

**OREGON STATE UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
WIND RESOURCES ASSESSMENT LABORATORY**

REPORT NO. BPA 88-28

SEPTEMBER 1989

REGIONAL WIND ENERGY ASSESSMENT

PROGRESS REPORT:

JUNE 1987 - MAY 1988

FINAL REPORT

Prepared by

J.E. Wade and Stel Walker

Submitted to the

**Bonneville Power Administration
Division of Resource Management
Portland, Oregon**

Contract No. DEAI79-86BP63406

MASTER

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ACKNOWLEDGEMENTS

This research was funded under Bonneville Power Administration contract DEAI79-86BP63406. We would like to acknowledge the substantial contributions of Nicholas Butler, electrical engineer and Contract Officer from BPA's Division of Resource Management. Max Holder, BPA instrument craftsman, deserves credit for keeping the equipment in the field operating and calibrated. We are also indebted to Laurie Dockendorf for her word processing support and Linda Hubbard, who provided the administrative support.

EXECUTIVE SUMMARY

The purpose of this report is to discuss the status of Bonneville Power Administrations wind monitoring program and the data collected from June 1987 through May 1988. The wind monitoring program has been on-going since 1976. the annual summary of this data provides BPA with a periodic status report on both the equipment and wind resource being measured.

There were 12 active sites this year. Three sites were instrumented at more than one level and one site, Cape Blanco, had anemometers at two different locations. The second Cape Blanco anemometer was taken out in January and the Albion Butte site failed in February and was removed in July of 1988. The data recovery rate for all sites this past year was 80%. Two sites were inactive for half the year, Albion Butte and Spring Creek. The Spring Creek site experienced reoccurring failure of the data logger cassette interface. Pequop Summit and Upper Pyle also had low data recovery rates because of problems with the cassette tape reader.

For each site data are summarized for the entire period of record in the report's Appendices. For three sites there are 12 years of record. These summaries provide the most important wind speed statistics required by potential wind developers. In addition, the appendices contain pressure and temperature data for each site.

A climatological analyses discussed the wind and weather during the past year so that the representativeness of this period could be established. The period June 1987-May 1988 was warmer, and drier, over most of the region. The winds were about average or slightly stronger than average at most sites except in the Columbia River Gorge. In the past, dry years have been associated with weaker winds. This past year June, August through November, and February were the extremely dry months. The Columbia Gorge sites had weaker winds during those months. The early spring drought reduced the coastal winds. In general, the worst drought occurred in the Fall when winds in the Pacific Northwest are typically weak.

The winds at each site are summarized in tables in the report and energy statistics present the gross annual energy output that could be produced by five different wind turbines. These statistics assume 100% machine availability and no losses due to array effects or electrical line losses. the most energetic site, Cape Blanco, had capacity factors that varied from 0.25 to 0.43 depending on the machine.

The distribution of wind speed is an important consideration in selecting a wind turbine and computing annual energy output. An examination of seasonal and annual variations of wind distribution showed that the interannual variations in the wind distribution shape were insignificant in determining annual energy output compared to variation in wind speed. However, seasonal variations in wind speed distributions are larger and are more important. Resource assessments that do not measure winds for an entire year run the risk of not only error in the estimated mean speed but also in the estimate of annual distribution of wind speeds. Typically the distribution of wind speeds is broader in the winter than in the summer. This broad distribution relates to low values of the distribution shape parameter. Some wind turbine generators perform better in wind regions with a low shape parameter and others may be more efficient at sites with higher shape parameters.

The variation of the shape of the wind speed distribution often varies little with height. But the scale of the distribution varies in the same way the mean wind speed varies with height.

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1.0 INTRODUCTION

This report is a summary of wind statistics collected for the period June 1987 through May 1988. The data were gathered at 12 locations throughout the Pacific Northwest as part of Bonneville Power Administration's Regional Wind Energy Assessment Program (Wind REAP) that has been continuing since 1981. The data collection sites are shown in Figure 1-1 and the status of the equipment is listed in Table 1-1. Albion Butte equipment failed in February 1988 and was removed in July of 1988.

The main objectives in this report are:

- Summarize data collected during the past year.
- Document the status of each site any equipment problems and quality assurance.
- Discuss the relationship of this year's winds to those of previous years and the climate experienced during the past year in the Pacific Northwest.
- Present analysis of wind characteristics at each site that will provide potential developers with necessary information to assess the quality and quantity of the wind resource.
- Examine the variation of the wind speed distribution with height, season, and year to year variations.

Section 2.0 is a climatological discussion of the wind and climate of the past year in the Pacific Northwest. The Wind REAP sites winds are compared with previous years and with the departures from "normal" of climate at the several nearby National Weather Service locations shown in Figure 1-1. In this report the term "normal" will refer to the National Weather Service definition, which is the previous 30-year period before this decade. The "normal" period is 1941-1970. In 1990 the normal period will advance to 1951-1980.

Section 3.0 is a discussion wind characteristics and the status of data collection. At Kennewick, the anemometer height changed. There is a discussion of the relationship between the wind speeds at the two levels when data were collected simultaneously. Supporting information presented in the appendices include analysis of all the data collected at each site and the

ACTIVE WIND REAP SITES

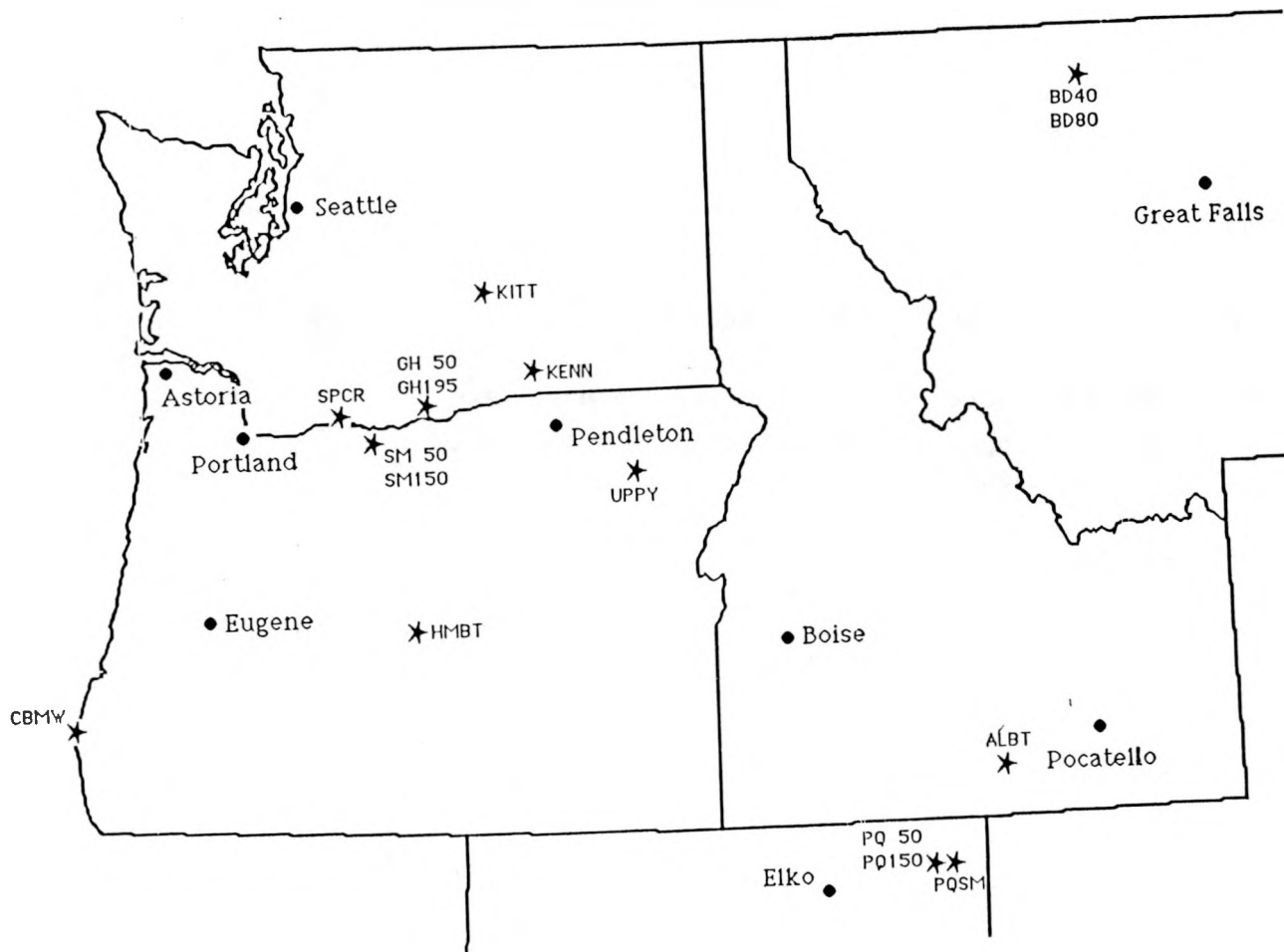


Figure 1-1. Map showing locations of Wind REAP sites and National Weather Service sites used in this report (see Table 1-1 for site names).

Table 1-1. Pacific Northwest wind energy site status.

UPDATE STATUS REPORT
(THROUGH MAY 31, 1988)

MAP ID NAME	SITE NAME	PERIOD OF RECORD	PRESENT STATUS	
			ACTIVE	INACTIVE
	OREGON			
CBMW	Cape Blanco M/W	Oct. 1976 - Present	X	
HMBT	Hampton Butte	Oct. 1983 - Present	X	
SM50	Seven Mile Hill 50'	Oct. 1978 - Present	X	
SM150	Seven Mile Hill 150'	Oct. 1978 - Present	X	
UPPY	Upper Pyle	Mar. 1984 - Present	X	
	WASHINGTON			
GH50	Goodnoe Hills 50'	May 1980 - Present	X	
GH150	Goodnoe Hills 195'	May 1980 - Present	X	
KENN	Kennewick	Jun. 1976 - Present	X	
KITT	Kittitas	Mar. 1980 - Present	X	
SPCR	Spring Creek	Mar. 1981 - Present	X	
	NEVADA			
PQSM	Pequop Summit	Apr. 1976 - Present	X	
PQ50	Pequop Tower 50'	Jun. 1982 - Present	X	
PQ150	Pequop Tower 150'	Jun. 1982 - Present	X	
	MONTANA			
BD40	Browning Depot 40'	Oct. 1985 - Present	X	
BD80	Browning Depot 80'	Oct. 1985 - Present	X	
	IDAHO			
ALBT	Albion Butte	Jul. 1984 - Mar. 1988		X

seasonal and diurnal variation of wind speed, temperature and the seasonal variation of pressure.

