GLOBAL ENERGY CONCEPTS

THE Wind Resource

Argonne Mesa
Wind Monitoring Program

FINAL REPORT

For

September 2002 – August 2004

Prepared for:

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SECTION I: PROJECT BACKGROUND

New Mexico Energy, Minerals and Natural Resources Department (EMNRD), hired Global Energy Concepts (GEC) to conduct a two-year wind monitoring program at a site on Argonne Mesa, near Santa Rosa, New Mexico. The wind resource assessment study includes monthly data validation and transmittal, one annual report, and one final report.

An annual report covering the period of September 2002 through August 2003 was submitted in September 2004. This final report presents the data collected September 2003 through August 2004 and includes a comparison of the two years of data collection.

The monitoring site is located on Argonne Mesa southwest of Santa Rosa, at 34º 49' 39" N – 104º 59' 55" W with an elevation of 1,786 m (5,860 ft). The site was commissioned on August 7, 2002. Figure 1 provides a map indicating the general site location.

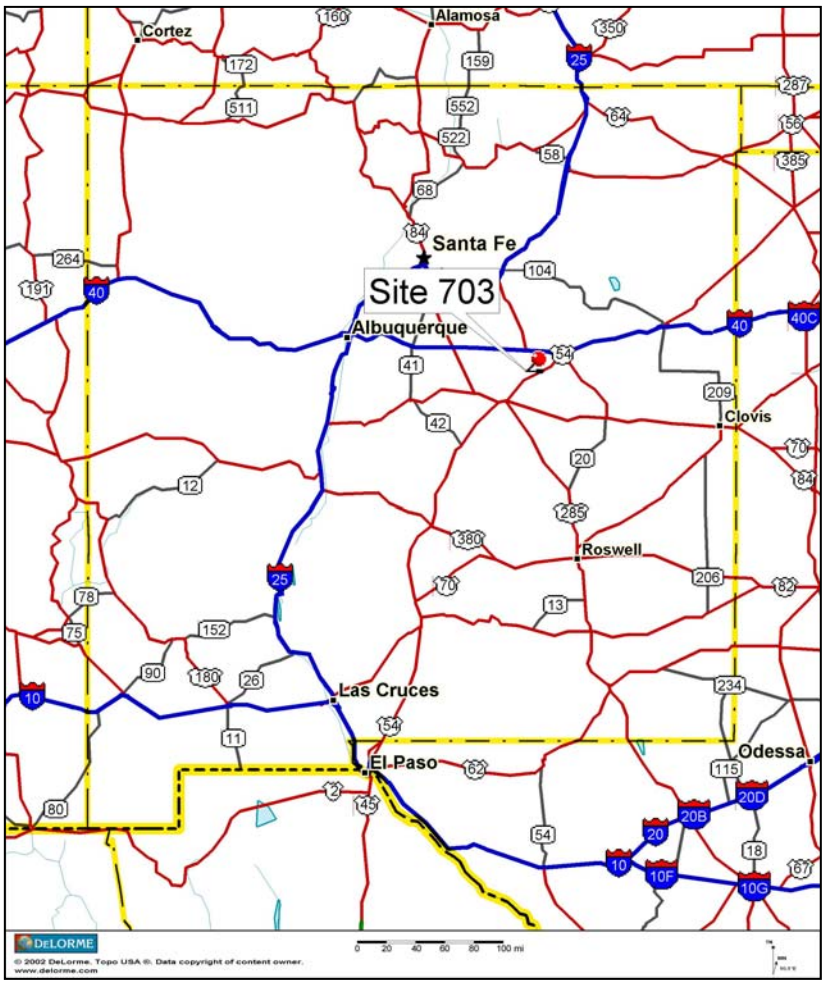

Figure 1. Location of Argonne Mesa Wind Monitoring Station

EQUIPMENT

The Argonne Mesa monitoring station is equipped with four wind speed sensors, two wind direction sensors, one temperature sensor, and a cellular data logger with a solar panel and battery. The station measures wind speed at 10, 25, and 40 m (two) and wind direction at 25 and 40 m. The 40 m anemometers are calibrated and the temperature sensor is located at 3 m.

DATA COLLECTION

The data were collected remotely through the cellular data logger. The logger was programmed to call a BaseStation computer at GEC and download data on a weekly basis. The data were maintained with a data collection log that tracked the call status, battery voltage, temperature, and cellular signal strength. Data recovery of 99% was achieved at all three sensor levels during the second annual period.

DATA PROCESSING

All data were reviewed for accuracy and invalid data removed to create a validated data set. Data are considered invalid if they do not represent the actual wind conditions at the site. Typical causes of invalid data include sensor icing, tower shadow, and equipment damage due to lightning, electrostatic discharge, failed components, or vandalism. The specific causes of invalid data during the second year are discussed in the next section of the report under Data Recovery.

For the data summary, the validated data set was used. The erroneous or missing data were replaced to create a representative data set. Data are replaced using the following methods in the order presented. In the case where only a few hours are missing, the average of the hour before and the hour after the outage is used to replace the invalid data. When a longer period of data is affected and another wind speed sensor is operating at the site, the data are filled in based on a correlation between the sensors. When all sensors are affected by the outage, the standard methodology for data replacement is to develop a correlation to a nearby reference site that has data concurrent with the affected hours.

SECTION II: DATA SUMMARY

This section summarizes the data collected for September 1, 2003, through August 31, 2004.

DATA RECOVERY

Although 100% of the data were recorded and recovered from the logger, a small percentage of the data were invalid. Table 1 provides the recovery rates for valid wind speed data collected at 10, 25, and 40 m. The "Hours Lost" column indicates the number of hourly data points that were missing or removed during the data validation process for each monitoring height. For example, if at the 50-m level, data were removed from 12:00 – 2:00, this would be considered three hourly data points. The remaining data are expressed as a percentage of total sensor hours in the period on the "Recovery Rate" column. All data removed during the second year were due to icing.

Table 1. Wind Speed Data Recovery – September 2003-August 2004

Month	Total Hours In Period	Hours Lost			Recovery Rate	
		10m	25m	40m	All Heights	40m Level
September	720	0	0	0	100.0%	100.0%
October	744	0	0	0	100.0%	100.0%
November	720	18	17	19	97.5%	97.4%
December	744	0	0	0	100.0%	100.0%
January	744	4	4	4	99.5%	99.5%
February	696	36	36	36	94.8%	94.8%
March	744	0	0	5	99.8%	99.3%
April	720	13	0	0	99.4%	100.0%
May	744	0	0	0	100.0%	100.0%
June	720	0	0	0	100.0%	100.0%
July	744	0	0	0	100.0%	100.0%
August	744	0	0	0	100.0%	100.0%
Annual	**8,784**	**71**	**57**	**64**	**99.3%**	**99.3%**

WIND DATA SUMMARY

The average monthly wind speeds are summarized in Table 2 and illustrated in Figure 2. As shown in the table and figure, the winds were highest during the winter and spring and lowest during the summer and fall.

