual projections at 80 and 100 feet based on 0.25 shear
*** Bergey numbers from Bergey website production calculator*
**** AWP numbers are a guess based on scaleup*

Given the lower wind speed averages measured from this site, its not an obvious choice for wind power. It is obvious that a larger rotor, low wind speed turbine such as the AWP 3.6 should be used to gather what energy is available. This site is out in the middle of the farm field and will require a considerable amount of wire to be trenched back to the house and electrical connection, this expense alone will exceed the price of the turbine if we use the standard $3 per foot price (and the expected turbine price is under $3,000). For economic comparison purposes, a kilowatt-hour of electricity is typically 8 to 10 cents at a farm residence, when purchased from the local electric co-op. The turbines above would produce $100-$170 worth of electricity per year. Economically it's a much better choice to change a few household use patterns or appliances to obtain that same savings (or greater). A wind turbine might still be desired for the purpose of generating electricity from the wind (its such a great idea), you have to spend money to make money the saying goes.