Section 4.0 presents analysis of the variation of the wind speed distribution with height, season and annual variations. A wind speed distribution using a theoretical fit is compared to the actual distribution.

2.0 CLIMATOLOGICAL ANALYSIS

The climatological analysis has two purposes: 1) to determine the extent the winds during the past year deviated from winds in prior years, and 2) to evaluate the degree that the past year is typical. The value of this exercise is that it puts into chronological perspective the winds measured at the Wind REAP sites during the past year. In addition any significant trends in the wind caused by anemometer malfunction or changes in surface roughness are readily identified.

The approach used in this analysis is to calculate departures from the mean at four widely dispersed wind energy survey sites in the Pacific Northwest. These sites have in common a long record of wind measurement. To amplify the analysis we also examine departures from "normal" (1941-1970 mean) for eight National Weather Service (NWS) sites scattered throughout BPA's service territory.

To support the wind climate analysis, there is an examination of the temperature and precipitation departures from "normal."

2.1 Results

Table 2-1 presents mean wind speeds for the period June 1987 through May 1988 and departures from the long-term mean. BPA and NWS site departures from the mean are also graphically presented in Figures 2-1 through 2-3. Figure 2-1 displays a bar graph of departure from the long-term mean of the winds at four Pacific Northwest wind survey sites. The winds were often above the mean. Goodnoe Hills was the only site that had below average winds for the period June 1987 - May 1988 (-6.7%).

In the eastern and southeastern part of the BPA service area winds were generally below "normal" for the second year in a row at National Weather Service sites. Pequop Summit's wind were about average. West of the Cascades, Astoria and Pendleton had stronger winds during the period June 1987 - May 1988, when Eugene and Portland were below average.

Table 2-1. Mean speeds for the period June 1987 – May 1988 and the departures from the mean. The mean period for the National Weather Service data is 1941-1970.

STATION		WIND SPEEDS												
		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	ANNUAL
ASTORIA (NWS)	41-70	8.3	8.5	8.0	7.5	7.5	8.8	9.3	9.4	8.9	8.9	8.7	8.5	8.5
	87-88	11.2	9.4	9.8	7.6	7.3	9.4	10.2	10.3	8.8	10.5	9.4	9.5	9.5
	% DEP	34.9	10.6	22.5	1.3	(2.7)	6.8	9.7	9.6	(1.1)	18.0	8.0	11.8	10.9
EUGENE (NWS)	41-70	7.4	8.0	7.5	7.4	6.5	7.4	7.9	8.1	8.0	8.6	7.7	7.4	7.7
	87-88	8.4	7.9	8.1	6.4	5.6	6.6	8.9	8.4	6.3	8.1	7.5	8.2	7.5
	% DEP	13.5	(1.3)	8.0	(13.5)	(13.8)	(10.8)	12.7	3.7	(21.3)	(5.8)	(2.6)	10.8	(1.6)
PORTLAND (NWS)	41-70	6.9	7.4	7.0	6.4	6.1	8.7	9.8	9.8	8.8	8.2	7.3	6.9	7.8
	87-88	7.7	8.1	7.7	6.2	6.1	8.2	8.5	10.3	6.4	7.0	6.5	7.2	7.5
	% DEP	11.6	9.5	10.0	(3.1)	.0	(5.7)	(13.3)	5.1	(27.3)	(14.6)	(11.0)	4.3	(3.6)
PENDLETON (NWS)	41-70	10.5	9.5	9.1	8.9	8.1	7.9	8.4	8.5	9.0	10.0	10.6	10.2	9.2
	87-88	7.3	9.0	8.8	8.4	6.3	6.9	8.3	8.0	8.9	10.6	10.0	10.7	8.6
	% DEP	(.5)	24.7		24.4	7.8	17.3	28.8	24.1	28.9	36.0	24.3	34.9	23.2
ELKO (NWS)	41-70	6.7	6.2	6.0	5.5	5.2	5.1	5.1	5.4	5.9	6.7	7.2	6.9	6.0
	87-88						5.0	6.1	5.4	5.2	6.8	7.5	7.1	6.2
	% DEP						(2.0)	19.6	.0					2.8
BOISE (NWS)	41-70	9.1	8.5	8.2	8.3	8.5	8.5	8.4	8.3	9.2	10.2	10.2	9.6	8.9
	87-88	8.5	8.4	7.7	7.3	6.5	6.7	9.0	6.5	7.0	9.3	8.9	9.3	7.9
	% DEP	(6.6)	(1.2)	(6.1)	(12.0)	(23.5)	(21.2)	7.1	(21.7)	(23.9)	(8.8)	(12.7)	(3.1)	(11.1)
POCATELLO (NWS)	41-70	10.3	9.2	9.0	9.1	9.2	10.2	10.2	11.2	10.9	11.6	11.8	10.6	10.3
	87-88	9.4	9.4	9.5	8.3	7.5	8.2	11.4	10.9	10.8	8.7	11.5	11.3	9.7
	% DEP	(8.7)	2.2	5.6	(8.8)	(18.5)	(19.6)	11.8	(2.7)	(.9)	(25.0)	(2.5)	6.6	(5.2)
GREAT FALLS (NWS)	41-70	11.2	10.2	10.3	11.4	13.3	14.6	15.6	15.2	14.5	13.1	12.9	11.5	12.8
	87-88	11.5	10.0	9.8	8.4	10.3	12.3	14.6	14.7	13.8	15.3	13.4	11.5	12.1
	% DEP	2.7	(2.0)	(4.9)	(26.3)	(22.6)	(15.8)	(6.4)	(3.3)	(4.8)	16.8	3.9	.0	(5.3)
CAPE BLANCO	76-86	18.5	20.0	16.2	16.7	17.4	20.4	20.0	20.5	24.1	20.5	18.0	17.7	19.2
	87-88	23.1	17.7		17.1	17.6	23.8	28.4	24.1	16.0	18.1	17.8	18.5	20.2
	% DEP	24.9	(11.5)		2.4	1.1	16.7	42.0	17.6	(33.6)	(11.7)	(1.1)	4.5	5.4
GOODNOE HILLS 195'	80-86	17.1	16.7	16.0	14.3	12.9	12.7	11.1	13.2	13.4	14.2	16.6	17.7	14.7
	87-88	14.9	17.2	13.2	12.3	10.4	10.5	10.6	11.5	14.3	16.5	16.7	16.0	13.7
	% DEP	(12.9)	3.0	(17.5)	(14.0)	(19.4)	(17.3)	(4.5)	(12.9)	6.7	16.2	.6	(9.6)	(6.7)
KENNEWICK	76-86	16.0	15.2	13.9	13.7	14.3	17.6	15.3	14.4	15.8	16.7	16.6	16.8	15.5
	87-88	14.4	16.6	10.5	10.8	8.9	16.6		17.0	18.5	17.8	14.5	18.1	15.7
	% DEP	(10.0)	9.2	(24.5)	(21.2)	(37.8)	(5.7)		18.1	17.1	6.6	(12.7)	7.7	1.0
PEQUOP SUMMIT	76-86	15.7	14.2	13.4	13.1	13.6	15.9	18.3	16.4	17.7	18.3	17.0	16.4	15.7
	87-88	14.0	14.6	13.5	11.6	10.9		19.5	17.3	16.0	20.8	16.6	17.6	15.7
	% DEP	(10.8)	2.8	.7	(11.5)	(19.9)		6.6	5.5	(9.6)	13.7	(2.4)	7.3	(.2)

IMPORTANT NOTES:

VALUES IN PARENTHESES REPRESENT NEGATIVE PERCENT DEPARTURES FROM NORMAL CAPE BLANCO NOV 86 AND FEB 87 ESTIMATED FROM NEARBY CAPE BLANCO RADIO AN ADJUSTMENT FACTOR OF 1.31 HAS BEEN APPLIED TO THE PENDLETON WIND DATA TO ACCOUNT FOR UNEXPLAINED LOW WIND SPEEDS THE KENNEWICK ANEMOMETER DURING 1987-1988 IS 20 FT LOWER THAN IT WAS DURING 1976-86.

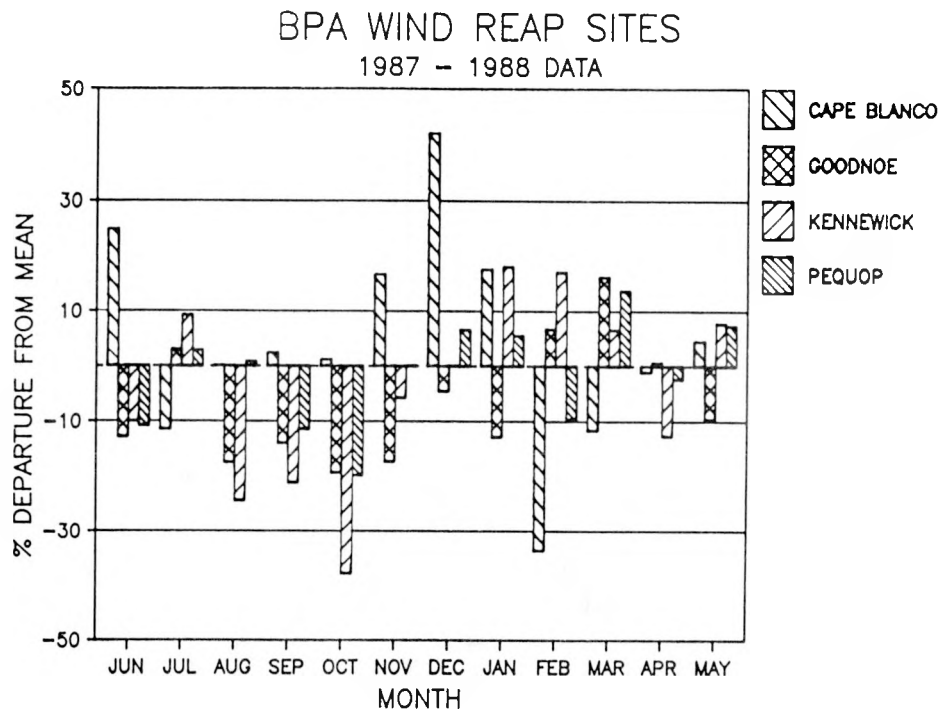


Figure 2-1. Wind speed departures from "mean" at four BPA wind sites for 1987-1988 data.