Table 2. Monthly Average Wind Speeds – September 2003-August 2004

	10M		25M		40M	
	m/s	**mph**	**m/s**	**mph**	**m/s**	**mph**
September	4.5	10.0	5.6	12.5	6.3	14.0
October	4.6	10.3	5.9	13.2	6.6	14.7
November	5.9	13.3	7.5	16.8	8.4	18.7
December	6.1	13.6	7.7	17.2	8.6	19.2
January	5.6	12.5	7.0	15.7	7.9	17.6
February	4.8	10.6	6.0	13.5	6.8	15.2
March	5.1	11.4	6.4	14.3	7.2	16.1
April	5.3	11.8	6.6	14.9	7.4	16.5
May	5.7	12.8	7.2	16.2	8.0	18.0
June	4.6	10.2	5.7	12.8	6.3	14.2
July	4.0	8.9	5.0	11.2	5.6	12.5
August	4.4	9.8	5.5	12.2	6.1	13.7
Annual	**5.0**	**11.3**	**6.3**	**14.2**	**7.1**	**15.9**

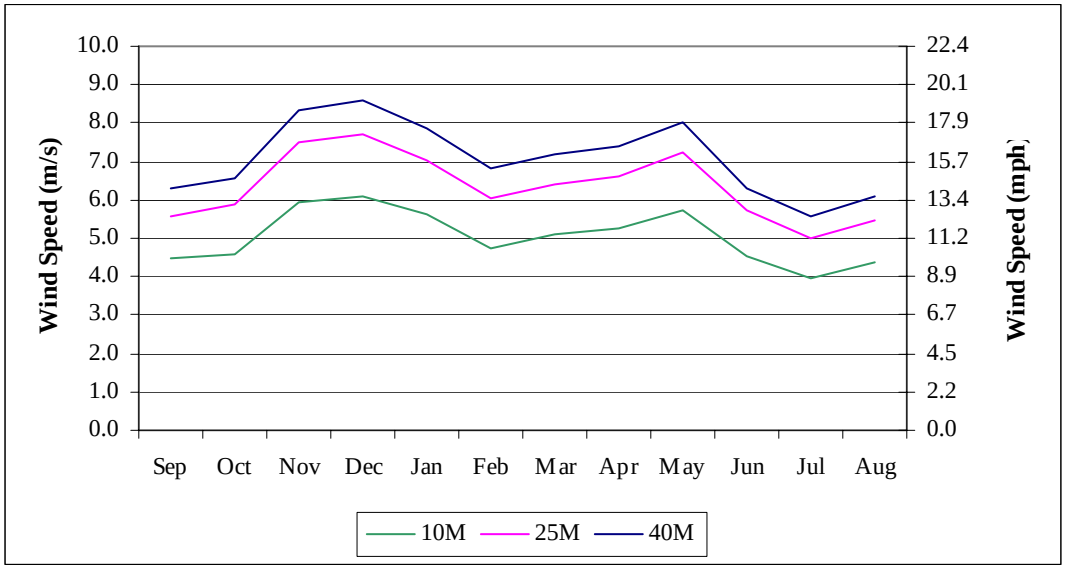

Figure 2. Monthly Wind Speeds – September 2003-August 2004

The average diurnal wind speeds are shown in Figure 3. As shown in the figure, the wind speeds are highest from about 3:00 p.m. throughout the night and into the early morning.

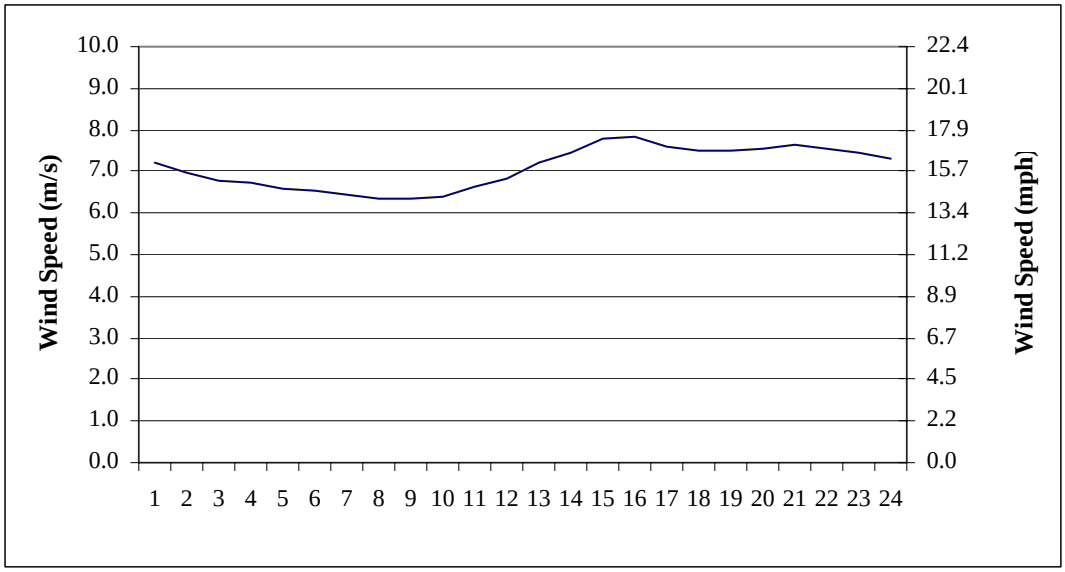

Figure 3. Diurnal Wind Speed Pattern – September 2003-August 2004

Figures 4 and 5 illustrate the monthly and annual wind direction patterns for Argonne Mesa during the period of record. The wind rose graphs consist of two bars in each of the 16 wind direction sectors that represent the percent of total time and the percent of total wind energy. During the second year, although there is monthly variability in the wind direction, on an annual basis the predominant wind energy direction at the site was west-northwest.

Wind shear exponent values are provided in Table 3. The wind shear exponent represents the degree to which wind speed increases with height. For the purposes of this report, the wind shear exponent was calculated between 25 and 40 m. The theoretically derived value for wind shear over smooth, flat terrain is 0.14. During this period the wind shear exponent in operable winds (winds above 4 m/s) was 0.24. During wind project development, wind shear is used when determining an appropriate wind turbine hub height.

Turbulence intensity (TI) is a relative indicator of turbulence and not an absolute value. The average turbulence intensity at the 50-m level is also provided in Table 3. The International Electrotechnical Commission (IEC) wind turbine design standards specify a turbine to be designed for TI levels up to 0.18 in 15 m/s winds. The TI values shown in the table are calculated from winds between 14 and 16 m/s. The number of data points used in the calculations is also indicated in the table. The TI values, which are based on hourly averages, are somewhat high and additional analysis prior to project development is warranted. GEC recommends performing a TI analysis based on the 10-minute data.

The temperature data collected during the second year are summarized in Table 4. As shown in the table, the average site temperature for the time period was 55°F (12.5°C). The maximum hourly average temperature was 93°F (34.0°C), which occurred in June. The minimum hourly temperature was 6°F (-14.5°C) and was recorded during February.

