



Wind Resource Summary for Holyoke Site
Final Report

Colorado Anemometer Loan Program

Monitoring Period: 6/21/2006 - 10/06/2007

Report Date: December 2, 2007

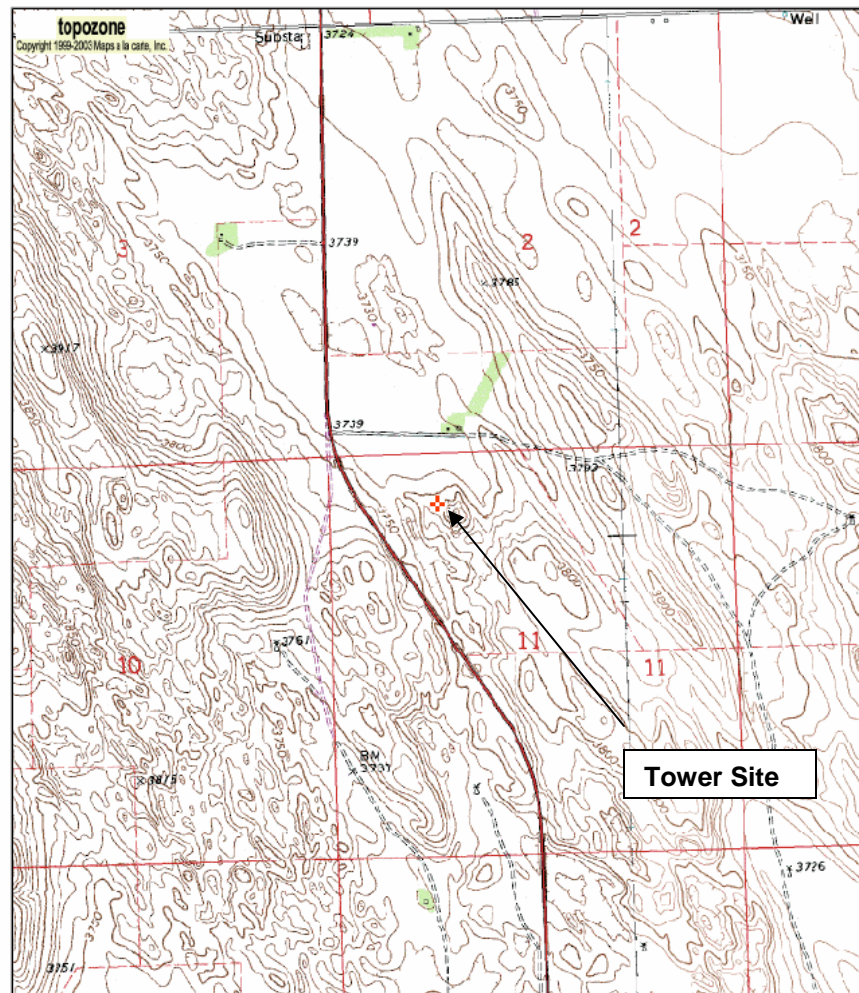
Site Description:

The site is 17.4 miles south of the town of Holyoke, Colorado, and it is east of U.S. Highway 385. The terrain is relatively flat, with less than 80 feet of relief over a mile. The tower is located in pasture, but cropland can be found immediately north of the site. A farmstead is located about 1,000 feet north-northeast of the site.

Table with 2 columns: Detail Name and Value. Includes Latitude, Longitude, Township, Range, Section, Elevation, Tower Type, Tower Height, Vane Offset, Direction Basis, and Mag. Declination.

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Report Date: 12/2/2007



Scale bars in km and miles. Coordinates: 40° 20' 05"N, 102° 15' 33"W (NAD83/WGS84) USGS Wauneta (CO) Quadrangle Projection is UTM Zone 13 NAD83 Datum

M=7.925 G=1.775

## Wind Resource Summary

All analysis performed using Windographer 1.13

Data Properties	
Data Set Starts:	6/21/2006 0:00
Data Set Ends:	10/2/2007 7:00
Data Set Duration:	15.5 months
Length of Time Step:	10 minutes
Elevation (ft.):	3,776
Calm threshold (mph):	0
Wind Power Coefficients	
Power Density at 50m:	281 W/m <sup>2</sup>
Wind Power Class:	2 (Marginal)
Wind Power Coefficients	
Power Law Exponent:	0.14
Surface Roughness:	0.01 m
Roughness Class:	0.078
Roughness Description:	Rough Pasture

