

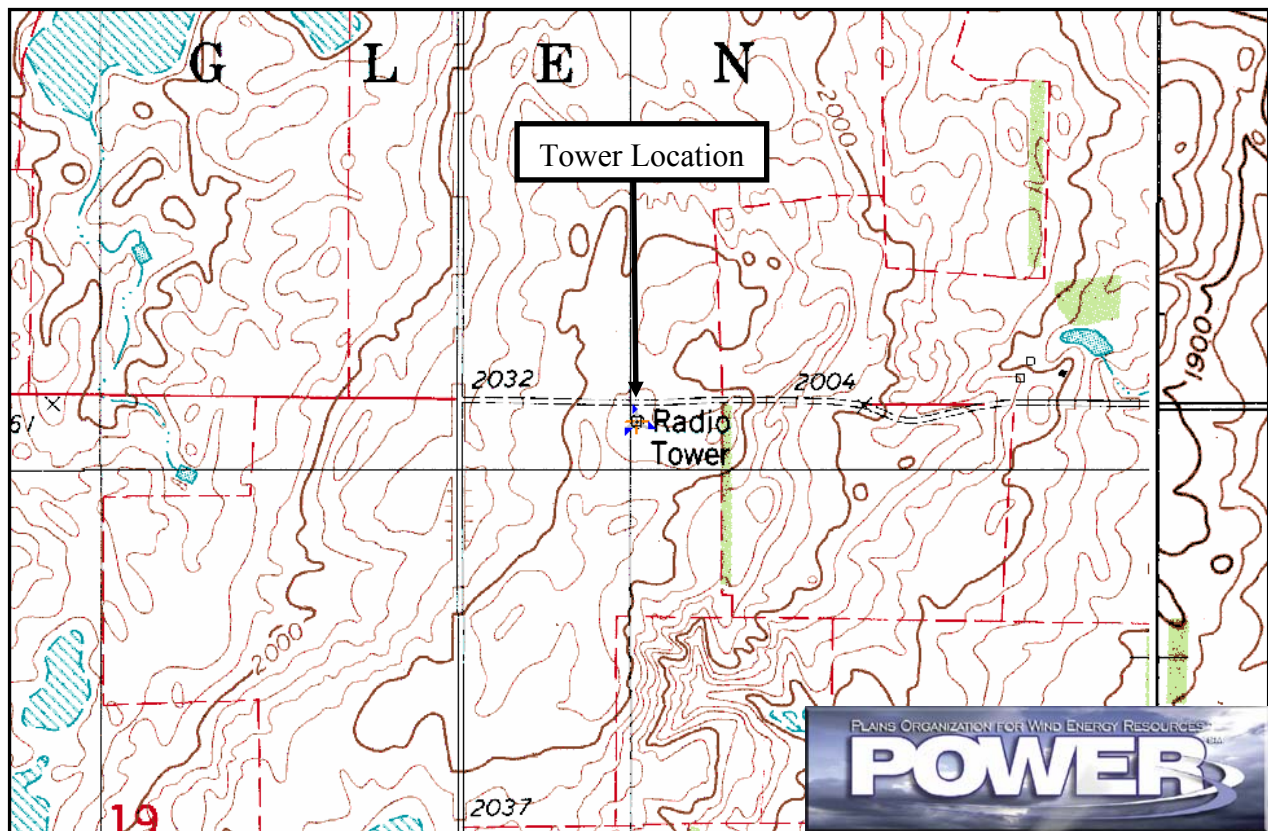
# Wind Resource Summary for Alfred Site

North Dakota Utility Study  
Winters<sup>a</sup> 1994, 1995 & 1996

## 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	17.0 mph	19.5 mph	20.5 mph
Maximum, 60-min Mean Wind Speed	63.7 mph at 131 ft AGL – 2/10/1996 7:00 a.m.		
Estimated Wind Power Class <sup>c</sup>	Class 6 (725 W/m <sup>2</sup> at 131 ft AGL)		

<sup>a</sup> Winter is defined as the months of December, January, and February. Winter 1994 begins with December 1994.

Data recovery rates at 33, 82, and 131 feet were 73%, 76%, and 82%, respectively.