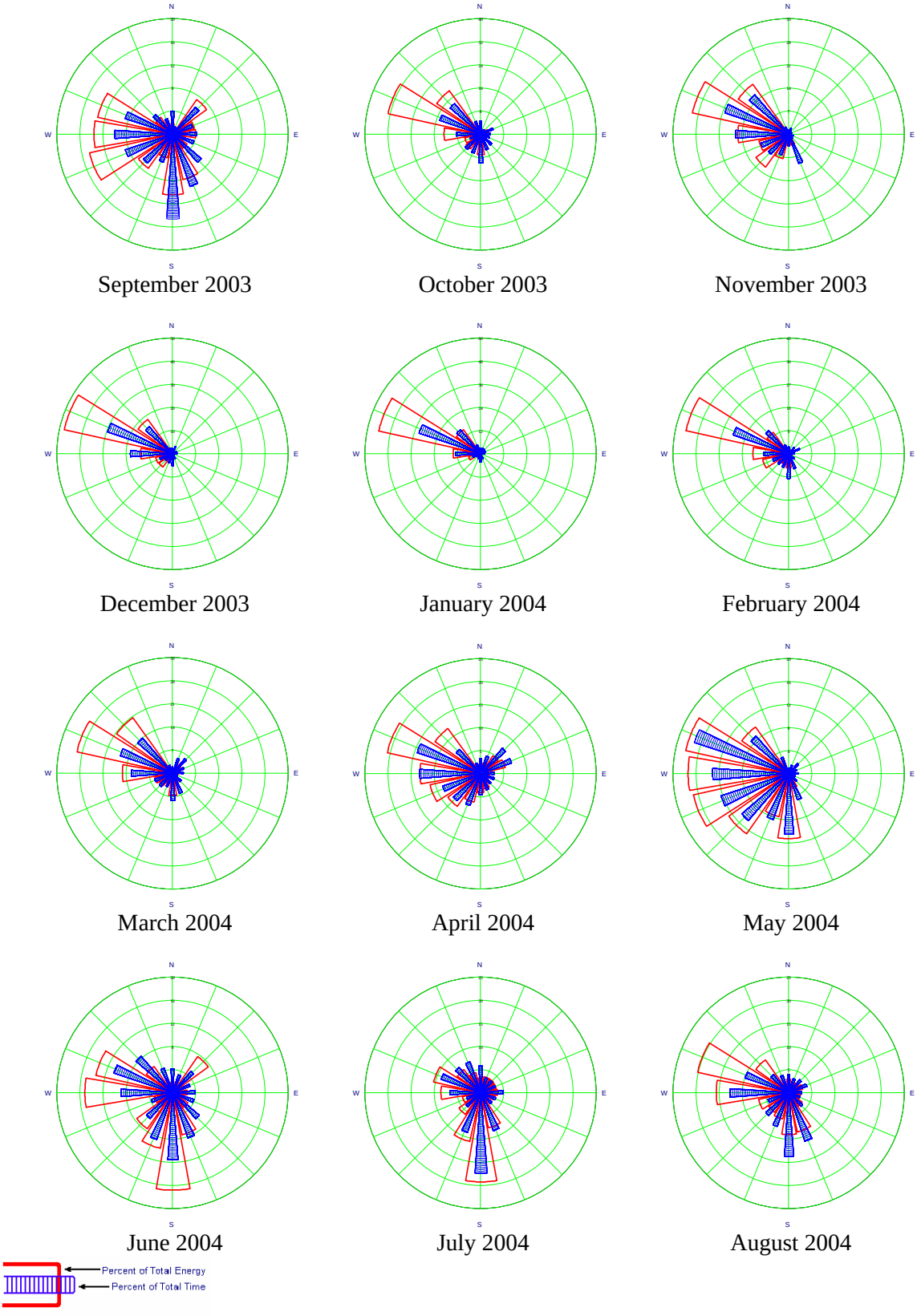

Figure 4. Monthly Wind Rose – September 2003-August 2004

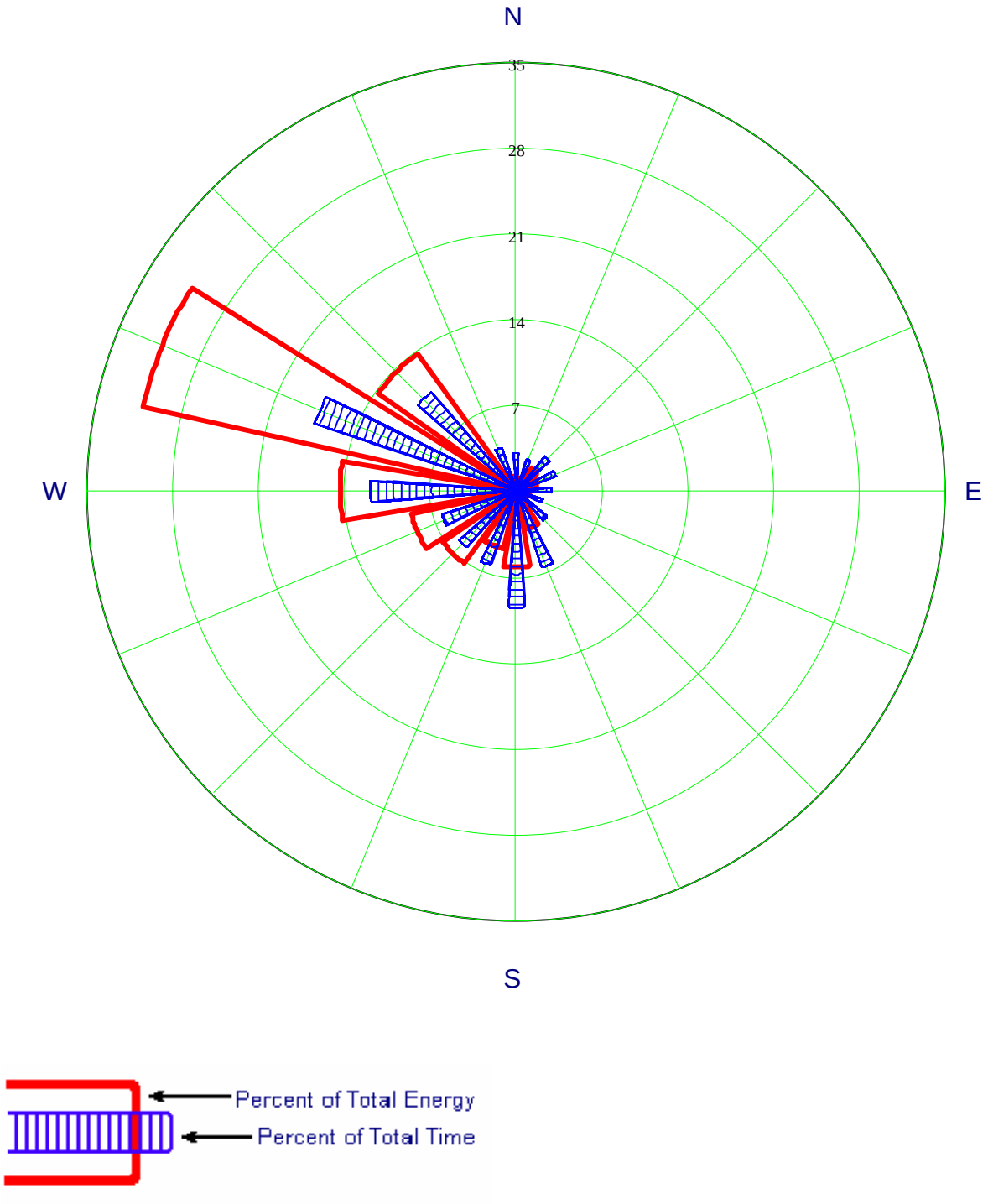

Figure 5. Annual Wind Rose – September 2003-August 2004

Table 3. Turbulence Intensity and Wind Shear – September 2003-August 2004

Month	25-40m Wind Shear [1]	Turbulence Intensity at 15 m/s [2]	Hours in 15 m/s bin
September	0.25	N/A	0
October	0.24	0.16	9
November	0.23	0.14	16
December	0.23	0.15	40
January	0.25	0.14	19
February	0.27	0.15	12
March	0.27	0.15	8
April	0.24	0.16	15
May	0.24	0.16	14
June	0.22	0.14	2
July	0.23	N/A	0
August	0.25	N/A	0
Annual	**0.24**	**0.15**	**135**

[1] Wind Shear was calculated when the 25-m wind speed was greater that 4 m/s.

