

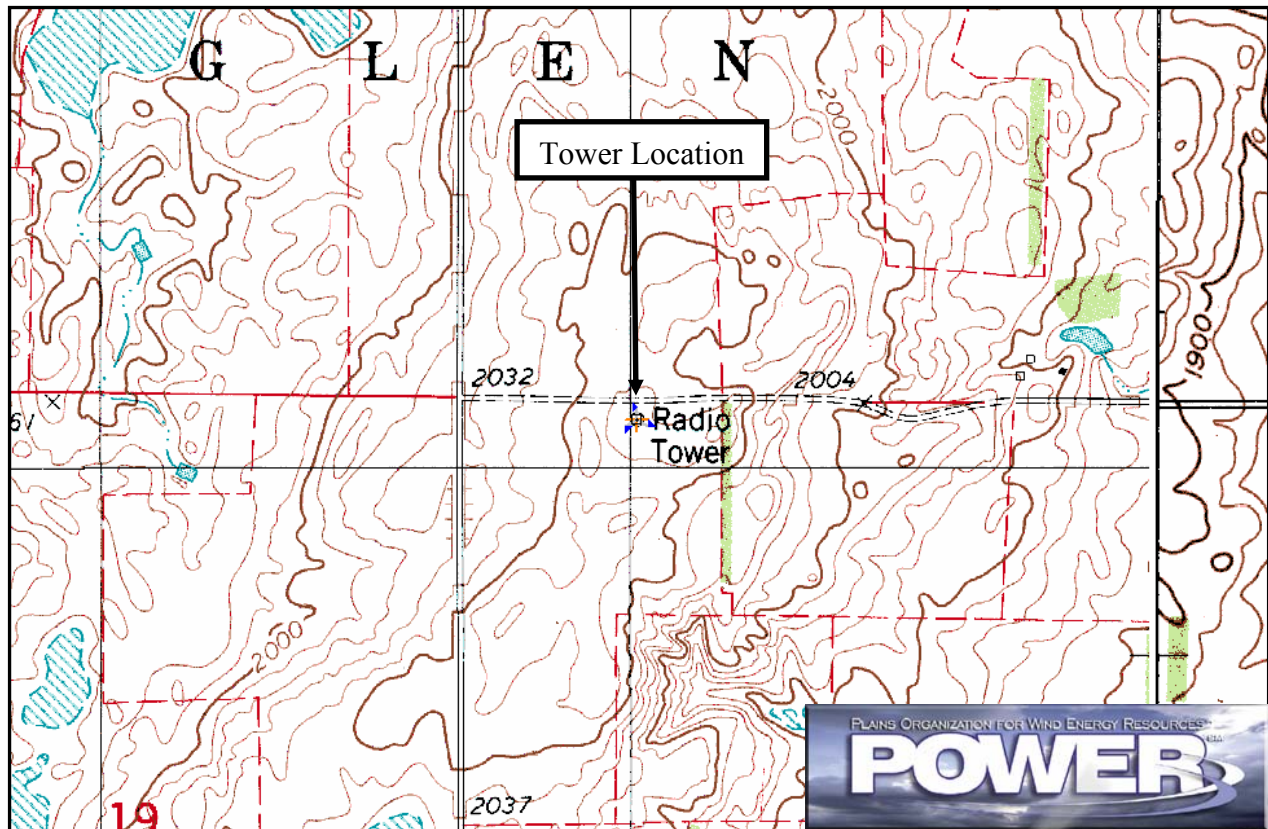
# Wind Resource Summary for Alfred Site

North Dakota Utility Study  
 Summers<sup>a</sup> 1995, 1996 & 1997

## Site Description:

Latitude: N 46° 35' 14"	Township: 136 N
Longitude: W 99° 0' 48"	Range: 66 W
Elevation: 2070 feet	Section: 20
Tower Type: Lattice Tower	Tower Height: 160 feet

The monitoring site was 6.7 miles southeast of the town of Gackle, North Dakota. An existing tower was used and instrumented at three levels: 33 ft (10 m), 82 ft (25 m), and 131 ft (40 m). The tower was located on a ridge with good wind exposure; however, an 1100-ft long, north-to-south windbreak was located 530 ft east of the tower.