*Note: Air temperature was not factored into wind calculations*

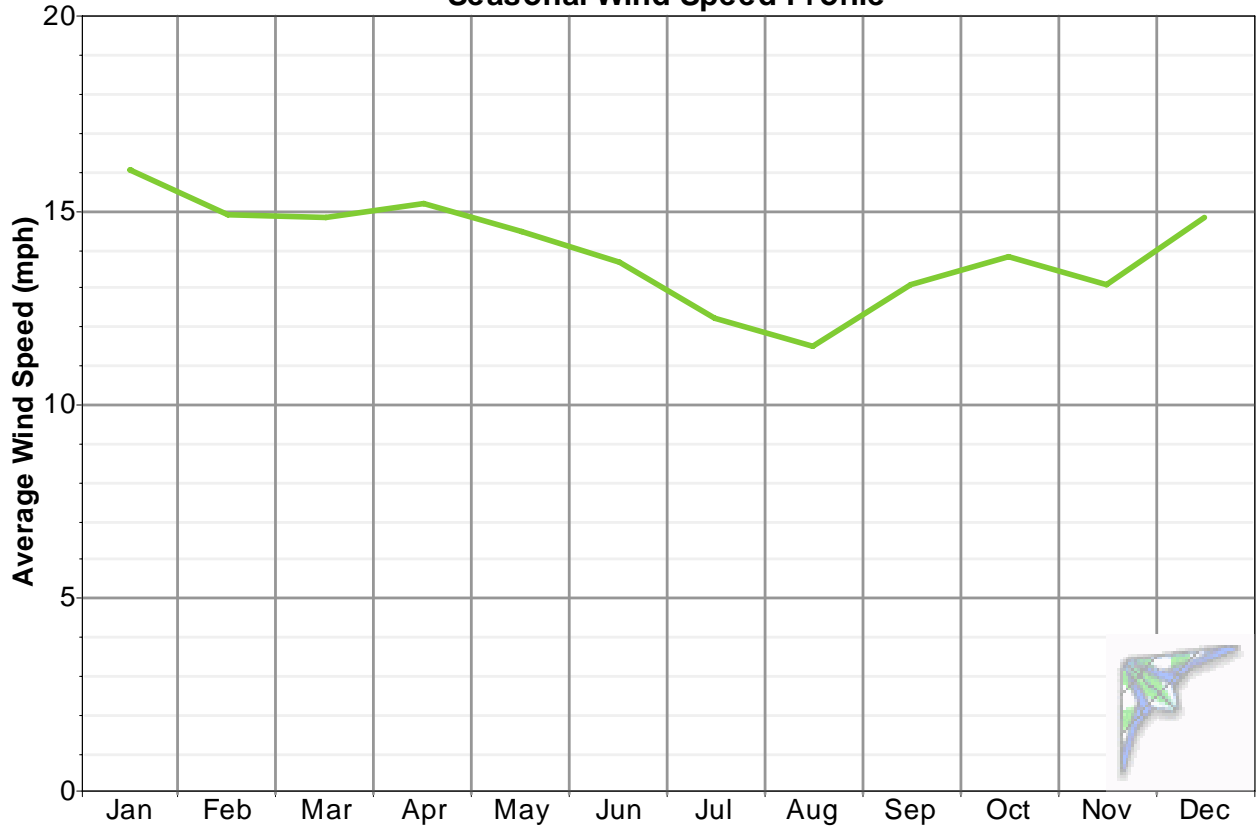
## Wind Resource Statistics

Variable	Wind Speed at 30m
Height above ground (m)	30
Mean wind speed (mph)	13.64
Median wind speed (mph)	12.92
Min wind speed (mph)	0
Max wind speed (mph)	50.87
Mean power density (W/m <sup>2</sup> )	227
Mean energy content (kWh/m <sup>2</sup> /yr)	1,990
Energy pattern factor	1.83
Weibull k	2.097
Weibull c (mph)	15.36
1-hr autocorrelation coefficient	0.825
Diurnal pattern strength	0.062
Hour of peak wind speed	15
Mean turbulence intensity	0.144
Standard deviation (mph)	6.76
Coefficient of variation (%)	49.6
Frequency of calms (%)	0.45
Actual observations	67,934
Missing observations	76
Data completeness (%)	99.9