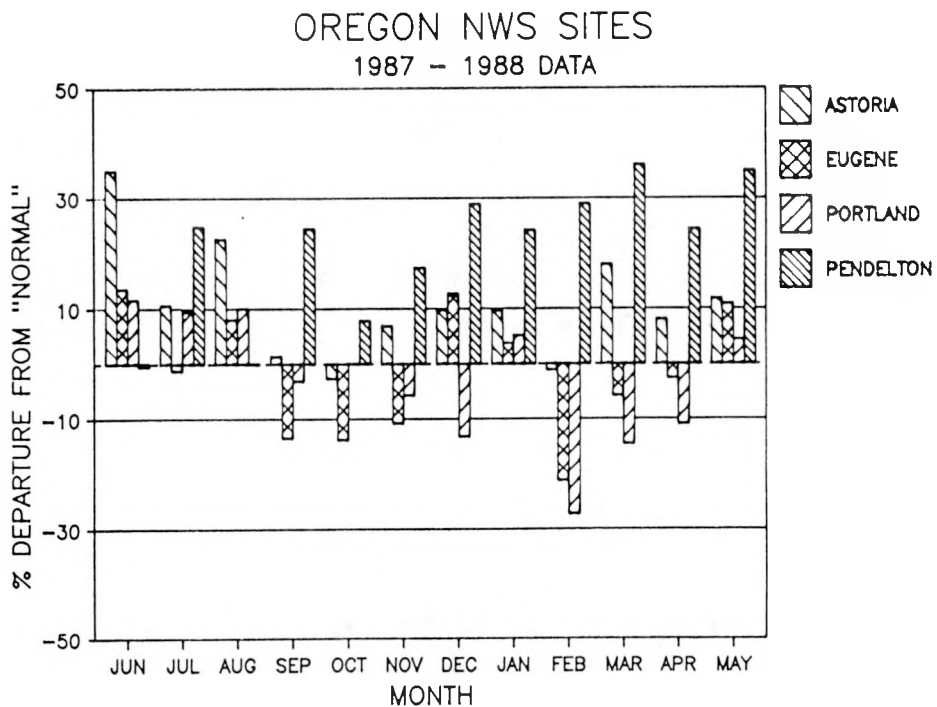


Figure 2-2. Wind speed departures from "normal" at four Oregon NWS sites for 1987-1988 data.

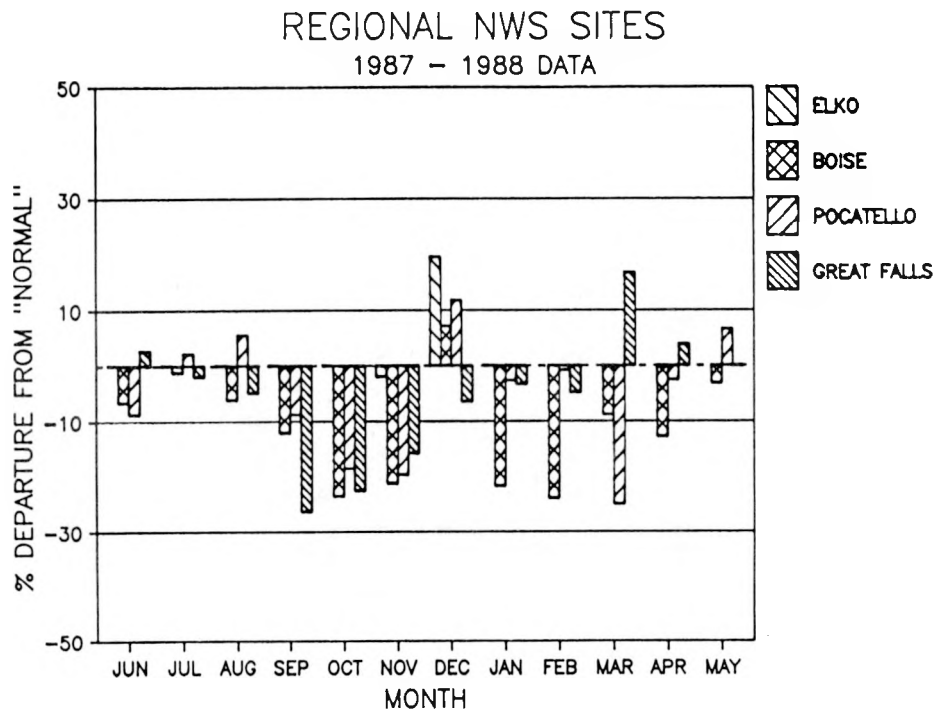


Figure 2-3. Wind speed departures from "normal" at four Regional NWS sites for 1987-1988 data.

The period June 1987 through May 1988 was warmer than "normal" throughout the region as it was the previous year. The departure from "normal" were much greater east of the Cascades (see Figures 2-4 and 2-5 and Table 2-2). Most sites were about 5% warmer than "normal" for the entire period. On an annual basis all sites departures from the mean were within 5%.

Precipitation departures from "normal" provide a good indication of the strength of the fall and winter wind resource in the Pacific Northwest (see Wade, et al, 1986). Table 2-3 and Figures 2-6 and 2-7 display the monthly departures from the 1941 through 1970 period "normal." The drought experienced in the Pacific Northwest is evident. Dry conditions in the eastern part of the region are often associated with weaker winds, but at the Oregon National Weather Service site the winds were stronger (see Figures 2-1 to 2-3).

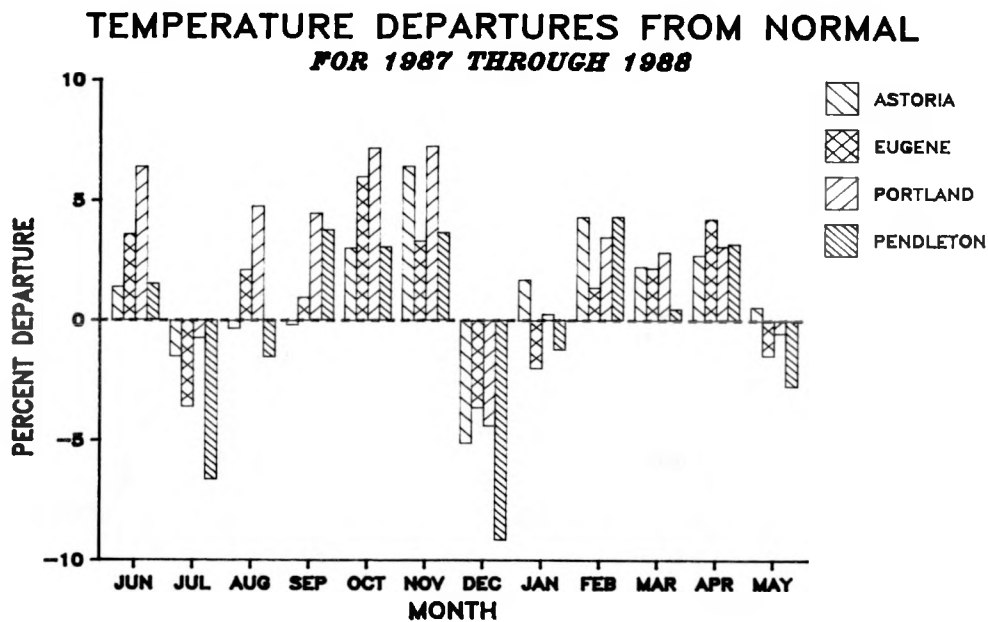


Figure 2-4. Temperature percent departures from "normal" at four NWS sites in Oregon.

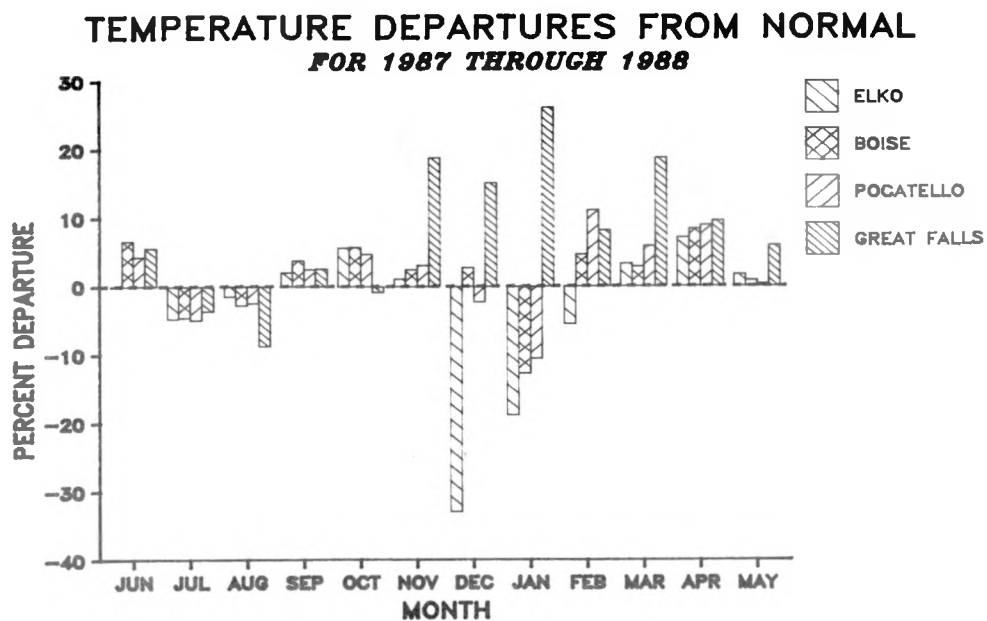


Figure 2-5. Temperature percent departures from "normal" at four NWS sites in Nevada, Idaho, and Montana.

Table 2-2. Temperature means and departures from "normal" for eight selected NWS sites in the Pacific Northwest. Temperatures are given in degrees Fahrenheit.