Summary Wind Data:	33 ft AGL <sup>b</sup>	82 ft AGL	131 ft AGL
Mean Wind Speed	11.7 mph	15.1 mph	15.6 mph
Maximum, 60-min Mean Wind Speed	44.0 mph at 131 ft AGL – 7/2/1997 7:00 a.m.		
Estimated Wind Power Class <sup>c</sup>	Class 3 (309 W/m <sup>2</sup> at 131 ft AGL)		

<sup>a</sup> Summer is defined as the months of June, July, and August. Summer 1995 begins with June 1995. Data recovery rates at 33, 82, and 131 feet were 87%, 54%, and 88%, respectively.

<sup>b</sup> Above ground level.

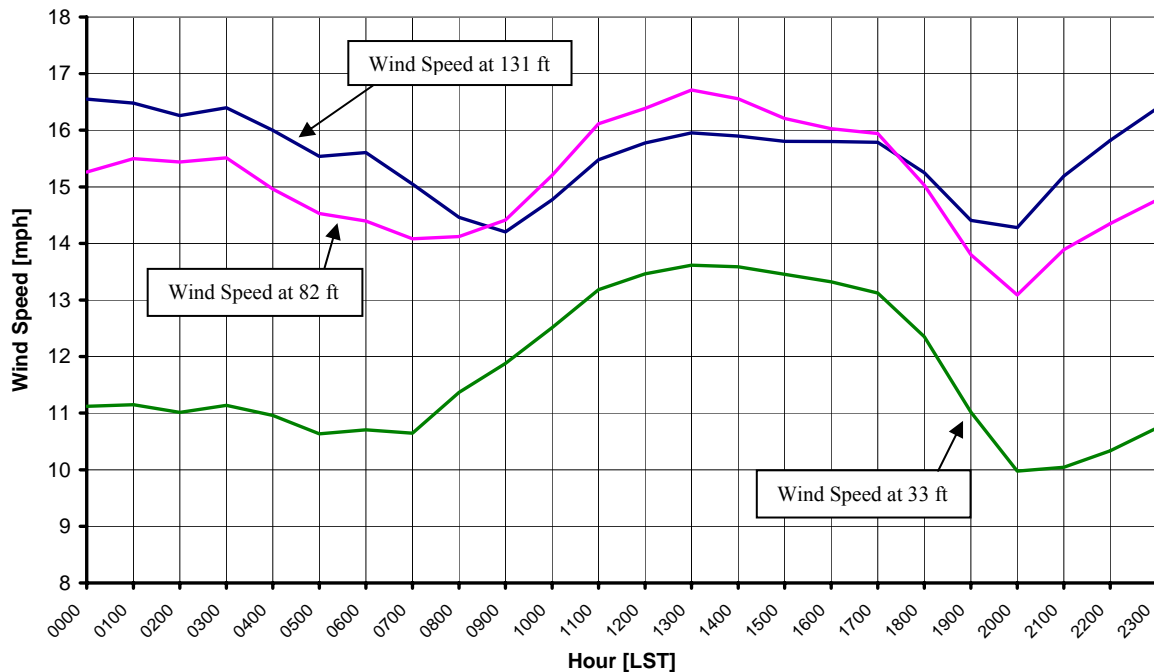
<sup>c</sup> Air temperature was not factored into calculations.