[2] TI was calculated using the 40-m wind speeds between 14 and 16 m/s.

Table 4. Temperature Summary – September 2003-August 2004

	Average Temperature		Maximum Temperature		Minimum Temperature	
Month	**Celsius**	**Fahrenheit**	**Celsius**	**Fahrenheit**	**Celsius**	**Fahrenheit**
September	18.4	65	31.1	88	5.6	42
October	15.1	59	28.0	82	-2.1	28
November	7.0	45	22.5	73	-6.9	20
December	3.7	39	17.5	64	-9.3	15
January	3.6	38	15.1	59	-13.8	7
February	1.3	34	18.2	65	-14.5	6
March	9.7	50	24.8	77	-2.6	27
April	10.0	50	23.3	74	-3.2	26
May	18.6	66	30.3	87	1.1	34
June	21.3	70	34.0	93	11.2	52
July	21.7	71	32.3	90	11.4	53
August	19.8	68	31.1	88	10.6	51
Annual	**12.5**	**55**	**34.0**	**93**	**-14.5**	**6**

Table 5 provides the monthly frequency distributions for the 40-m wind speeds collected during the second year.

Table 5. Monthly Frequency Distributions – September 2003-August 2004

Bin	Sep	Oct	Nov	Dec	Jan	Feb *	Mar	Apr	May	Jun	Jul	Aug	Annual
0.0	0	1	5	2	3	2	2	5	0	0	6	3	29
0.5	1	9	9	6	1	4	4	13	0	2	8	7	64
1.0	2	11	5	9	7	14	12	9	4	7	10	6	96
1.5	6	16	7	9	9	15	16	6	8	18	16	22	148
2.0	14	28	11	14	23	33	18	22	14	25	26	29	257
2.5	30	41	14	26	20	14	28	22	19	42	41	34	331
3.0	44	31	25	16	29	25	33	30	31	49	46	29	388
3.5	39	53	13	20	29	37	36	22	34	42	64	39	428
4.0	47	48	25	34	42	44	31	35	23	48	72	52	501
4.5	39	40	22	27	29	26	53	37	16	58	69	57	473
5.0	44	50	18	26	39	42	40	33	31	44	56	69	492
5.5	51	55	29	34	42	39	45	31	24	42	58	53	503
6.0	39	43	34	25	38	48	35	42	35	48	60	59	506
6.5	45	33	38	48	29	57	49	31	42	34	58	47	511
7.0	57	53	36	38	36	48	39	47	45	51	33	52	535
7.5	50	45	47	41	37	29	37	35	47	38	39	47	492
8.0	47	24	49	40	29	25	33	47	50	35	15	31	425
8.5	37	18	50	32	34	31	31	45	51	30	18	24	401
9.0	38	23	51	32	32	31	29	35	40	21	16	25	373
9.5	26	18	35	26	31	22	28	47	50	16	8	19	326
10.0	25	17	27	23	30	21	27	27	44	20	9	14	284
10.5	11	16	28	28	38	14	31	20	31	15	6	6	244
11.0	7	13	21	30	34	7	12	15	28	11	0	6	184
11.5	12	15	26	25	16	9	21	23	16	9	4	7	183
12.0	2	12	27	20	19	9	17	14	22	7	3	1	153
12.5	5	13	24	18	19	6	11	4	14	1	1	4	120
13.0	2	6	14	13	15	4	11	5	8	1	1	0	80
13.5	0	3	10	20	8	1	6	4	4	2	1	2	61
14.0	0	4	5	14	9	3	4	3	4	1	0	0	47
14.5	0	1	7	11	5	2	1	5	7	1	0	0	40
15.0	0	2	1	5	3	6	0	4	1	0	0	0	22
15.5	0	1	2	7	3	1	2	0	1	0	0	0	17
16.0	0	1	1	5	1	3	2	1	0	2	0	0	16
16.5	0	0	1	2	4	0	0	0	0	0	0	0	7
17.0	0	0	0	6	0	1	0	0	0	0	0	0	7
17.5	0	0	0	4	0	0	0	0	0	0	0	0	4
18.0	0	0	0	0	1	0	0	0	0	0	0	0	1
18.5	0	0	1	4	0	1	0	1	0	0	0	0	7
19.0	0	0	0	0	0	0	0	0	0	0	0	0	0
19.5	0	0	2	2	0	0	0	0	0	0	0	0	4
20.0	0	0	0	1	0	0	0	0	0	0	0	0	1
20.5	0	0	0	0	0	0	0	0	0	0	0	0	0
21.0	0	0	0	1	0	0	0	0	0	0	0	0	1
21.5	0	0	0	0	0	0	0	0	0	0	0	0	0
22.0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	0	0	0	0	0	0	0	0	0	0	0	0	0
23.0+	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**720**	**744**	**720**	**744**	**744**	**672**	**744**	**720**	**744**	**720**	**744**	**744**	**8,760**

* Normalized to 28 days.

The Appendix contains the following reports:

- Site and Sensor Information Table
- Data Validation Table
- Summary Table for Monthly and Diurnal Wind Speeds

The forms and reports in the appendix are consistent with the reporting procedures developed for the Utility Wind Resource Assessment Program (UWRAP). Electronic copies of the raw hourly averaged data, hourly averaged validated data, and corrected hourly data files have been submitted to EMNRD.

SECTION III: TWO-YEAR COMPARISON

This section compares the first and second year of data collection at Argonne Mesa, September 2002 through August 2003 and September 2003 through August 2004.

The data recovery rate for the two-year data collection program was very high. Table 6 summarizes the monthly data recovery for the two years.

Table 6. Comparison of Monthly Data Recovery

	Year 1		Year 2	
Month	**All Heights**	**40m Level**	**All Heights**	**40m Level**
September	100.0%	100.0%	100.0%	100.0%
October	100.0%	100.0%	100.0%	100.0%
November	100.0%	100.0%	97.5%	97.4%
December	96.2%	97.6%	100.0%	100.0%
January	100.0%	100.0%	99.5%	99.5%
February	95.6%	95.2%	94.8%	94.8%
March	100.0%	100.0%	99.8%	99.3%
April	100.0%	100.0%	99.4%	100.0%
May	100.0%	100.0%	100.0%	100.0%
June	100.0%	100.0%	100.0%	100.0%
July	100.0%	100.0%	100.0%	100.0%
August	100.0%	100.0%	100.0%	100.0%
Annual	**99.3%**	**99.4%**	**99.3%**	**99.3%**

The first- and second-year average monthly wind speeds are summarized in Table 7 and illustrated in Figure 6. As shown in the table, the annual average wind speed for the first year of data collection was 7.2 m/s (16.0 mph) and 7.1 m/s (15.9 mps) for the second year. Although the annual average wind speeds were similar, as shown in Figure 6, the seasonal pattern differed somewhat between the two years.