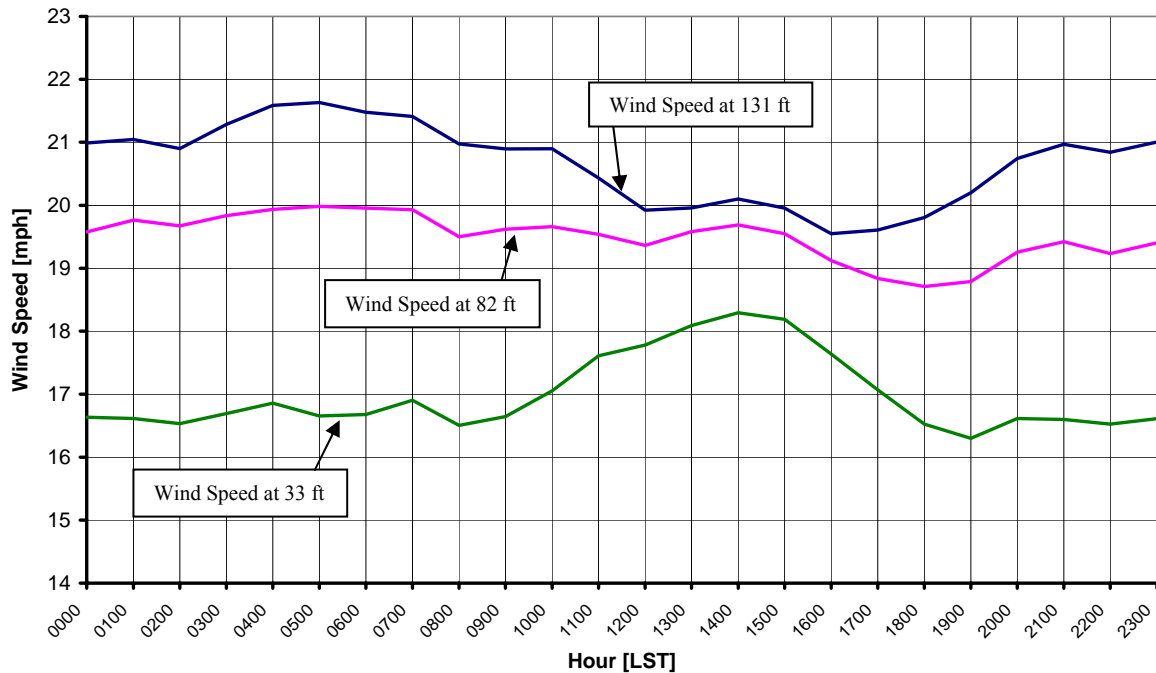
<sup>b</sup> Above ground level.

<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	21.0	9.38	19.6	8.75	16.6	7.44
0100	21.0	9.41	19.8	8.84	16.6	7.43
0200	20.9	9.34	19.7	8.79	16.5	7.39
0300	21.3	9.52	19.8	8.87	16.7	7.46
0400	21.6	9.65	19.9	8.91	16.9	7.54
0500	21.6	9.67	20.0	8.93	16.7	7.45
0600	21.5	9.60	20.0	8.92	16.7	7.46
0700	21.4	9.57	19.9	8.91	16.9	7.56
0800	21.0	9.38	19.5	8.72	16.5	7.38
0900	20.9	9.34	19.6	8.77	16.6	7.44
1000	20.9	9.34	19.7	8.79	17.1	7.62
1100	20.4	9.13	19.5	8.73	17.6	7.87
1200	19.9	8.91	19.4	8.66	17.8	7.95
1300	20.0	8.92	19.6	8.75	18.1	8.09
1400	20.1	8.99	19.7	8.80	18.3	8.18
1500	20.0	8.92	19.5	8.74	18.2	8.13
1600	19.5	8.74	19.1	8.55	17.6	7.88
1700	19.6	8.76	18.8	8.42	17.1	7.63
1800	19.8	8.85	18.7	8.36	16.5	7.39
1900	20.2	9.03	18.8	8.40	16.3	7.29
2000	20.7	9.27	19.3	8.61	16.6	7.43
2100	21.0	9.37	19.4	8.68	16.6	7.42
2200	20.8	9.32	19.2	8.60	16.5	7.39
2300	21.0	9.39	19.4	8.67	16.6	7.43

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



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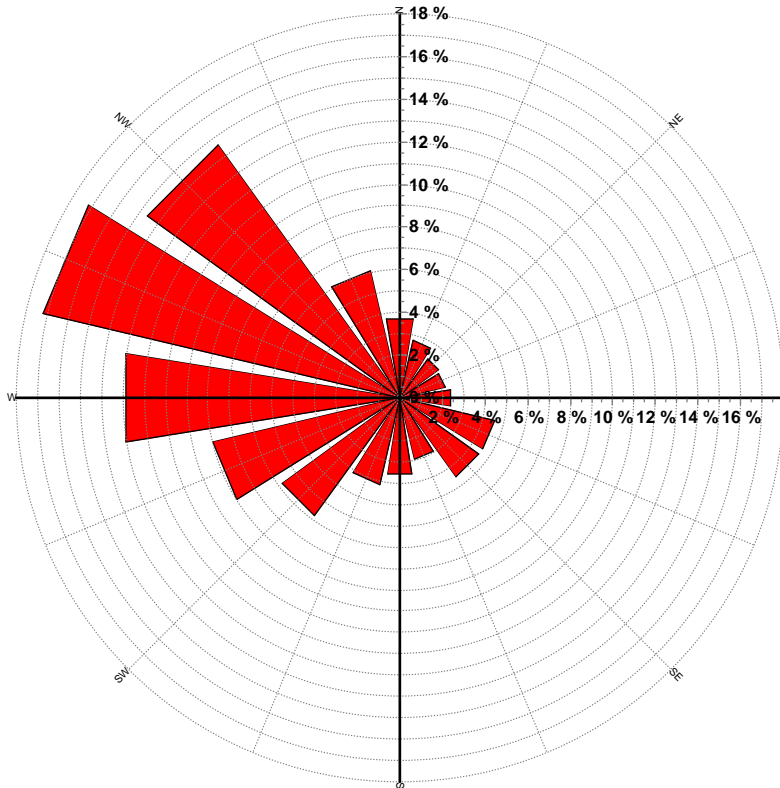
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## Wind Directional Frequency