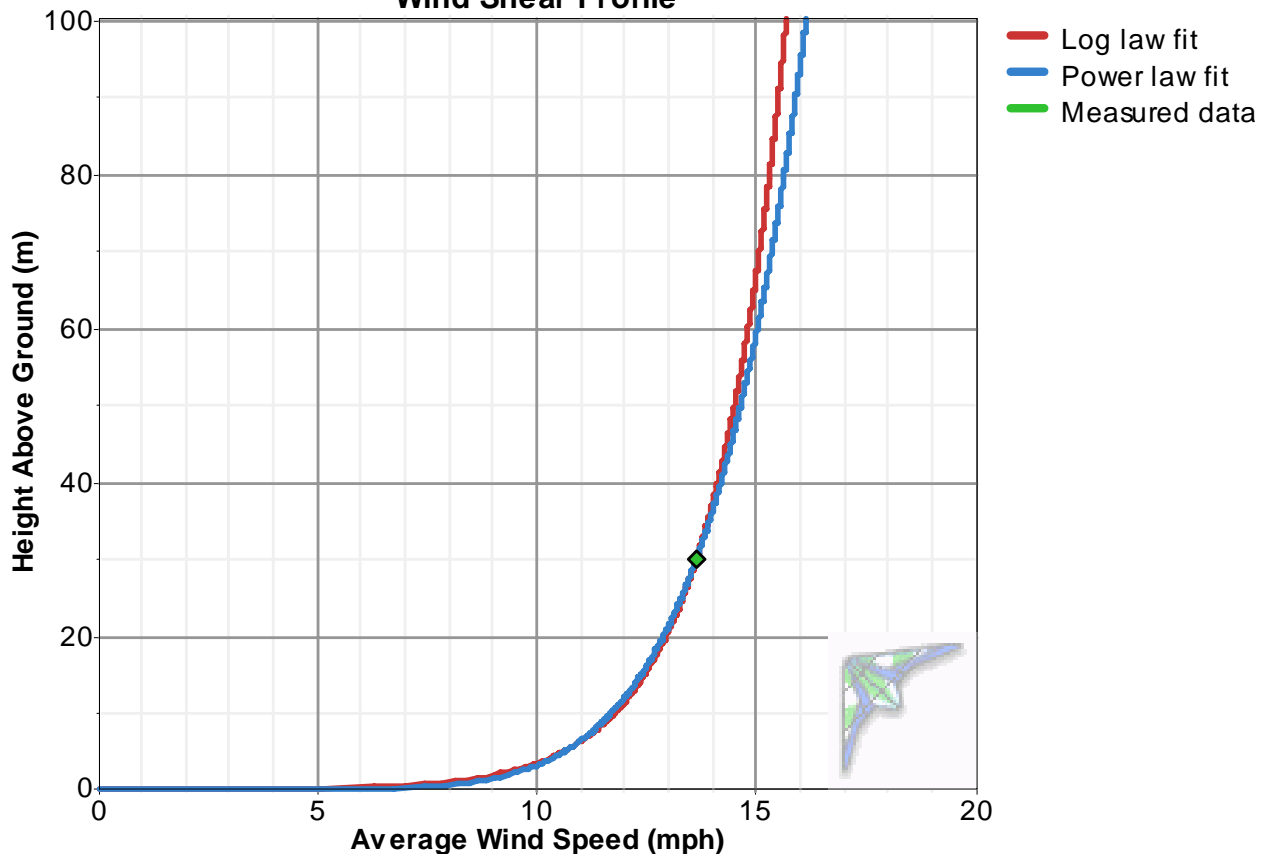
Hour of Day	Average Wind speed mph
0.5	13.458
1.5	13.060
2.5	12.794
3.5	12.809
4.5	12.717
5.5	12.485
6.5	12.562
7.5	12.903
8.5	13.573
9.5	14.135
10.5	14.219
11.5	14.543
12.5	14.508
13.5	14.689
14.5	14.620
15.5	14.553
16.5	14.438
17.5	13.715
18.5	13.513
19.5	13.547
20.5	13.700
21.5	13.753
22.5	13.475
23.5	13.502

Direction Sector Midpoint degrees	Frequency percent
0	7.6515
10	0
20	6.8655
30	0
40	0
50	6.5681
60	0
70	4.6369
80	0
90	3.4239
100	0
110	4.2527
120	0
130	0
140	3.9789
150	0
160	5.9999
170	0
180	8.8483
190	0
200	12.9508
210	0
220	0
230	9.3782
240	0
250	4.4087
260	0
270	3.2811
280	0
290	4.048
300	0
310	0
320	6.0515
330	0
340	7.2026
350	0