Table 7. Monthly Wind Speed Comparison at 40 m

	Year 1		Year 2	
	m/s	**mph**	**m/s**	**mph**
September	6.1	13.7	6.3	14.0
October	6.2	13.9	6.6	14.7
November	7.4	16.6	8.4	18.7
December	8.1	18.1	8.6	19.2
January	7.3	16.4	7.9	17.6
February	7.7	17.2	6.8	15.2
March	8.3	18.5	7.2	16.1
April	9.0	20.1	7.4	16.5
May	7.3	16.4	8.0	18.0
June	6.7	15.1	6.3	14.2
July	6.3	14.0	5.6	12.5
August	5.5	12.3	6.1	13.7
Annual	**7.2**	**16.0**	**7.1**	**15.9**

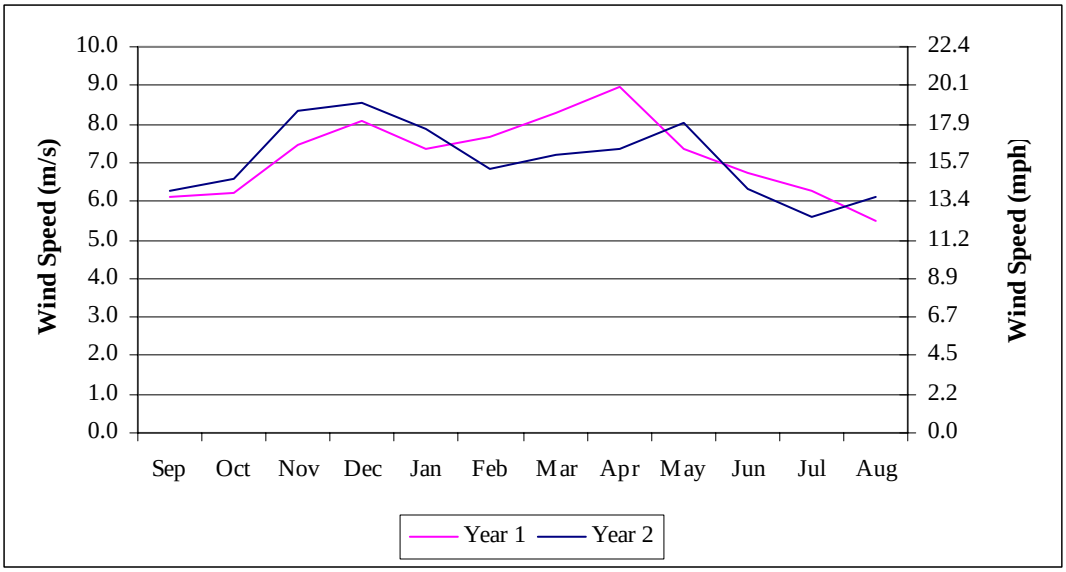

Figure 6. Monthly Wind Speed Comparison at 40 m

The average diurnal wind speeds for both years are shown in Figure 3. As shown in the figure, the diurnal wind speed pattern at this site is very similar for both years.

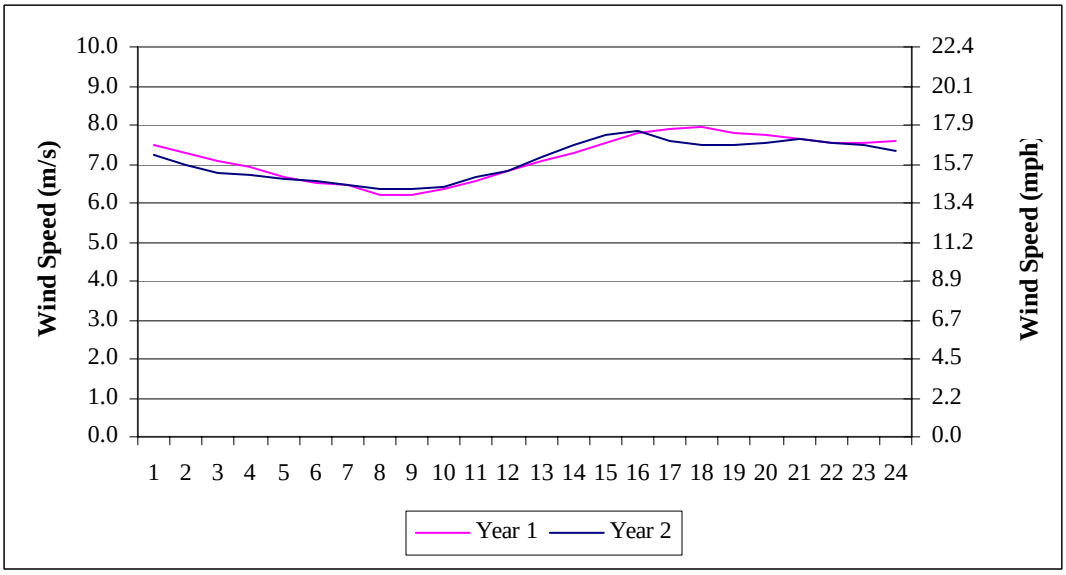

Figure 7. Diurnal Wind Speed Pattern – September 2003-August 2004

A two-year cumulative wind rose graph is presented in Figure 8. The wind rose graph consists of two bars in each of the 16 wind direction sectors that represent the percent of total time and the percent of total wind energy. The predominant wind energy direction at the site was west-northwest.

Wind shear exponent values are provided in Table 8. The wind shear exponent represents the degree to which wind speed increases with height. For the purposes of this report, the wind shear exponent was calculated between 25 and 40 m for operable winds (winds above 4 m/s). The theoretically derived value for wind shear over smooth, flat terrain is 0.14. The average wind shear for the first year is 0.21. The

average wind shear for the second year is somewhat higher at 0.24. During wind project development, wind shear is used when determining an appropriate wind turbine hub height.

Turbulence intensity (TI) is a relative indicator of turbulence and not an absolute value. The average turbulence intensity at the 40-m level for both years is also provided in Table 8. The International Electrotechnical Commission (IEC) wind turbine design standards specify a turbine to be designed for TI levels up to 0.18 in 15 m/s winds. The TI values shown in the table are calculated from winds between 14 and 16 m/s. The number of data points used in the calculations is also indicated in the table. As mentioned in the previous section, the TI values are high enough to warrant additional analysis using the 10-minute averaged wind data.