STATION		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	ANNUAL
ASTORIA	41-70	56.6	60.1	60.6	58.5	52.9	46.6	43.1	41.1	43.9	44.4	47.6	52.2	50.6
	87-88 DEP	.8	(.9)	(.2)	(.1)	1.6	3.0	(2.2)	.7	1.9	1.0	1.3	.3	.6
	87-88	57.4	59.2	60.4	58.4	54.5	49.6	40.9	41.8	45.8	45.4	48.9	52.5	51.2
	% DEP	1.4	(1.5)	(.3)	(.2)	3.0	6.4	(5.1)	1.7	4.3	2.3	2.7	.6	1.3
EUGENE	41-70	61.1	66.8	66.2	62.1	53.3	45.3	41.3	40.1	43.5	45.8	49.6	55.1	52.5
	87-88 DEP	2.2	(2.4)	1.4	.6	3.2	1.5	(1.5)	(.8)	.6	1.0	2.1	(.8)	.6
	87-88	63.3	64.4	67.6	62.7	56.5	46.8	39.8	39.3	44.1	46.8	51.7	54.3	53.1
	% DEP	3.6	(3.6)	2.1	1.0	6.0	3.3	(3.6)	(2.0)	1.4	2.2	4.2	(1.5)	1.1
PORTLAND	41-70	62.5	67.7	67.3	62.7	54.3	45.5	40.9	38.9	43.2	45.9	58.4	56.7	53.7
	87-88 DEP	4.0	(.5)	3.2	2.8	3.9	3.3	(1.8)	.1	1.5	1.3	1.8	(.3)	1.6
	87-88	66.5	67.2	70.5	65.5	58.2	48.8	39.1	39.0	44.7	47.2	60.2	56.4	55.3
	% DEP	6.4	(.7)	4.8	4.5	7.2	7.3	(4.4)	.3	3.5	2.8	3.1	(.5)	2.8
PENDLETON	41-70	66.2	73.8	71.7	63.8	52.5	41.1	36.0	32.8	39.4	43.9	50.3	58.4	52.5
	87-88 DEP	1.0	(4.9)	(1.1)	2.4	1.6	1.5	(3.3)	(.4)	1.7	.2	1.6	(1.6)	(.1)
	87-88	67.2	68.9	70.6	66.2	54.1	42.6	32.7	32.4	41.1	44.1	51.9	56.8	52.4
	% DEP	1.5	(6.6)	(1.5)	3.8	3.0	3.6	(9.2)	(1.2)	4.3	.5	3.2	(2.7)	(.1)
ELKO	41-70	61.2	70.1	67.6	58.4	47.5	35.3	26.1	25.0	31.0	36.0	43.4	52.4	46.2
	87-88 DEP		(3.3)	(1.0)	1.2	2.7	.4	(8.6)	(4.7)	(1.7)	1.2	3.1	.9	(.9)
	87-88	61.2	66.8	66.6	59.6	50.2	35.7	17.5	20.3	29.3	37.2	46.5	53.3	45.4
	% DEP	.0	(4.7)	(1.5)	2.1	5.7	1.1	(33.0)	(18.8)	(5.5)	3.3	7.1	1.7	(3.5)
BOISE	41-70	65.8	74.6	72.0	63.2	51.9	39.7	32.0	29.9	36.1	41.4	48.6	57.4	51.1
	87-88 DEP	4.4	(3.4)	(2.0)	2.4	3.0	1.0	.9	(3.8)	1.7	1.2	4.1	.5	.8
	87-88	70.2	71.2	70.0	65.6	54.9	40.7	32.9	26.1	37.8	42.6	52.7	57.9	51.9
	% DEP	6.7	(4.6)	(2.8)	3.8	5.8	2.5	2.8	(12.7)	4.7	2.9	8.4	.9	1.5
POCATELLO	41-70	62.5	71.2	68.9	59.2	48.1	35.2	26.6	23.8	29.5	35.5	44.6	54.0	46.6
	87-88 DEP	2.7	(3.5)	(1.7)	1.5	2.3	1.1	(.6)	(2.5)	3.3	2.1	4.0	.2	.7
	87-88	65.2	67.7	67.2	60.7	50.4	36.3	26.0	21.3	32.8	37.6	48.6	54.2	47.3
	% DEP	4.3	(4.9)	(2.5)	2.5	4.8	3.1	(2.3)	(10.5)	11.2	5.9	9.0	.4	1.8
GREAT FALLS	41-70	61.9	69.3	67.5	57.4	47.9	34.0	25.7	18.7	26.7	31.4	42.7	53.2	44.7
	87-88 DEP	3.5	(2.5)	(5.9)	1.5	(.4)	6.4	3.9	4.9	2.2	5.9	4.1	3.2	2.2
	87-88	65.4	66.8	61.6	58.9	47.5	40.4	29.6	23.6	28.9	37.3	46.8	56.4	46.9
	% DEP	5.7	(3.6)	(8.7)	2.6	(.8)	18.8	15.2	26.2	8.2	18.8	9.6	6.0	8.2

VALUES IN PARENTHESIS REPRESENT NEGATIVE NUMBERS

Table 2-3. Precipitation means and departures from "normal" for eight selected NWS sites in the Pacific Northwest. Precipitation is given in inches.

STATION		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	ANNUAL
ASTORIA	41-70	2.4	1.0	1.6	3.1	6.2	9.9	11.6	11.3	7.8	7.3	4.6	2.8	69.6
	87-88 DEP	(1.8)	.1	(1.4)	(2.2)	(5.7)	(5.6)	(2.7)	(4.7)	(4.2)	.6	(.6)	1.3	(26.9)
	87-88	.7	1.1	.2	1.0	.5	4.3	8.9	6.6	3.6	7.9	4.0	4.1	42.7
	% DEP	(73.3)	(5.8)	(89.7)	(69.5)	(91.6)	(56.2)	(23.5)	(41.8)	(53.9)	8.3	(13.3)	44.0	
EUGENE	41-70	1.2	.3	1.0	1.5	3.5	6.8	8.5	8.4	5.1	5.1	2.8	2.0	46.0
	87-88 DEP	(1.2)	2.7	(.7)	(1.3)	(3.2)	(2.2)	6.9	.3	(3.5)	(.3)	2.9	1.7	2.2
	87-88	.1	3.0	.3	.2	.2	4.7	15.4	8.7	1.6	4.8	5.7	3.7	48.3
	% DEP	(94.4)		(72.6)	(86.2)	(93.1)	(31.8)	81.4	3.9	(68.9)	(6.5)	104.7	88.3	
PORTLAND	41-70	1.5	.5	1.1	1.6	3.1	5.2	6.4	6.2	3.9	3.6	2.3	2.1	37.4
	87-88 DEP	(1.3)	.6	(.8)	(1.3)	(2.8)	(3.2)	1.6	(1.2)	(2.8)	(.5)	2.3	.5	(9.0)
	87-88	.1	1.0	.4	.3	.3	2.0	8.0	5.0	1.2	3.1	4.6	2.5	28.4
	% DEP	(90.5)	123.9	(69.0)	(81.4)	(91.1)	(62.1)	24.8	(19.6)	(70.2)	(13.3)	97.8	21.6	
PENDLETON	41-70	.7	.3	.6	.6	1.0	1.5	1.7	1.7	1.1	1.1	1.0	.7	11.8
	87-88 DEP	(.3)	.0	(.5)	(.6)	(1.0)	(.7)	(.4)	.1	(1.0)	(.1)	1.5	.5	(2.5)
	87-88	.4	.3	.1	.0	.0	.8	1.2	1.9	.1	1.0	2.5	1.2	9.4
	% DEP	(45.7)	13.3	(90.9)	(94.8)		(48.6)	(25.9)	7.5	(89.2)	(10.4)	149.5	67.1	
ELKO	41-70	.9	.3	.6	.5	.6	.8	1.0	1.2	.8	.9	.8	1.0	9.3
	87-88 DEP	(.2)	(.2)	(.6)	(.4)	.0	1.1	(.2)	.1	(.8)	(.8)	(.3)	(.1)	(2.4)
	87-88	.7	.1	.0	.1	.6	2.0	.7	1.3	.1	.0	.5	.9	6.9
	% DEP	(24.2)	(57.6)	(98.3)	(80.9)	(1.8)	137.3	(24.5)	9.5	(92.6)	(95.3)	(41.8)	(11.7)	
BOISE	41-70	1.0	.3	.4	.6	.8	1.3	1.3	1.6	1.1	1.0	1.2	1.2	11.7
	87-88 DEP	(.4)	.4	(.3)	(.6)	(.8)	(.3)	(.3)	(.3)	(.6)	.4	.6	.1	(2.0)
	87-88	.6	.7	.1	.0	.0	1.0	1.1	1.3	.4	1.5	1.8	1.3	9.7
	% DEP	(38.9)	169.2	(72.5)			(22.5)	(21.6)	(20.7)	(59.8)	40.8	51.3	10.0	
POCATELLO	41-70	1.1	.5	.6	.7	.9	.9	1.0	1.1	.9	.9	1.2	1.2	10.9
	87-88 DEP	(.4)	1.5	.1	(.7)	(.7)	(.5)	.3	(.1)	(.7)	(.1)	(.2)	(.4)	(1.9)
	87-88	.7	1.9	.7	.0	.3	.4	1.2	1.1	.2	.8	1.0	.8	9.0
	% DEP	(36.8)	310.6	10.0		(72.8)	(51.6)	26.0	(6.2)	(75.6)	(11.7)	(16.4)	(35.0)	
GREAT FALLS	41-70	2.8	1.1	1.3	1.0	.8	.7	.8	1.0	.8	.9	1.5	2.5	15.2
	87-88 DEP	(1.4)	2.0	1.1	.3	(.8)	(.4)	(.6)	(.2)	(.3)	(.5)	(.7)	(.9)	(2.5)
	87-88	1.3	3.1	2.4	1.3	.0	.3	.2	.8	.5	.4	.8	1.6	12.7
	% DEP	(51.6)	177.3	85.5	26.2	(97.6)	(59.5)	(70.0)	(24.0)	(37.3)	(52.7)	(48.3)	(36.5)	

VALUES IN PARENTHESES REPRESENT NEGATIVE NUMBERS

**TOTAL PRECIPITATION DEPARTURES FROM NORMAL
FOR 1987 THROUGH 1988**

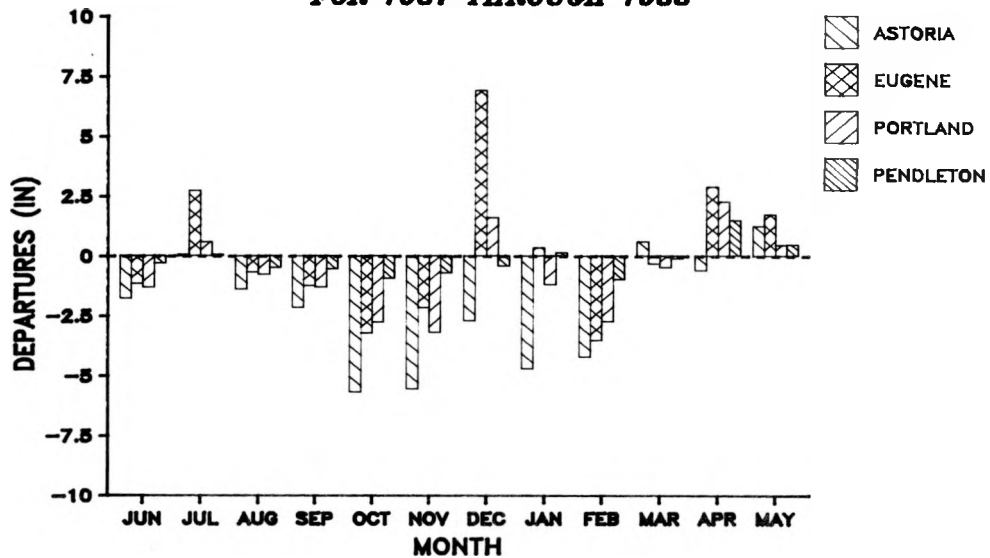


Figure 2-6. Precipitation departures from "normal" (inches) at four NWS sites in Oregon.