## Average Hourly Wind Speeds

LST <sup>d</sup>	131 ft AGL		82 ft AGL		33 ft AGL	
	mph	m/s	mph	m/s	mph	m/s
0000	16.5	7.40	15.3	6.82	11.1	4.97
0100	16.5	7.37	15.5	6.93	11.1	4.98
0200	16.3	7.27	15.4	6.90	11.0	4.92
0300	16.4	7.33	15.5	6.93	11.1	4.98
0400	16.0	7.15	15.0	6.69	11.0	4.90
0500	15.5	6.95	14.5	6.49	10.6	4.75
0600	15.6	6.98	14.4	6.44	10.7	4.79
0700	15.0	6.73	14.1	6.29	10.6	4.76
0800	14.5	6.46	14.1	6.31	11.4	5.08
0900*	14.2	6.35	14.4	6.44	11.9	5.31
1000*	14.8	6.60	15.2	6.80	12.5	5.59
1100*	15.5	6.92	16.1	7.20	13.2	5.89
1200*	15.8	7.05	16.4	7.33	13.5	6.02
1300*	16.0	7.13	16.7	7.47	13.6	6.09
1400*	15.9	7.11	16.6	7.40	13.6	6.07
1500*	15.8	7.07	16.2	7.25	13.5	6.01
1600*	15.8	7.06	16.0	7.17	13.3	5.96
1700*	15.8	7.06	15.9	7.13	13.1	5.87
1800	15.3	6.82	15.0	6.72	12.4	5.52
1900	14.4	6.44	13.8	6.17	11.0	4.93
2000	14.3	6.38	13.1	5.85	10.0	4.46
2100	15.2	6.79	13.9	6.21	10.0	4.49
2200	15.8	7.07	14.4	6.42	10.3	4.62
2300	16.4	7.33	14.8	6.60	10.7	4.80

\* A decrease in average wind speed with height is due to differences in data recovery.

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<sup>d</sup> Local standard time.



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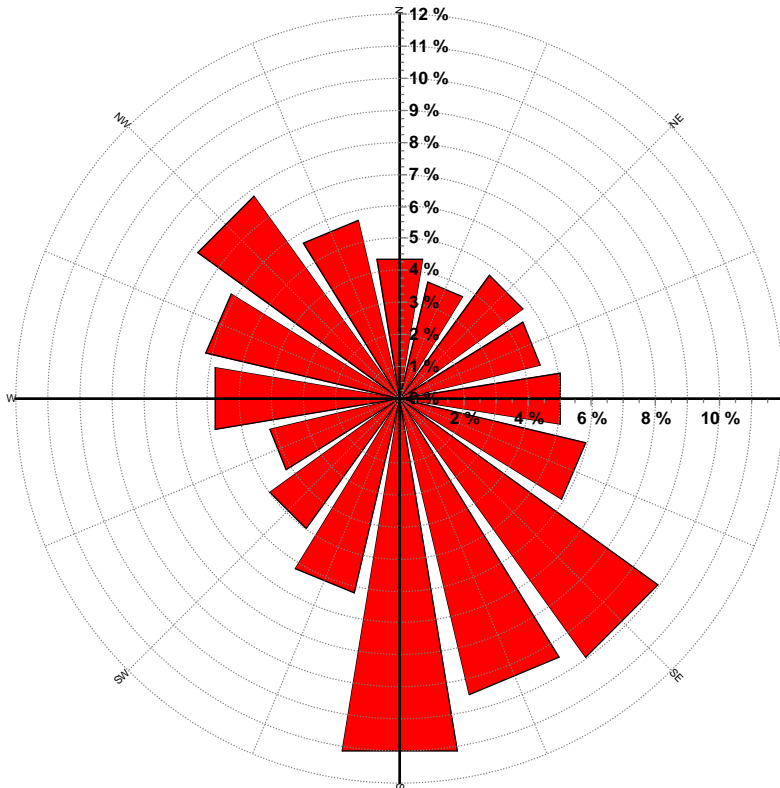
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## Wind Directional Frequency

**Winds from the... Frequency (%)**

NNW	5.7
NW	7.8
WNW	6.2
W	5.9
WSW	4.2
SW	5.0
SSW	6.2
S	11.2
SSE	9.5
SE	9.9
ESE	6.0
E	5.1
ENE	4.5
NE	4.8
NNE	3.7
N	4.4

North Dakota Utility Study – Alfred Site  
Wind Rose for 131 ft AGL  
Summers 1995, 1996 & 1997