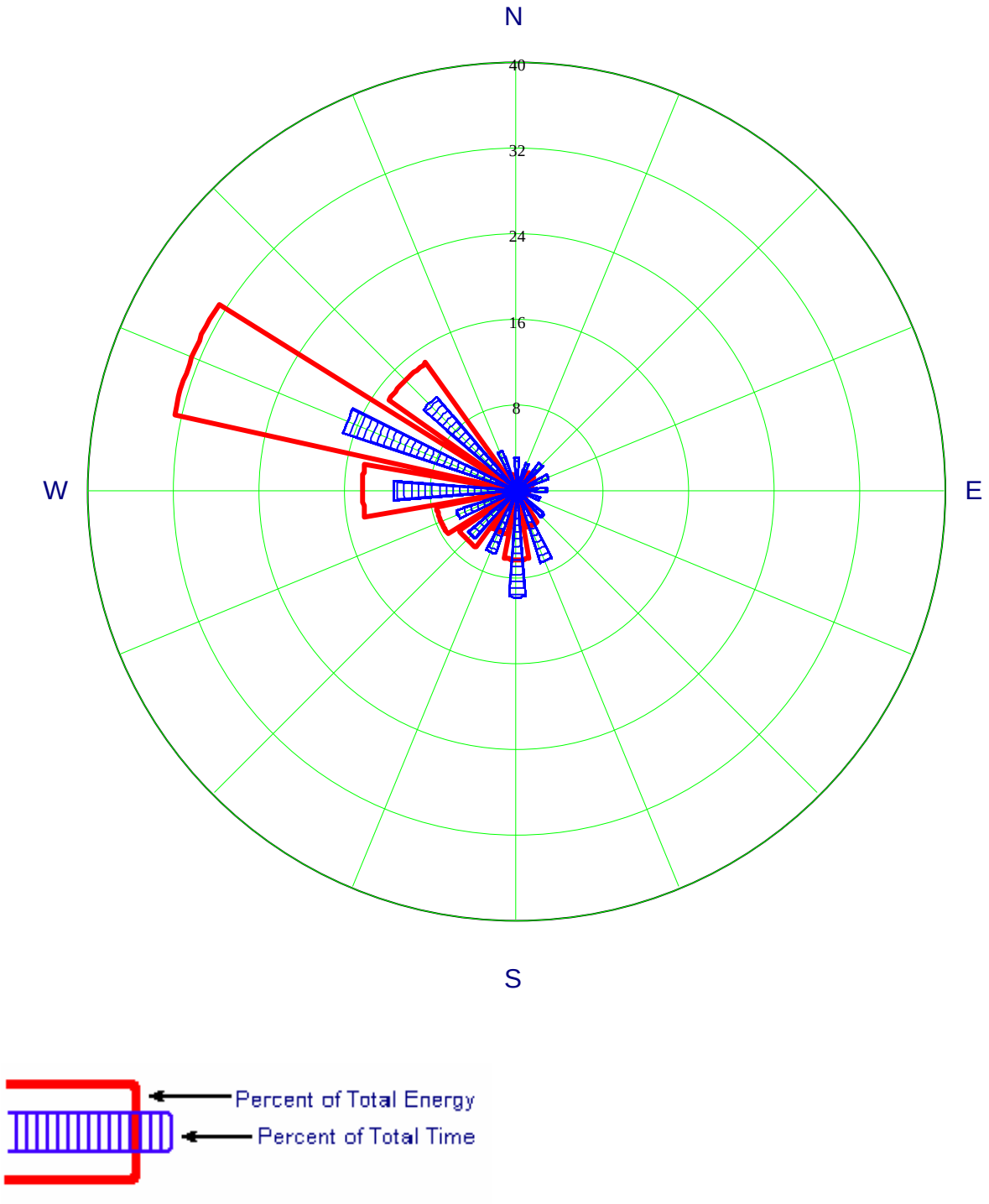

Figure 8. Two-Year Cumulative Wind Rose – September 2002-August 2004

Table 8. Turbulence Intensity and Wind Shear Comparison

Month	25-40m Wind Shear [1]		Turbulence Intensity at 15 m/s [2]	
	Year 1	Year 2	Year 1	Year 2
September	0.18	0.25	0.14	N/A
October	0.20	0.24	0.13	0.16
November	0.21	0.23	0.15	0.14
December	0.21	0.23	0.14	0.15
January	0.20	0.25	0.15	0.14
February	0.20	0.27	0.15	0.15
March	0.23	0.27	0.15	0.15
April	0.20	0.24	0.15	0.16
May	0.19	0.24	0.17	0.16
June	0.22	0.22	0.13	0.14
July	0.26	0.23	N/A	N/A
August	0.26	0.25	N/A	N/A
Annual	**0.21**	**0.24**	**0.15**	**0.15**

[1] Wind Shear was calculated when the 25-m wind speed was greater that 4 m/s.
[2] TI was calculated using the 40-m wind speeds between 14 and 16 m/s.

Figure 9 illustrates the similarity between the first and second year annual frequency distributions.

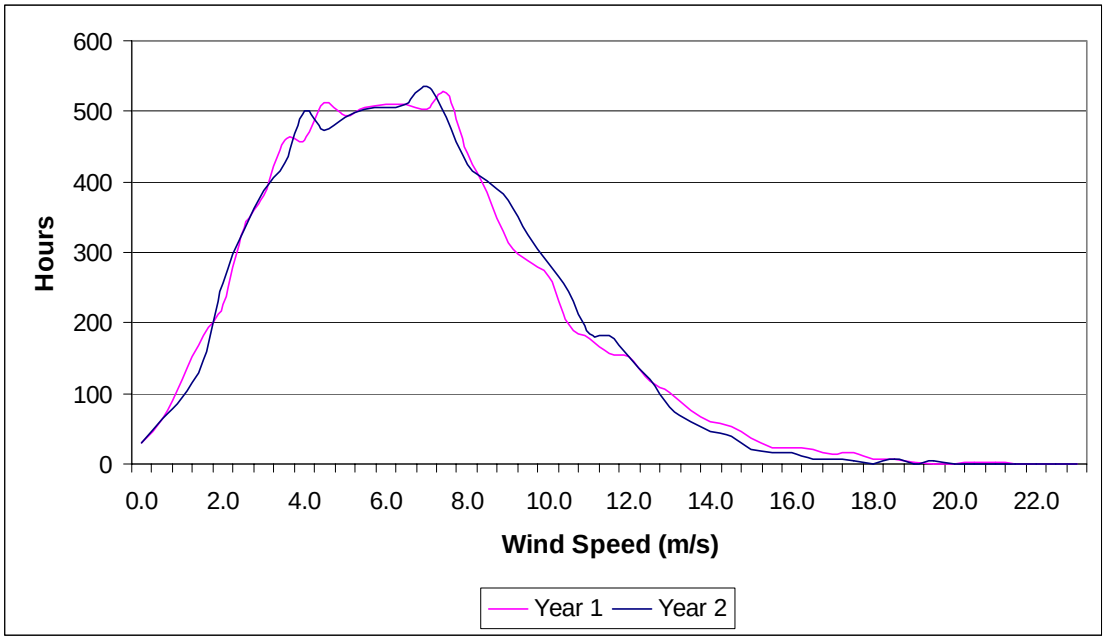

Figure 9. Annual Frequency Distributions at 40m

APPENDIX

SITE 703 – ARGONNE MESA

DATA REPORT -- ARGONNE MESA WIND MONITORING PROGRAM

Station Name: Argonne Mesa
Station Number: 703
Period: September 2003 - August 2004

SITE INFORMATION

Site Number:	703
Client Name:	New Mexico EMNRD
Client Code:	NM5
Project:	Wind Monitoring Project
Location:	Argonne Mesa
Latitude:	34o 49.644' N
Longitude:	104o 59.916' W
Elevation:	1786M
Serial Number:	100271
Time Zone:	-7 (MTN STD)
Magnetic Declination:	9E
Interval:	10 min