**TOTAL PRECIPITATION DEPARTURES FROM NORMAL
FOR 1987 THROUGH 1988**

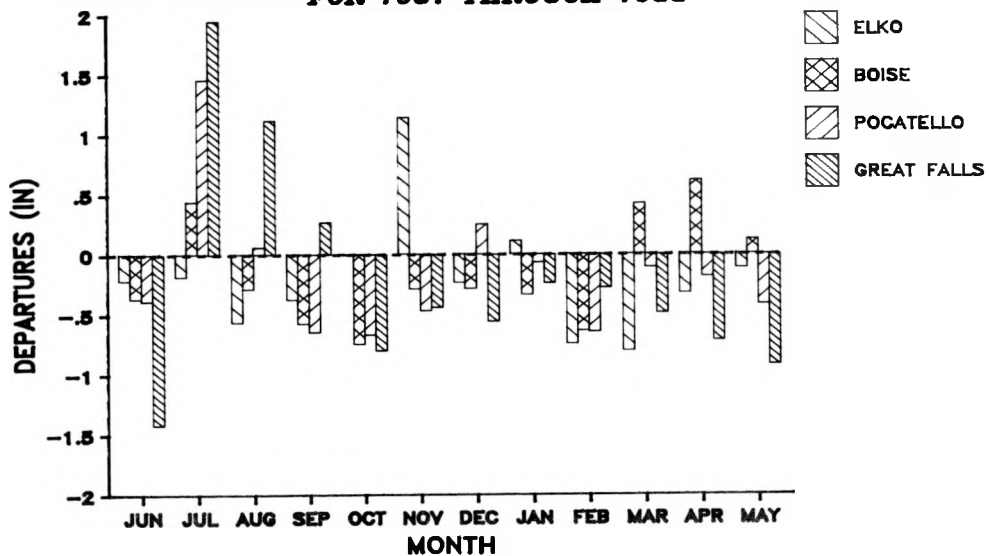


Figure 2-7. Precipitation departures from "normal" (inches) at four NWS sites in Nevada, Idaho, and Montana.

3.0 WIND SITE DATA SUMMARY

Wind data have been collected at high wind sites throughout the BPA area since 1976. In this section we will examine the statistics at each active wind energy survey site during the period 1 June 1987 through 31 May 1988. Table 3-1 summarizes the statistics for this period for all the current sites. The statistics include mean monthly speed in mph, number of hours of data, power density in watts per square meter, mean monthly temperature, and mean monthly pressure in inches of mercury.

This report presents all the most important wind statistics in tables for each site for the entire period of record in the appendices. The statistics summarized include: monthly mean speeds, number of observations since the site was instrumented, monthly power densities for 1987-88, speed and energy distributions, diurnal wind speed variations for each month, monthly temperature variations and monthly pressure variations.

A summary table presents information on anemometer height, data recovery rate, peak hourly average wind speed, peak gust and time of occurrence, energy statistics, and the Weibull fit shape and scale parameters.

The energy statistics supplied for each site include available energy, power density and estimated gross annual energy output for five selected wind turbines at that site.

NOTE: These gross annual energy estimates should not be confused with the energy that could be produced at a site. The net power produced at a site would include losses because of turbine down time, array effects, electrical line losses, blade fouling, performance penalties, turbulence effects or any other factor that may alter machine performance.

Table 3-1. Wind statistics at active BPA wind survey sites in the Pacific Northwest.

SITE NAME ANEM. HGT (FT)/ ELEV. (FT)		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	ANNUAL AVG.
ALBION BUTTE IDAHO 21/7110	V(MPH)	11.2	13.4	13.0	11.4	11.4	5.0			19.2				12.1
	N	302.0	744.0	744.0	720.0	744.0	82.0			119.0				3455.0
	PD(W/M**2)	535.6	468.2	354.6	563.1	582.4	129.3			958.1				513.0
	TEMP(DEG)	65.4	65.0	66.9	62.8	52.5	42.3			31.8				55.2
	PRES.(IN)	24.2	24.1	24.2	24.2	24.2	24.1			24.1				24.2
BROWNING DEPOT MONTANA 40/4500	V(MPH)	12.9	10.9	9.7	11.8	13.7	18.2	19.0	19.5	18.1	17.1		14.5	15.0
	N	720.0	744.0	378.0	720.0	742.0	710.0	743.0	706.0	629.0	729.0		352.0	7173.0
	PD(W/M**2)	340.7	269.9	288.8	313.4	526.9	734.6	780.2	1054.8	928.0	628.6		282.3	558.9
	TEMP(DEG)	60.3	60.6	56.0	58.0	46.9	38.4	27.3	24.0	29.6	32.4		48.0	43.8
	PRES.(IN)					NO PRESSURE INSTRUMENT INSTALLED								
CAPE BLANCO MW OREGON 50/217	V(MPH)	23.1	17.7		17.1	17.6	23.8	28.4	24.1	16.0	18.1	17.8	18.5	20.2
	N	721.0	593.0		505.0	610.0	296.0	709.0	695.0	677.0	694.0	629.0	719.0	6848.0
	PD(W/M**2)	1026.8	945.4		765.2	713.2	2275.7	2201.4	2168.0	657.2	933.4	1193.1	1469.2	1304.4
	TEMP(DEG)	55.3	58.9	55.1	57.1	56.0	48.6	47.3	48.9	49.0	46.4	48.6	51.9	51.9
	PRES.(IN)	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	30.1	30.0	29.8	29.8	29.9
GOODNOE HILLS WASHINGTON 50/2540	V(MPH)	9.8	11.8	9.1	10.2	9.2	8.6	8.9	9.4	9.8	10.6	11.0	10.6	9.9
	N	720.0	743.0	736.0	589.0	546.0	251.0	634.0	708.0	660.0	744.0	674.0	744.0	7749.0
	PD(W/M**2)	269.5	271.2	276.7	403.7	233.4	215.3	357.1	382.0	382.9	339.6	296.4	321.3	312.4
	TEMP(DEG)	63.3	61.7	67.3	64.8	52.8	46.4	28.0	29.0	36.4	38.2	45.4	49.7	48.6
	PRES.(IN)	27.2	27.2	27.2	26.7	26.6	27.3	27.2	27.3	27.8	27.7	27.5	27.6	27.3
HAMPTON BUTTE OREGON 34/6343	V(MPH)	11.2	12.5	11.5	10.2	10.3	14.8	18.7	16.2	14.0	17.7	16.1	14.3	14.0
	N	720.0	744.0	744.0	720.0	744.0	719.0	740.0	742.0	696.0	744.0	720.0	744.0	8777.0
	PD(W/M**2)	319.1	367.7	292.8	258.2	235.9	352.0	805.5	577.1	499.2	688.3	474.5	374.1	437.0
	TEMP(DEG)	61.3	59.5	66.7	64.3	57.5	36.7	26.5	28.0	38.5	35.3	42.5	46.6	47.0
	PRES.(IN)	24.6	24.5	24.6	24.7	24.7	24.6	24.4	24.4	24.5	24.6	24.5	24.6	24.6
KENNEWICK MW WASHINGTON 80/2200	V(MPH)	14.4	16.6	10.5	10.8	8.9	16.6	24.5	17.0	18.5	17.8	14.5	18.1	15.7
	N	720.0	744.0	729.0	708.0	744.0	715.0	217.0	83.0	696.0	744.0	720.0	739.0	7559.0
	PD(W/M**2)	291.1	822.8	581.7	1006.1	528.0	1200.8	1741.5	683.9	1489.6	1241.7	781.1	948.9	943.1
	TEMP(DEG)	64.7	67.8	72.9	66.7	57.3	42.8	45.1	27.9	40.6	44.4	52.3	58.1	53.4
	PRES.(IN)	28.1	28.0	28.1	28.1	28.2	28.1	27.8	28.0	28.2	28.2	28.0	28.0	28.1
KITITITAS MW WASHINGTON 110/2660	V(MPH)	12.2	14.9	12	10.3	9.6	9.9	8.3	9.1	12.0	13.9	12.9	14.5	11.6
	N	720.0	744.0	719.0	715.0	389.0	720.0	744.0	719.0	696.0	744.0	720.0	730.0	8360.0
	PD(W/M**2)	554.6	679.9	595.2	802.5	678.4	535.2	494.1	683.8	733.6	942.1	602.5	662.7	663.7
	TEMP(DEG)	67.3	67.5	68.5	65.9	60.2	42.2	31.3	30.2	39.4	42.9	50.1	55.5	51.8
	PRES.(IN)	27.6	27.5	27.6	27.6	27.7	27.6	27.5	27.6	27.7	27.6	27.5	27.4	27.6
PEQUOP SUMMIT NEVADA 30/7538	V(MPH)	14.0	14.6	13.5	11.6	10.9		19.5	17.3	16.0	20.8	16.6	17.6	15.7
	N	356.0	693.0	694.0	702.0	576.0		602.0	596.0	672.0	386.0	720.0	744.0	6741.0
	PD(W/M**2)	651.0	557.0	541.0	461.0	515.0		1149.0	1325.0	1122.0	1435.0	960.0	937.0	478.0
	TEMP(DEG)	59.1	62.1	61.5	59.1	50.1		20.2	21.7	27.2	31.1			43.6
	PRES.(IN)	23.7	23.7	23.8	23.8	23.9		23.5	23.6	23.7	23.6	23.6	23.6	23.7
PEQUOP TOWER NEVADA 50/7540	V(MPH)	13.2	15.6	14.2	12.3	12.0	14.6	23.8	25.1	11.7	30.0	21.8	22.0	18.0
	N	658.0	735.0	744.0	715.0	738.0	691.0	524.0	333.0	197.0	735.0	717.0	731.0	7518.0
	PD(W/M**2)	527.2	431.0	370.0	300.3	364.5	502.8	1124.3	1386.5	431.7	1819.6	966.3	1066.0	774.2
	TEMP(DEG)				(NO TEMPERATURE OR PRESSURE DATA)									
	PRES.(IN)													
SEVEN MILE HILL OREGON 50/1880	V(MPH)	17.6	21.3	16.8	15.3	10.8	8.8	8.7	8.0	11.4	13.9	16.3	15.4	13.7
	N	720.0	734.0	744.0	721.0	744.0	709.0	738.0	743.0	667.0	729.0	718.0	732.0	8699.0
	PD(W/M**2)	730.1	991.2	970.4	1044.3	727.4	696.9	453.8	729.1	687.0	764.6	886.5	813.2	791.2
	TEMP(DEG)	62.2	61.3	66.4	62.4	55.2	41.7	32.7	31.5	39.1	40.7	45.5	50.0	49.1
	PRES.(IN)	28.3	28.2	28.3	28.3	28.4	28.4	28.3	28.4	28.5	28.4	28.2	28.3	28.3
SPRING CREEK WASHINGTON 100/97	V(MPH)	12.8	14.2	9.5	12.0	8.5	6.4	6.7	4.8				12.6	9.7
	N	586.0	621.0	106.0	700.0	477.0	707.0	331.0	219.0				443.0	4190.0
	PD(W/M**2)	414.4	437.7	499.0	635.4	375.4	345.2	272.6	202.4				317.1	388.8
	TEMP(DEG)	67.3	70.0	72.2	67.6	61.4	45.9	40.3	34.6					57.4
	PRES.(IN)	29.9	29.8	29.9	30.0	30.0	30.1	29.8	29.9				29.9	29.9
UPPER PYLE OREGON 50/3660	V(MPH)	14.9			11.0	11.3	15.5	19.0	15.3	11.5	14.9	14.6	13.0	14.1
	N	165.0			351.0	744.0	718.0	738.0	715.0	302.0	651.0	720.0	289.0	5393.0
	PD(W/M**2)	409.0			292.8	305.0	615.1	1213.6	793.8	287.6	539.7	513.1	377.3	534.7
	TEMP(DEG)	59.6			60.6	51.7	35.7	27.4	26.1	25.7	35.1	44.4	45.7	41.2
	PRES.(IN)	26.6			26.9	26.9	26.8	26.7	26.8	26.9	26.8	26.7	26.7	26.8