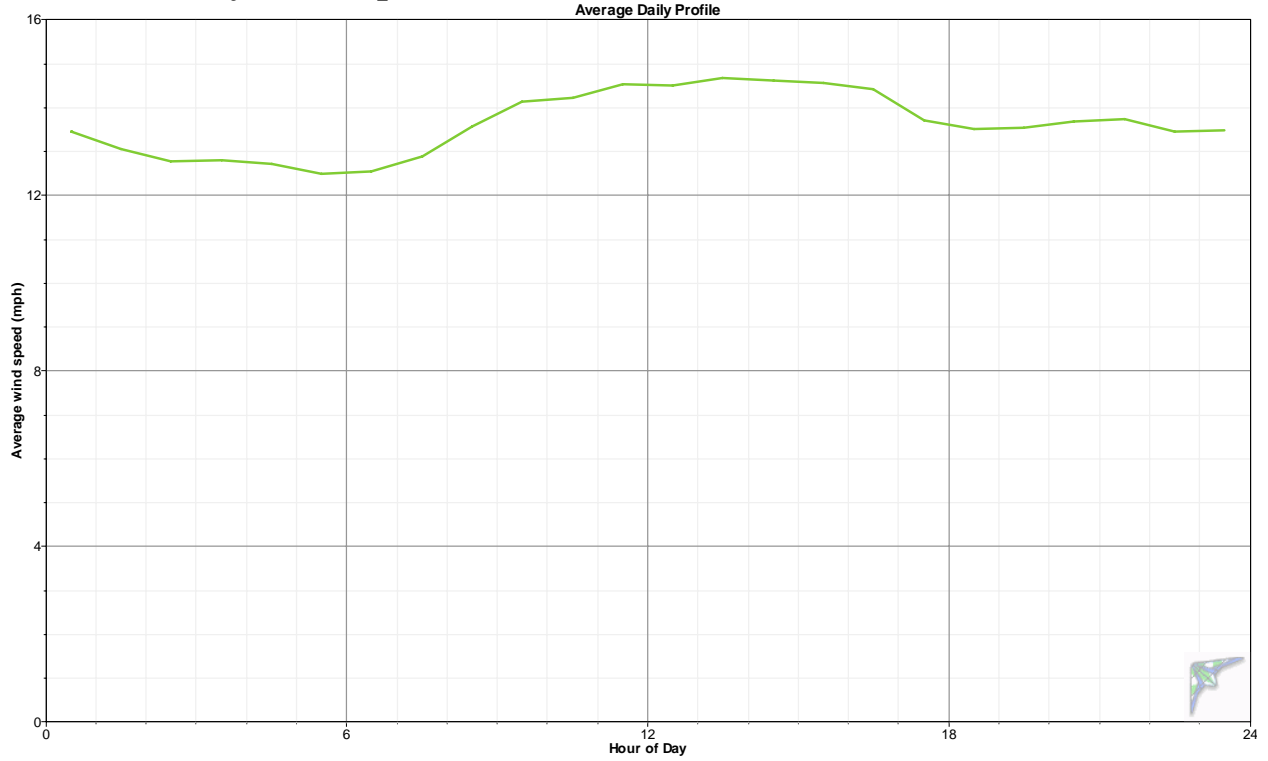
### Seasonal Wind Speed Profile



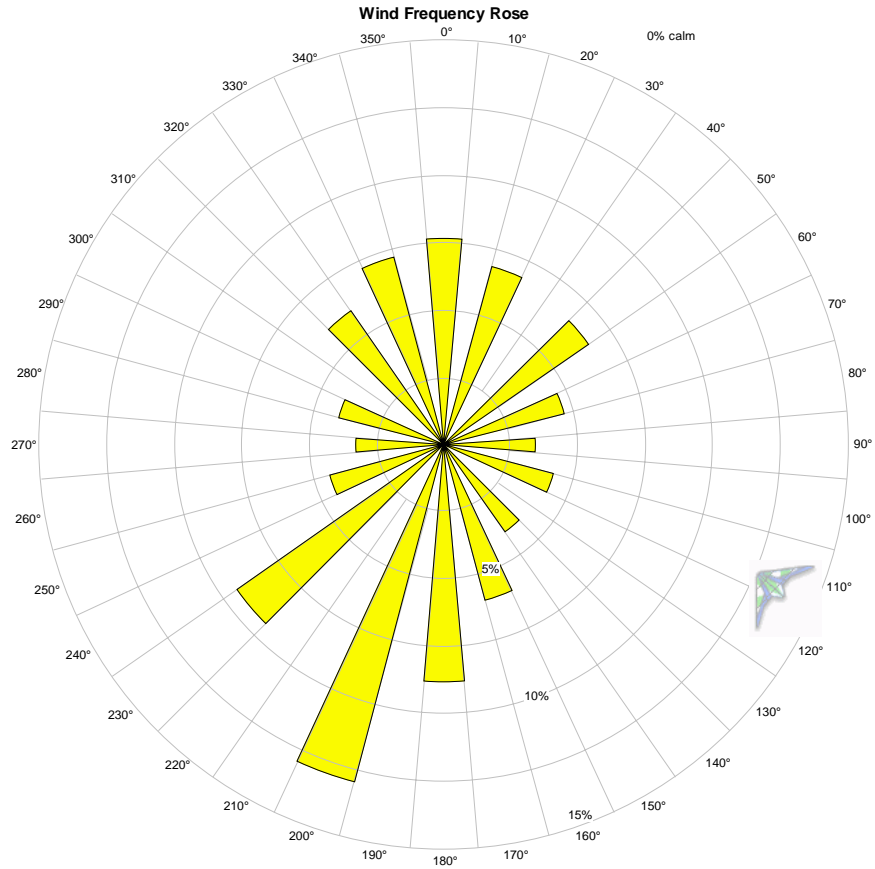