SENSOR INFORMATION

Channel Number	Sensor Type	Height	Scale	Offset	Units	Description
1	Anemometer	10M	0.765	0.35	m/s	Maximum 40 (calibrated)
2	Anemometer	25M	0.765	0.35	m/s	Maximum 40 (calibrated)
3	Anemometer	39.4M	0.7589	0.375	m/s	Maximum 40 (calibrated/grounded)
4	Anemometer	39.7M	0.7609	0.359	m/s	Maximum 40 (standard)
7	Direction Vane	25M	1	0	Degrees	NRG 200P
8	Direction Vane	39.4M	1	0	Degrees	NRG 200P
12	Temperature Probe	3.6M	0.1356	-86.39	Celsius	NRG 110S

Site 703 - Argonne Mesa Commissioning Date/Time Augsut 7, 2002

Diurnal Wind Speed Summary

10 M	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Sep-03	4.8	4.5	3.8	3.6	3.6	3.7	3.6	3.8	3.9	4.1	4.3	4.6	4.7	4.7	4.6	5.1	5.4	5.1	4.5	5.0	5.1	4.9	4.8	4.6
Oct-03	4.2	4.4	4.2	4.3	4.5	4.6	4.4	4.6	4.8	4.6	4.6	4.8	4.8	4.9	5.1	5.3	5.1	4.6	4.4	4.4	4.6	4.4	4.2	4.1
Nov-03	5.9	5.5	5.3	5.3	5.1	4.9	4.8	4.8	5.2	5.7	6.3	6.6	6.8	7.1	7.3	7.2	6.2	5.7	5.8	6.1	6.6	6.5	6.1	5.9
Dec-03	5.8	5.9	5.9	6.0	6.2	6.0	5.8	5.8	5.7	5.9	6.5	6.9	7.1	7.2	7.1	6.7	5.9	5.6	5.7	5.8	5.6	5.8	5.6	5.7
Jan-04	5.7	5.6	5.4	5.7	5.7	5.6	5.4	5.6	5.9	5.7	5.7	5.8	6.0	6.1	6.0	6.1	5.4	4.7	4.9	5.3	5.3	5.5	5.5	5.8
Feb-04	4.7	4.6	4.3	4.2	4.1	4.3	4.4	4.5	5.0	5.2	5.2	5.2	5.2	5.2	5.4	5.4	5.3	4.6	4.3	4.3	4.8	4.6	4.7	4.8
Mar-04	5.2	5.0	4.8	4.7	4.3	4.7	4.9	4.8	5.2	5.2	5.3	5.2	5.2	5.2	5.4	5.5	5.5	5.2	4.8	4.9	5.0	5.3	5.5	5.4
Apr-04	5.0	4.9	5.1	5.3	4.7	4.5	4.8	5.1	5.4	5.5	5.4	5.1	5.2	5.7	6.0	6.1	6.1	5.9	5.4	5.2	5.2	5.0	5.0	4.9
May-04	5.8	5.4	5.2	5.0	4.8	4.6	4.4	4.8	5.1	5.0	5.2	5.6	6.1	6.5	7.0	7.0	7.0	6.5	5.8	5.5	6.1	6.4	6.4	6.2
Jun-04	3.8	3.7	3.7	3.8	4.0	3.9	3.8	3.8	3.9	4.2	4.5	4.8	5.2	5.6	5.8	5.4	4.9	5.7	5.8	5.2	4.9	4.4	4.4	4.0
Jul-04	3.2	3.2	3.0	3.3	4.0	4.0	3.7	3.7	3.7	4.0	4.2	4.4	5.0	5.1	5.3	4.9	4.1	4.0	4.1	3.7	3.7	3.5	3.6	3.5
Aug-04	3.9	3.6	3.5	3.6	3.7	3.8	4.2	4.4	4.6	4.7	5.0	5.1	5.5	5.2	5.3	4.7	4.3	4.3	4.2	4.3	4.4	4.4	4.4	4.0
Annual	**4.8**	**4.7**	**4.5**	**4.6**	**4.6**	**4.6**	**4.5**	**4.7**	**4.8**	**5.0**	**5.2**	**5.3**	**5.6**	**5.7**	**5.9**	**5.8**	**5.4**	**5.2**	**5.0**	**5.0**	**5.1**	**5.1**	**5.0**	**4.9**

25M	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Sep-03	6.4	5.9	5.2	4.7	4.8	4.9	4.7	4.6	4.6	4.8	5.0	5.3	5.4	5.4	5.4	6.0	6.4	6.4	6.0	6.6	6.7	6.4	6.4	6.1
Oct-03	5.6	5.8	5.6	5.7	5.9	6.0	5.8	5.8	5.8	5.6	5.6	5.8	5.8	5.8	6.2	6.5	6.5	6.1	6.0	5.9	6.1	5.9	5.6	5.6
Nov-03	7.6	7.1	6.9	6.9	6.7	6.5	6.3	6.2	6.5	7.0	7.7	8.0	8.2	8.5	8.8	8.8	7.7	7.2	7.4	7.9	8.4	8.2	7.9	7.7
Dec-03	7.4	7.5	7.7	7.7	8.1	7.8	7.5	7.5	7.1	7.2	7.9	8.3	8.6	8.8	8.6	8.3	7.5	7.2	7.3	7.6	7.3	7.5	7.2	7.3
Jan-04	7.3	7.1	6.9	7.3	7.3	7.2	6.9	7.1	7.2	6.8	6.9	7.0	7.2	7.4	7.3	7.4	6.8	6.1	6.5	6.9	6.8	7.1	7.1	7.4
Feb-04	6.2	6.0	5.7	5.5	5.5	5.6	5.7	5.8	6.2	6.3	6.3	6.2	6.2	6.2	6.5	6.5	6.5	6.0	5.7	5.7	6.4	6.1	6.2	6.2
Mar-04	6.8	6.5	6.3	6.1	5.7	6.1	6.4	6.0	6.2	6.2	6.2	6.0	6.1	6.1	6.4	6.6	6.6	6.5	6.4	6.5	6.5	6.9	7.2	7.0
Apr-04	6.6	6.4	6.5	6.8	6.1	5.9	6.2	6.3	6.4	6.5	6.5	6.1	6.2	6.9	7.2	7.6	7.6	7.4	7.0	6.8	6.8	6.5	6.5	6.4
May-04	7.7	7.2	6.9	6.7	6.4	6.0	5.6	5.8	6.1	6.0	6.2	6.6	7.3	7.7	8.6	8.5	8.6	8.1	7.5	7.3	8.0	8.3	8.3	8.1
Jun-04	5.1	5.0	4.9	4.8	4.8	4.6	4.5	4.4	4.4	4.8	5.1	5.6	6.2	6.8	7.3	7.0	6.5	7.4	7.6	6.9	6.5	5.9	5.8	5.4
Jul-04	4.3	4.2	4.0	4.2	4.7	4.8	4.4	4.3	4.3	4.6	4.9	5.2	6.0	6.2	6.7	6.4	5.6	5.6	5.6	5.0	5.0	4.8	4.8	4.7
Aug-04	5.1	4.7	4.6	4.5	4.5	4.5	4.9	5.1	5.3	5.4	5.7	5.9	6.6	6.4	6.6	6.2	5.7	5.7	5.6	5.7	5.7	5.8	5.7	5.2
Annual	**6.3**	**6.1**	**5.9**	**5.9**	**5.9**	**5.8**	**5.7**	**5.8**	**5.8**	**5.9**	**6.2**	**6.3**	**6.6**	**6.9**	**7.1**	**7.1**	**6.8**	**6.6**	**6.5**	**6.5**	**6.7**	**6.6**	**6.6**	**6.4**