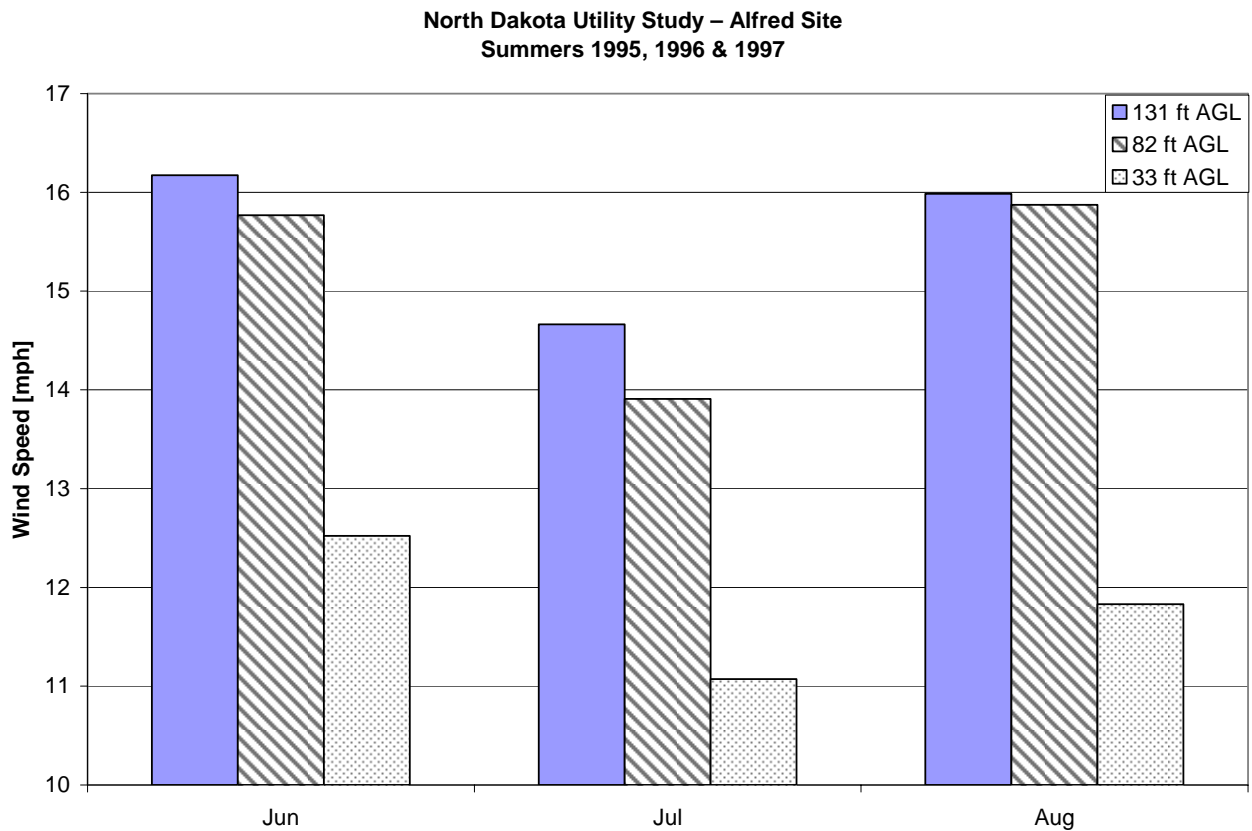


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## Monthly Wind Speed Averages

Month	131 ft AGL		82 ft AGL		33 ft AGL	
	mph	m/s	mph	m/s	mph	m/s
Jun	16.2	7.23	15.8	7.05	12.5	5.60
Jul	14.7	6.56	13.9	6.22	11.1	4.95
Aug	16.0	7.15	15.9	7.10	11.8	5.29



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