### Wind Shear Profile



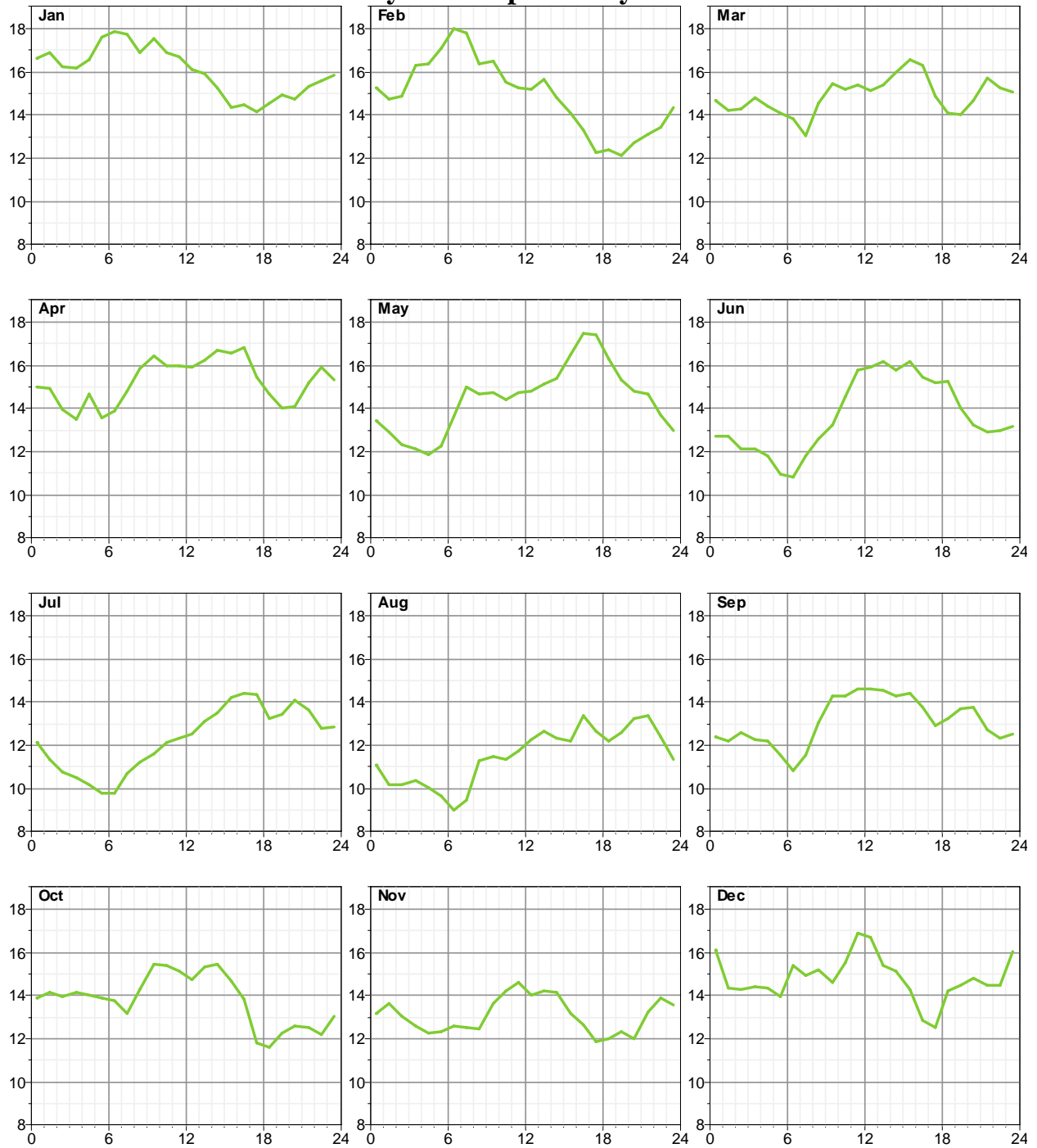
# Daily Wind Speed Profile – Total For Measurement Period