3.1 Site Discussions

Albion Butte

The Albion Butte site characteristics are described in detail in BPA report 85-19. Severe ice and wind continued to cause problems at this site in south-central Idaho. A considerable amount of data were lost from November 1987 through May 1988. The mean speed measured during the period of record was 12 mph. However, the strongest wind speeds occur in the winter months at this site. A typical mean speed for a year would be closer to 16 mph.

Table 3-2 presents wind statistics for Albion Butte. Data recovery was only 40%, so the statistics should be used cautiously. Although energy statistics are normalized to a full year, the strongest wind season was not included in the record.

It will be difficult to assess the wind power potential at this site even though the site was instrumented for four years because little data was collected during the winter months which are the strongest wind season. No data were collected in the months of March or April at this site. Summarized statistics for this site are also presented in Appendix A.

Table 3-2. Annual Summary Statistics for Albion Butte.

ALBION BUTTE			
Data Period: Jun. 1987 - May 1988		Site Elevation: 7110 ft	
Wind Statistics			
Anemometer Level:	21 ft	Data Recovery Rate:	39.4%
Average Speed:	12.3 mph	Power Density:	241 W/M**2
Available Energy:	2108 KWh/M**2	% Time (Speed 12.0-60.0):	45.7%
Maximum (1 hr Avg.):	56.4 mph	Maximum Gust:	76.9 mph
Date:	6/21 - 2200	Date:	6/21 - 2200
Shape Factor:	1.41	Scale Factor:	13.5 mph
Standard Deviation of Hourly Wind Speeds:		8.98	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	125515 kWh	556316 kWh	263597 kWh 164414 kWh
Capacity Factor*:	0.217	0.212	0.100 0.188
Efficiency Factor**:	0.202	0.226	0.267 0.249
Alpha Factor Used:	0.100	0.100	0.100 0.100
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	251694 kWh		
Capacity Factor*:	0.140		
Efficiency Factor**:	0.211		
Alpha Factor Used:	0.100		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Browning Depot

At the Browning Depot the mean wind speed averaged 16.0 mph at the 80 ft level for the 1987-88 period. Data recovery was 86% for the year. A maximum gust of 80 mph was measured in April (see Table 3-3). The shear coefficient between the 50 and 80 ft levels was 0.10. The CR-21 recorder failed in late March and was replaced in mid May.

Appendix B presents summarized statistics for Browning.

Table 3-3. Annual Summary Statistics for Browning Depot.

BROWNING DEPOT			
Data Period: Jun. 1987 - May 1988		Site Elevation: 4500 ft	
Wind Statistics			
Anemometer Level:	50 ft	Data Recovery Rate:	81.8%
Average Speed:	15.3 mph	Power Density:	360 W/M**2
Available Energy:	3151 KWh/M**2	% Time (Speed 12.0-60.0):	60.5%
Maximum (1 hr Avg.):	55.6 mph	Maximum Gust:	80.0 mph
Date:	1/14 - 2000	Date:	1/22 - 1500
Shape Factor:	1.83	Scale Factor:	17.2 mph
Standard Deviation of Hourly Wind Speeds:			8.76
Anemometer Level:	80 ft	Data Recovery Rate:	81.6%
Average Speed:	16.0 mph	Power Density:	396 W/M**2
Available Energy:	3473 KWh/M**2	% Time (Speed 12.0-60.0):	64.2%
Maximum (1 hr Avg.):	56.8 mph	Maximum Gust:	79.0 mph
Date:	1/14 - 2000	Date:	1/22 - 1500
Shape Factor:	1.89	Scale Factor:	18.0 mph
Standard Deviation of Hourly Wind Speeds:			8.90
Alpha Value (50 ft-80 ft):			0.098
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	161785 kWh	706812 kWh	327061 kWh 206710 kWh
Capacity Factor*:	0.280	0.269	0.124 0.236
Efficiency Factor**:	0.236	0.261	0.300 0.283
Alpha Factor Used:	0.098	0.098	0.098 0.098
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	321363 kWh		
Capacity Factor*:	0.179		
Efficiency Factor**:	0.245		
Alpha Factor Used:	0.098		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Cape Blanco

There were two anemometer sites at Cape Blanco within 200 yards of each other. The Cape Blanco Radio Site was installed in October 1986 and removed in January 1988. Cape Blanco Microwave was installed in October of 1976. A telephone modem is used to retrieve the data since January 1988. Before January of 1988 data were collected on cassette tape and strip charts prior to 1986. Some data recovery problems were encountered this past year at the microwave site because of improper installation of cassette tapes. Since a modem was installed data recovery improved from 67% to 94%. Statistical data for the microwave site are given in Table 3-4.

The site recorded maximum winds of 115 mph during the past year. Strongest hourly speed was 88.2 mph. The mean speed was 20.2 mph, about 5% stronger than average. Summarized statistics for Cape Blanco, since 1976, are presented in Appendix C.

Table 3-4. Annual Summary Statistics for Cape Blanco Microwave.

CAPE BLANCO M/W			
Data Period: Jun. 1987 - May 1988		Site Elevation: 217 ft	
Wind Statistics			
Anemometer Level:	50 ft	Data Recovery Rate:	78.2%
Average Speed:	20.2 mph	Power Density:	1204 W/M**2
Available Energy:	10547 KWh/M**2	% Time (Speed 12.0-60.0):	67.1%
Maximum (1 hr Avg.):	86.2 mph	Maximum Gust:	115.6 mph
Date:	11/31 - 000	Date:	12/7 - 2100
Shape Factor:	1.56	Scale Factor:	22.5 mph
Standard Deviation of Hourly Wind Speeds:		13.43	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	250292 kWh	1055013 kWh	648327 kWh 309938 kWh
Capacity Factor*:	0.433	0.401	0.247 0.354
Efficiency Factor**:	0.118	0.137	0.177 0.128
Alpha Factor Used:	0.000	0.000	0.000 0.000
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	445109 kWh		
Capacity Factor*:	0.248		
Efficiency Factor**:	0.137		
Alpha Factor Used:	0.000		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Goodnoe Hills

Wind data have been collected at the BPA tower since May of 1980. During the past year data recovery was 88% at this location. The site statistics are presented in Table 3-5. A peak gust of 98 mph was measured at the 50 ft level of Goodnoe Hills tower in February of 1988. The mean speed measured at the site was 10 mph at the 50 ft level and 14 mph at the 195 ft level. The mean shear level is 0.245 which has increased from 0.21 in earlier studies (see BPA Report 85-19). The increase in shear may be attributed to an increase in roughness around the tower or a variation in the frequency of certain wind directions associated with high shear. The second explanation is more likely since last year's shear coefficient was 0.19.

Wind statistics for Goodnoe Hills are also presented in Appendix D.

Table 3-5. Annual Summary Statistics for Goodnoe Hills.

GOODNOE HILLS TOWER			
Data Period: Jun. 1987 – May 1988		Site Elevation: 2540 ft	
Wind Statistics			
Anemometer Level:	50 ft	Data Recovery Rate:	88.5%
Average Speed:	10.0 mph	Power Density:	130 W/M**2
Available Energy:	1140 KWh/M**2	% Time (Speed 12.0–60.0):	35.3%
Maximum (1 hr Avg.):	90.3 mph	Maximum Gust:	97.9 mph
Date:	2/3 – 1100	Date:	2/3 – 1100
Shape Factor:	1.57	Scale Factor:	11.2 mph
Standard Deviation of Hourly Wind Speeds:		6.62	
Anemometer Level:	195 ft	Data Recovery Rate:	88.3%
Average Speed:	14.0 mph	Power Density:	359 W/M**2
Available Energy:	3146 KWh/M**2	% Time (Speed 12.0–60.0):	52.1%
Maximum (1 hr Avg.):	90.8 mph	Maximum Gust:	91.9 mph
Date:	2/3 – 1100	Date:	2/3 – 1100
Shape Factor:	1.51	Scale Factor:	15.5 mph
Standard Deviation of Hourly Wind Speeds:		9.58	
Alpha Value (50 ft–195 ft):		0.245	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	92331 kWh	440270 kWh	140267 kWh 94269 kWh
Capacity Factor*:	0.160	0.168	0.108 0.236
Efficiency Factor**:	0.295	0.314	0.312 0.283
Alpha Factor Used:	0.245	0.245	0.245 0.098
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	229081 kWh		
Capacity Factor*:	0.128		
Efficiency Factor**:	0.273		
Alpha Factor Used:	0.245		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Hampton Butte

Data recovery at Hampton Butte was nearly 100% this year. The mean wind speed for this first complete year of wind data was 14.0 mph. The site experienced no gusts above 75 mph (see Table 3-6).