40M A	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Sep-03	7.2	6.7	6.0	5.4	5.4	5.5	5.3	5.0	4.9	5.1	5.4	5.7	5.9	5.9	5.9	6.6	7.2	7.3	7.0	7.7	7.8	7.4	7.4	7.0
Oct-03	6.4	6.7	6.3	6.5	6.7	6.8	6.6	6.4	6.3	6.0	6.0	6.2	6.3	6.3	6.7	7.1	7.2	7.0	6.9	6.9	7.1	6.8	6.5	6.3
Nov-03	8.6	8.0	7.8	7.9	7.5	7.4	7.1	7.0	7.1	7.6	8.3	8.6	8.9	9.3	9.6	9.7	8.5	8.2	8.4	8.9	9.4	9.2	8.8	8.7
Dec-03	8.3	8.5	8.7	8.8	9.1	8.8	8.4	8.4	7.8	7.7	8.5	8.9	9.3	9.5	9.3	9.0	8.3	8.1	8.3	8.6	8.2	8.5	8.2	8.3
Jan-04	8.3	8.0	7.8	8.2	8.3	8.2	7.9	8.0	8.1	7.5	7.4	7.6	7.7	8.0	7.9	8.1	7.4	6.9	7.5	8.0	7.9	8.2	8.1	8.5
Feb-04	7.1	7.0	6.6	6.4	6.3	6.5	6.7	6.5	6.9	6.8	6.8	6.6	6.6	6.7	7.0	7.1	7.2	6.8	6.7	6.6	7.3	7.0	7.1	7.2
Mar-04	7.7	7.4	7.2	7.1	6.6	7.0	7.3	6.8	6.8	6.7	6.7	6.6	6.6	6.7	6.9	7.1	7.2	7.3	7.5	7.7	7.6	7.9	8.2	8.0
Apr-04	7.5	7.3	7.5	7.8	7.0	6.7	6.9	6.9	7.0	7.0	7.0	6.6	6.6	7.5	7.9	8.2	8.3	8.1	7.9	7.8	7.8	7.4	7.3	7.3
May-04	8.8	8.3	8.1	7.8	7.3	6.9	6.3	6.3	6.5	6.3	6.6	7.1	7.8	8.3	9.3	9.2	9.4	8.9	8.5	8.3	9.1	9.4	9.4	9.2
Jun-04	5.9	5.7	5.5	5.2	5.0	4.9	4.8	4.7	4.7	5.1	5.5	6.1	6.7	7.4	8.0	7.9	7.4	8.4	8.6	7.8	7.4	6.7	6.6	6.2
Jul-04	4.9	4.7	4.5	4.6	5.1	5.1	4.7	4.6	4.7	5.0	5.4	5.6	6.7	6.9	7.4	7.2	6.5	6.5	6.4	5.7	5.6	5.4	5.4	5.3
Aug-04	5.7	5.3	5.2	5.0	4.8	4.8	5.2	5.4	5.7	5.9	6.3	6.5	7.4	7.2	7.4	7.0	6.7	6.8	6.5	6.5	6.5	6.6	6.5	5.8
Annual	**7.2**	**7.0**	**6.8**	**6.7**	**6.6**	**6.5**	**6.4**	**6.3**	**6.4**	**6.4**	**6.7**	**6.8**	**7.2**	**7.5**	**7.8**	**7.9**	**7.6**	**7.5**	**7.5**	**7.5**	**7.6**	**7.5**	**7.5**	**7.3**

Note: 10 meter and 25 meter data based on validated data set with no corrections.
40 meter data based on validated and corrected data set.

ARGONNE MESA WIND MONITORING PROJECT
Site Data Validation Report

Note #	Sensor/Channel	From	To	Code	Description
1	ANEM 10M	11/13/2003 12:00	11/14/2003 6:00	ICE	Data deleted and not replaced.
2	ANEM 10M	1/21/2004 5:00	1/21/2004 9:00	ICE	Data deleted and not replaced.
3	ANEM 10M	2/23/2004 22:00	2/25/2004 10:00	ICE	Data deleted and not replaced.
4	ANEM 10M	4/10/2004 21:00	4/11/2004 10:00	ICE	Data deleted and not replaced.
5	ANEM 25M	11/13/2003 12:00	11/14/2003 5:00	ICE	Data deleted and not replaced.
6	ANEM 25M	1/21/2004 5:00	1/21/2004 9:00	ICE	Data deleted and not replaced.
7	ANEM 25M	2/23/2004 22:00	2/25/2004 10:00	ICE	Data deleted and not replaced.
8	ANEM 40A	11/13/2003 10:00	11/14/2003 5:00	ICE	Data deleted and replaced based on correlation to 25M anemometer and diurnal averages.
9	ANEM 40A	1/21/2004 5:00	1/21/2004 9:00	ICE	Data deleted and replaced based on diurnal averages.
10	ANEM 40A	2/23/2004 22:00	2/25/2004 11:00	ICE	Data deleted and replaced based on correlation to 25M anemometer and diurnal averages.
11	ANEM 40A	3/3/2004 5:00	3/3/2004 10:00	ICE	Data deleted and replaced based on correlation to 25M anemometer.
12	ANEM 40A	8/9/2004 21:00	8/31/2004 23:00	MAL	Data deleted and replaced based on correlation to 40M B anemometer.
13	ANEM 40B	11/13/2003 10:00	11/14/2003 5:00	ICE	Data deleted and not replaced.
14	ANEM 40B	1/21/2004 5:00	1/21/2004 9:00	ICE	Data deleted and not replaced.
15	ANEM 40B	2/23/2004 22:00	2/25/2004 10:00	ICE	Data deleted and not replaced.
16	ANEM 40B	3/3/2004 5:00	3/3/2004 10:00	ICE	Data deleted and not replaced.
17	VANE 25M	11/12/2003 23:00	11/14/2003 5:00	ICE	Data deleted and not replaced.
18	VANE 25M	1/21/2004 5:00	1/21/2004 9:00	ICE	Data deleted and not replaced.
19	VANE 25M	2/23/2004 21:00	2/25/2004 10:00	ICE	Data deleted and not replaced.
20	VANE 25M	4/10/2004 19:00	4/11/2004 10:00	ICE	Data deleted and not replaced.
21	VANE 40M	11/12/2003 20:00	11/14/2003 5:00	ICE	Data deleted and not replaced.
22	VANE 40M	1/21/2004 5:00	1/21/2004 9:00	ICE	Data deleted and not replaced.
23	VANE 40M	2/23/2004 20:00	2/25/2004 9:00	ICE	Data deleted and not replaced.
24	VANE 40M	3/2/2004 22:00	3/3/2004 10:00	ICE	Data deleted and not replaced.
25	VANE 40M	4/10/2004 19:00	4/11/2004 10:00	ICE	Data deleted and not replaced.

Explanation of Codes:

UKN	Unknown
ICE	Icing or wet snow
LTG	Static Voltage Discharge
TWR	Wind shading from tower
DBD	Wind vane dead band
OPR	Operator error
MAL	Equipment Malfunction
MTC	Maintenance
MSN	Missing Data