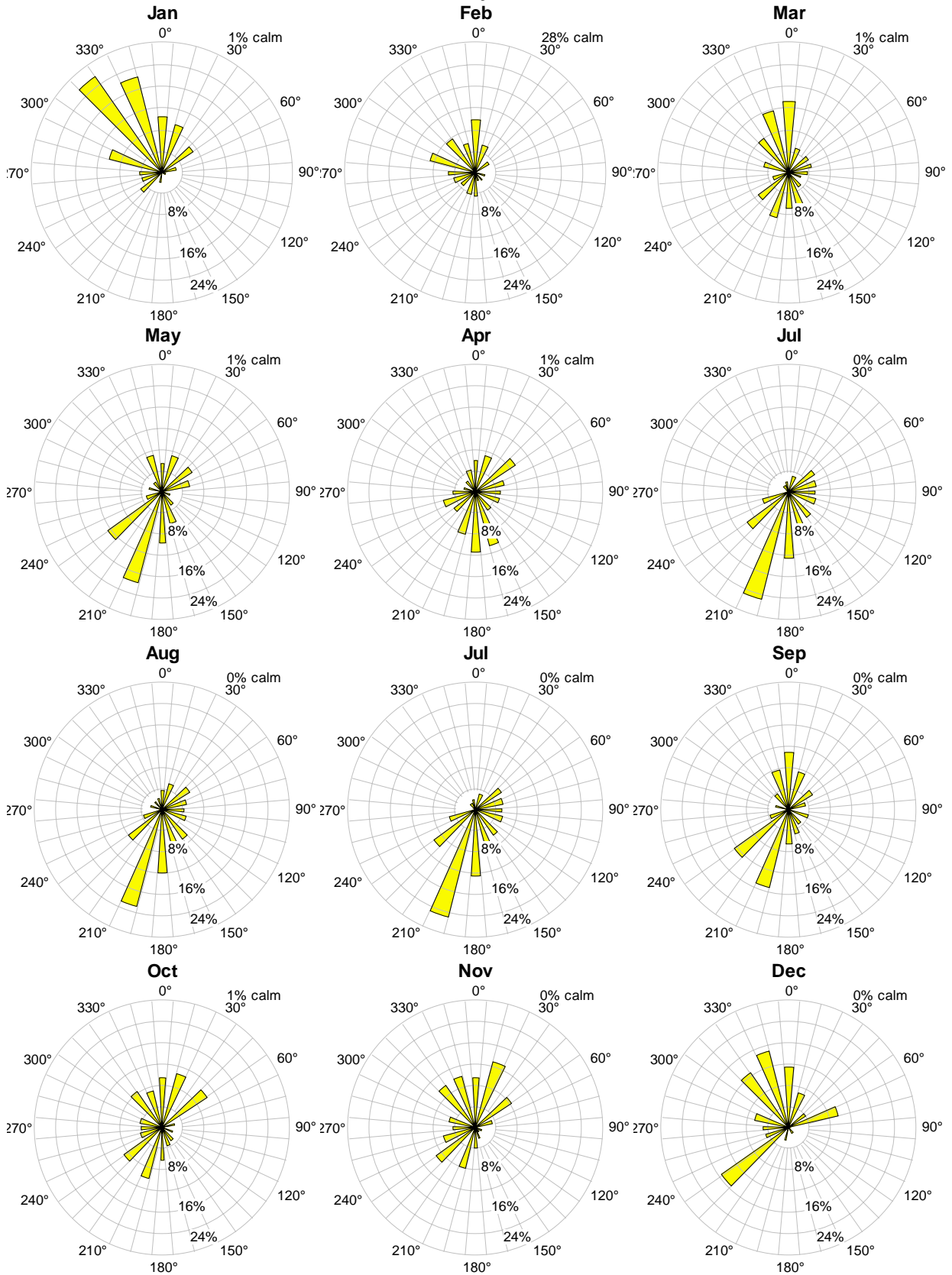
# Wind Direction – For Total Measurement Period