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

NNW	6.1
NW	14.6
WNW	17.2
W	13.1
WSW	9.0
SW	6.8
SSW	4.2
S	3.6
SSE	3.0
SE	4.5
ESE	4.6
E	2.4
ENE	2.2
NE	2.3
NNE	2.7
N	3.7

North Dakota Utility Study – Alfred Site  
Wind Rose for 131 ft AGL  
Winters 1994, 1995 & 1996

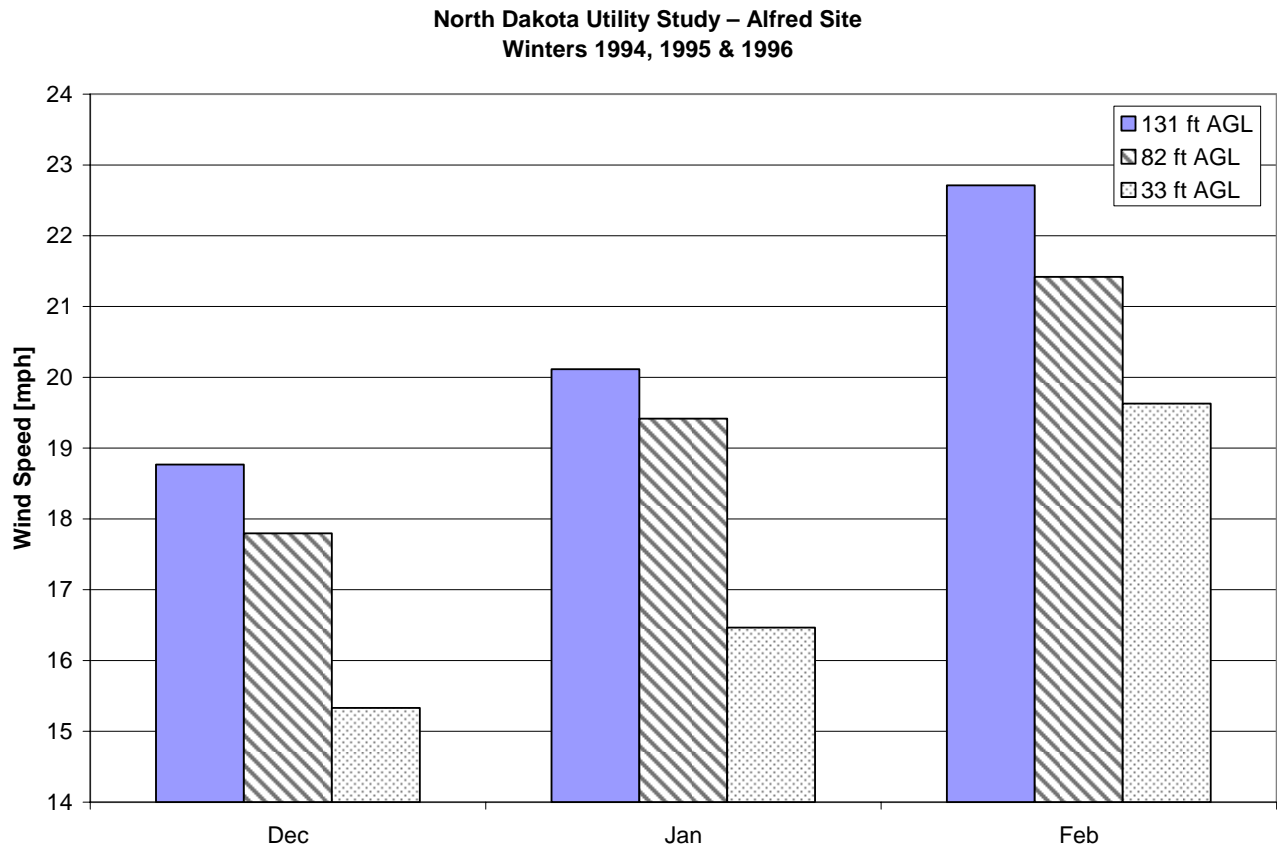


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## Monthly Wind Speed Averages

Month	131 ft AGL		82 ft AGL		33 ft AGL	
	mph	m/s	mph	m/s	mph	m/s
Dec	18.8	8.39	17.8	7.96	15.3	6.85
Jan	20.1	8.99	19.4	8.68	16.5	7.36
Feb	22.7	10.15	21.4	9.57	19.6	8.78



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