Wind statistics for this site are also presented in Appendix E. An analysis of the diurnal variation of wind speed in Appendix E shows that during the summer months this site has weaker winds during the day. During the winter months day time winds are also weaker than nighttime but the diurnal cycle is less evident.

Table 3-6. Annual Summary Statistics for Hampton Butte.

HAMPTON BUTTE			
Data Period: Jun. 1987 – May 1988		Site Elevation: 6343 ft	
Wind Statistics			
Anemometer Level:	34 ft	Data Recovery Rate:	100.2%
Average Speed:	14.0 mph	Power Density:	268 W/M**2
Available Energy:	2347 KWh/M**2	% Time (Speed 12.0–60.0):	54.8%
Maximum (1 hr Avg.):	56.1 mph	Maximum Gust:	71.4 mph
Date:	12/9 – 2300	Date:	3/26 – 1400
Shape Factor:	1.80	Scale Factor:	15.7 mph
Standard Deviation of Hourly Wind Speeds:		8.11	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	134573 kWh	589913 kWh	268520 kWh 168882 kWh
Capacity Factor*:	0.233	0.224	0.102 0.193
Efficiency Factor**:	0.225	0.249	0.282 0.265
Alpha Factor Used:	0.100	0.100	0.100 0.100
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	264274 kWh		
Capacity Factor*:	0.147		
Efficiency Factor**:	0.230		
Alpha Factor Used:	0.100		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Kennewick

The anemometer was moved from 105 ft to 80 ft (on a new tower) at the Kennewick site this year. Three months of overlapping measurements were collected so that the data at 80 ft could be related to the 105 ft level of the anemometer location for twelve years. Long-term wind statistics presented in Appendix F are from the 105 ft level.

Data recovery was 72% at Kennewick 80 ft level this year. The equipment was not installed until mid-July and programming problems on the CR-21 caused lost data in December and January. The mean speed measured was 14.9 mph at 80 ft and the available energy was 4,620 kWh for the period (see Table 3-7).

Figure 3-1 compares the ratio of the new anemometer height 80 ft to the long-term anemometer height 105 ft. The mean ratio is 0.93 for the wind speed range of 10 to 97 mph. There is little evidence that the ratio is a function of wind speed but is a strong function of wind direction. There is considerable difference in the ratio for the two most frequent directions. It appears that for directions that are northeast through southwest, a correction of about 5% is appropriate, and for the remainder of the directions sectors a 10% correction would be adequate.

Table 3-7. Annual Summary Statistics for Kennewick 80 ft level.

KENNEWICK M/W				
Data Period: Jun. 1987 – May 1988			Site Elevation: 2200 ft	
Wind Statistics				
Anemometer Level:	80 ft	Data Recovery Rate:	71.9%	
Average Speed:	14.9 mph	Power Density:	527 W/M**2	
Available Energy:	4620 KWh/M**2	% Time (Speed 12.0–60.0):	47.6%	
Maximum (1 hr Avg.):	66.9 mph	Maximum Gust:	97.2 mph	
Date:	5/12 – 2300	Date:	9/30 – 1300	
Shape Factor:	1.36	Scale Factor:	16.2 mph	
Standard Deviation of Hourly Wind Speeds:			11.26	
Estimated Turbine Energy Output (Normalized to period of record)				
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW	USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft	60 ft
Swept Area:	201 M**2	730 M**2	347 M**2	229 M**2
Est. Total Energy*:	160020 kWh	1055013 kWh	648327 kWh	309938 kWh
Capacity Factor*:	0.277	0.271	0.143	0.241
Efficiency Factor**:	0.176	0.198	0.260	0.218
Alpha Factor Used:	0.100	0.100	0.100	0.100
Turbine Type:	DYNERGY 180 KW			
Hub Height:	160 ft			
Swept Area:	308 M**2			
Est. Total Energy*:	334952 kWh			
Capacity Factor*:	0.187			
Efficiency Factor**:	0.191			
Alpha Factor Used:	0.100			

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

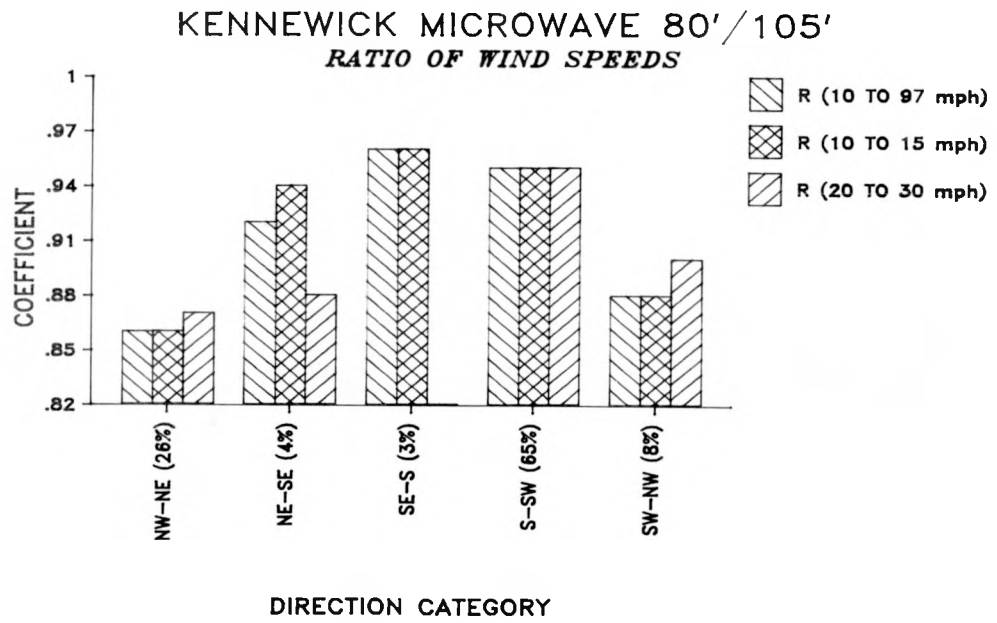


Figure 3-1. The ratio of the 80 ft anemometer to the 105 ft anemometer wind speeds as a function of wind speed and direction at Kennewick Microwave.

Kittitas Microwave

Data recovery at Kittitas was 95% during the past year and the measured mean annual wind speed was 11.7 mph. The winds this year were about 10% weaker than normal. Statistics for the site are presented in Table 3-8 and in Appendix G.

The data in Appendix G suggest the strongest winds occur two to three hours after the time of the highest temperatures. This may be the lag time between the establishment of a temperature gradient and strong wind flow in response to the gradient.

Table 3-8. Annual Summary Statistics for Kittitas Microwave.

KITTTITAS M/W			
Data Period: Jun. 1987 – May 1988		Site Elevation: 2660 ft	
Wind Statistics			
Anemometer Level:	110 ft	Data Recovery Rate:	95.4%
Average Speed:	11.7 mph	Power Density:	272 W/M**2
Available Energy:	2386 KWh/M**2	% Time (Speed 12.0–60.0):	38.8%
Maximum (1 hr Avg.):	52.5 mph	Maximum Gust:	67.8 mph
Date:	5/12 – 2300	Date:	5/12 – 2300
Shape Factor:	1.32	Scale Factor:	12.7 mph
Standard Deviation of Hourly Wind Speeds:		9.10	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	95844 kWh	423900 kWh	193217 kWh 119939 kWh
Capacity Factor*:	0.166	0.161	0.074 0.137
Efficiency Factor**:	0.224	0.251	0.284 0.264
Alpha Factor Used:	0.100	0.100	0.100 0.100
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	191425 kWh		
Capacity Factor*:	0.107		
Efficiency Factor**:	0.233		
Alpha Factor Used:	0.100		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Pequop Summit

The Pequop Summit site had only fair data recovery during the period (77%). The data tape recording system was the source of most of the problem. Several tapes were extremely difficult to read. The statistics are presented in Table 3-9. Summary statistics are in Appendix H.

The wind speeds measured at Pequop Summit had been adjusted by a factor of 1.29 (see BPA Report 88-27) to account for systematic error in the data. The equipment was repaired in May of 1987. The adjustment is no longer necessary.

Table 3-9. Annual Summary Statistics for Pequop Summit.

PEQUOP SUMMIT			
Data Period: Jun. 1987 – May 1988		Site Elevation: 7538 ft	
Wind Statistics			
Anemometer Level:	30 ft	Data Recovery Rate:	77.0%
Average Speed:	15.5 mph	Power Density:	517 W/M**2
Available Energy:	4527 KWh/M**2	% Time (Speed 12.0–60.0):	53.2%
Maximum (1 hr Avg.):	77.2 mph	Maximum Gust:	110.1 mph
Date:	12/10 – 1300	Date:	3/31 – 1800
Shape Factor:	1.36	Scale Factor:	17.0 mph
Standard Deviation of Hourly Wind Speeds:		11.70	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	150135 kWh	649223 kWh	365553 kWh 201054 kWh
Capacity Factor*:	0.260	0.247	0.139 0.230
Efficiency Factor**:	0.152	0.176	0.220 0.182
Alpha Factor Used:	0.030	0.030	0.030 0.030
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	278605 kWh		
Capacity Factor*:	0.155		
Efficiency Factor**:	0.172		
Alpha Factor Used:	0.030		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Pequop Tower

The Pequop Tower has been in operation since 1982. Data recovery this year was 86% at the 50 ft level and 50% at the 150 ft level. The 150 ft level failed in December and the equipment was removed in July of 1988.

The mean 50 ft speed was 14.5 mph. The statistics for both Pequop Summit and Pequop Tower indicate unusually strong peak wind speeds and peak gusts. These gusts are much higher than previously measured at this site and raise questions about their validity. Since there are no nearby sites that can be cross-referenced, we have to accept the data. But we do so with reservations! The equipment removed from the Pequop Tower will be calibrated in near future which should verify the accuracy of the equipment.

Statistics for this site are also presented in Appendix I and Table 3-10.