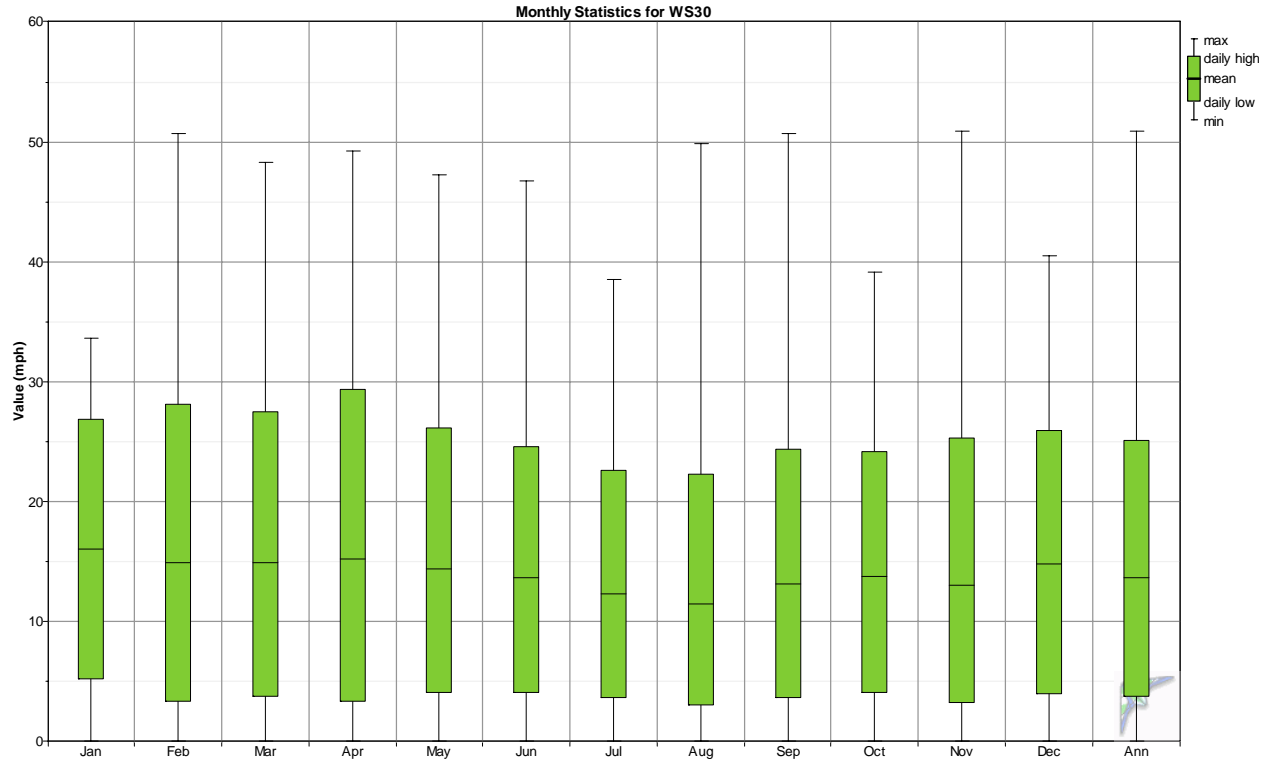
# Hourly Wind Speed – By Month



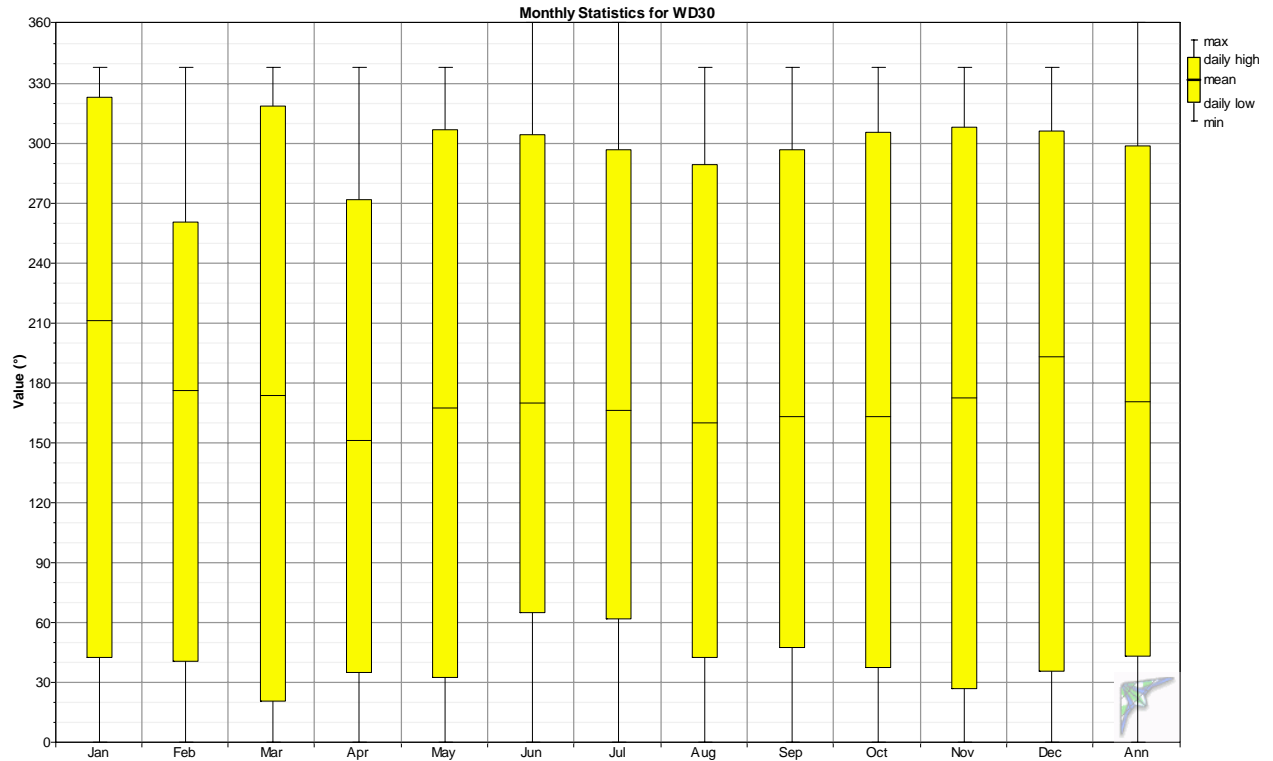
# Wind Direction – By Month (All Years)



## Box Plot for Wind Speed – By Month



## Box Plot for Wind Direction – By Month



## Estimated Wind Turbine Performance

The wind resource data from this site was compared against typical small wind turbines at 30m tower height to project the total energy production potential. The table below lists the turbines considered, the estimated turbine costs and the expected turbine performance:

Turbine	Estimated Turbine Cost (w/o tower)	Rotor Diameter meters	Rotor Power kW	Hub Height meters	Hub Height Wind Speed mph	Time At Zero Output percent	Time At Rated Output percent	Average Net Power Output kW	Average Net Energy Output kW	Average Net Capacity Factor kW
Bergey Excel-R/120V	\$16,560	6.7	7.5	30	13.64	15.11	4.31	1.76	15,458	23.5
Bergey Excel-S/60	\$20,610	6.7	10	30	13.64	7.35	1.83	1.89	16,576	18.9
Bergey XL.1	\$2,650	2.5	1	30	13.64	2.66	6.01	0.264	2,316	26.4
Southwest Skystream 3.7	\$8,999	3.7	1.8	30	13.64	13.86	0	0.495	4,337	27.5
Southwest Whisper 500	\$6,062	4.5	3	30	13.64	15.06	5.22	0.856	7,501	28.5

**Note that the costs do *not* include the costs for the tower or labor for installation.**



*These turbines are not recommended or endorsed. Landowners interested in installing a turbine are encouraged to contact a wind equipment dealer or a wind developer for design assistance and equipment recommendations.*

*The costs shown above were obtained from publicly available costs on the Internet. For reference, the costs for these turbines were obtained from the following vendor:*

*Earth Solar Group  
6315 Canyon Dr.  
Amarillo, TX 79110  
1.800.329.3283  
<http://www.earthsolar.com/>*