Table 3-10. Annual Summary Statistics for Pequop Tower.

PEQUOP TOWER			
Data Period: Jun. 1987 – May 1988		Site Elevation: 7540 ft	
Wind Statistics			
Anemometer Level:	50 ft	Data Recovery Rate:	85.8%
Average Speed:	18.0 mph	Power Density:	658 W/M**2
Available Energy:	5760 KWh/M**2	% Time (Speed 12.0–60.0):	65.0%
Maximum (1 hr Avg.):	85.4 mph	Maximum Gust:	124.9 mph
Date:	12/10 – 1300	Date:	3/30 – 600
Shape Factor:	1.62	Scale Factor:	20.1 mph
Standard Deviation of Hourly Wind Speeds:		11.53	
Anemometer Level:	150 ft	Data Recovery Rate:	51.4%
Average Speed:	14.8 mph	Power Density:	325 W/M**2
Available Energy:	2849 KWh/M**2	% Time (Speed 12.0–60.0):	57.3%
Maximum (1 hr Avg.):	76.1 mph	Maximum Gust:	121.9 mph
Date:	12/10 – 1200	Date:	12/22 – 1100
Shape Factor:	1.79	Scale Factor:	16.6 mph
Standard Deviation of Hourly Wind Speeds:		8.68	
Alpha Value (50 ft–150 ft):		0.100	
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO–190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	248257 kWh	1108767 kWh	553438 kWh 315263 kWh
Capacity Factor*:	0.429	0.422	0.211 0.360
Efficiency Factor**:	0.158	0.178	0.222 0.189
Alpha Factor Used:	0.100	0.100	0.100 0.100
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	488962 kWh		
Capacity Factor*:	0.273		
Efficiency Factor**:	0.162		
Alpha Factor Used:	0.100		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Seven Mile Hill Tower

Data have been collected at Seven Mile Hill, near The Dalles, Oregon, since 1978. The tower has two anemometer levels 50 and 150 ft. The 1987-88 statistics are presented in Table 3-11 and summarized for the entire period of record are presented in Appendix J. The data recovery for this past year was 99%. The winds at both levels were about 9% lower than the long-term mean speed this year.

This site exhibits a large difference in the shape factor with height. Figure 3-2 shows the wind speed distribution at the two levels of the tower. In Section 4.0 there will be a discussion of the variation of the wind speed distribution with height.

Table 3-11. Annual Summary Statistics for Seven Mile Hill Tower.

SEVEN MILE HILL TOWER			
Data Period: Jun. 1987 - May 1988		Site Elevation: 1880 ft	
Wind Statistics			
Anemometer Level:	50 ft	Data Recovery Rate:	99.3%
Average Speed:	13.7 mph	Power Density:	411 W/M**2
Available Energy:	3602 KWh/M**2	% Time (Speed 12.0-60.0):	48.7%
Maximum (1 hr Avg.):	51.6 mph	Maximum Gust:	67.1 mph
Date:	7/15 - 1800	Date:	9/12 - 2000
Shape Factor:	1.31	Scale Factor:	14.9 mph
Standard Deviation of Hourly Wind Speeds:		10.66	
Anemometer Level:	150 ft	Data Recovery Rate:	99.3%
Average Speed:	15.3 mph	Power Density:	499 W/M**2
Available Energy:	4369 KWh/M**2	% Time (Speed 12.0-60.0):	53.7%
Maximum (1 hr Avg.):	54.8 mph	Maximum Gust:	65.3 mph
Date:	7/15 - 1800	Date:	3/26 - 1400
Shape Factor:	1.45	Scale Factor:	16.9 mph
Standard Deviation of Hourly Wind Speeds:		10.85	
Alpha Value (50 ft-150 ft):			0.101
Estimated Turbine Energy Output (Normalized to period of record)			
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft 60 ft
Swept Area:	201 M**2	730 M**2	347 M**2 229 M**2
Est. Total Energy*:	164129 kWh	716926 kWh	348970 kWh 215048 kWh
Capacity Factor*:	0.284	0.273	0.133 0.245
Efficiency Factor**:	0.231	0.254	0.309 0.284
Alpha Factor Used:	0.101	0.101	0.101 0.101
Turbine Type:	DYNERGY 180 KW		
Hub Height:	160 ft		
Swept Area:	308 M**2		
Est. Total Energy*:	336820 kWh		
Capacity Factor*:	0.188		
Efficiency Factor**:	0.245		
Alpha Factor Used:	0.101		

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

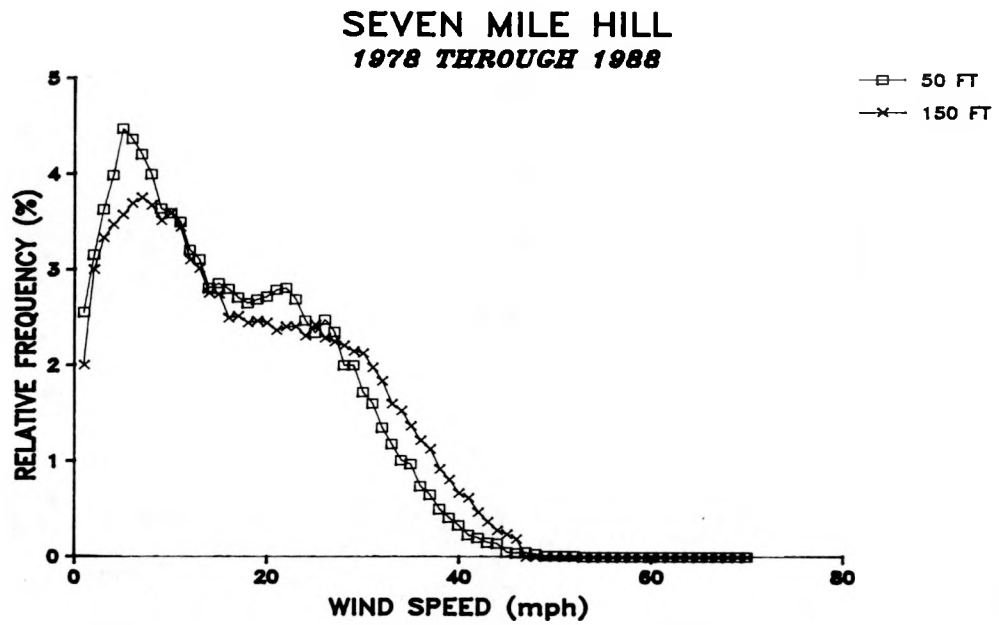


Figure 3-2. The distribution of wind speeds at the 50 and 150 ft levels of the Seven Mile Tower.

Spring Creek Hatchery

An anemometer is located in Columbia River Gorge on a 100 ft pole at the Spring Creek Fish Hatchery. Statistics for the past year are presented in Table 3-12. The data recovery for this site only 48%. Most of the problems, at this site, were with the tape recorder for the data logger. Some problems were encountered reading tapes during the past year. The tape recorder was changed again in May 1988 and the problem has been eliminated.

This location has a large seasonal wind speed variation (see Table 3-1). The consequence of this is low data recovery means normalized energy statistics presented in Table 3-12 are subject to error in estimates of gross annual energy output.

Table 3-12. Annual Summary Statistics for Spring Creek Hatchery.

SPRING CREEK HATCHERY				
Data Period: Jun. 1987 – May 1988			Site Elevation: 97 ft	
Wind Statistics				
Anemometer Level:	100 ft	Data Recovery Rate:	47.8%	
Average Speed:	10.3 mph	Power Density:	183 W/M**2	
Available Energy:	1606 KWh/M**2	% Time (Speed 12.0–60.0):	40.0%	
Maximum (1 hr Avg.):	39.7 mph	Maximum Gust:	57.3 mph	
Date:	9/24 – 1200	Date:	12/9 – 1800	
Shape Factor:	1.31	Scale Factor:	11.1 mph	
Standard Deviation of Hourly Wind Speeds:			8.02	
Estimated Turbine Energy Output (Normalized to period of record)				
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW	USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft	60 ft
Swept Area:	201 M**2	730 M**2	347 M**2	229 M**2
Est. Total Energy*:	86581 kWh	387552 kWh	143611 kWh	94565 kWh
Capacity Factor*:	0.150	0.147	0.055	0.108
Efficiency Factor**:	0.303	0.331	0.326	0.319
Alpha Factor Used:	0.140	0.140	0.140	0.140
Turbine Type:	DYNERGY 180 KW			
Hub Height:	160 ft			
Swept Area:	308 M**2			
Est. Total Energy*:	175746 kWh			
Capacity Factor*:	0.098			
Efficiency Factor**:	0.291			
Alpha Factor Used:	0.140			

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

Upper Pyle Canyon

Upper Pyle Canyon has had a data recovery rate of 62% during this past year. The low data recovery problems are because of tape recorders problems, low battery voltage and in one case the tape record button was not pushed in. The wind and energy statistics are presented in Table 3-13 and in Appendix L. The maximum gust at this site was 115 mph, measured in September of 1987. The mean speed for the past year is 14.5 mph, which is stronger than the mean for this site for the period 3/84 - 5/88 (13.7 mph).

Table 3-13. Annual Summary Statistics for Upper Pyle Canyon.

UPPER PYLE CANYON				
Data Period: Jun. 1987 – May 1988			Site Elevation: 3660 ft	
Wind Statistics				
Anemometer Level:	50 ft	Data Recovery Rate:	61.6%	
Average Speed:	14.5 mph	Power Density:	366 W/M**2	
Available Energy:	3209 KWh/M**2	% Time (Speed 12.0–60.0):	55.7%	
Maximum (1 hr Avg.):	73.3 mph	Maximum Gust:	115.2 mph	
Date:	9/16 – 1200	Date:	9/16 – 1200	
Shape Factor:	1.64	Scale Factor:	16.2 mph	
Standard Deviation of Hourly Wind Speeds:		9.19		
Estimated Turbine Energy Output (Normalized to period of record)				
Turbine Type:	NORDTANK 65 KW	ENERTECH 300 KW	FLO-190 300 KW	USWP 56 100 KW
Hub Height:	75 ft	100 ft	57 ft	60 ft
Swept Area:	201 M**2	730 M**2	347 M**2	229 M**2
Est. Total Energy*:	148319 kWh	657189 kWh	310780 kWh	184290 kWh
Capacity Factor*:	0.257	0.250	0.118	0.210
Efficiency Factor**:	0.203	0.228	0.268	0.238
Alpha Factor Used:	0.100	0.100	0.100	0.100
Turbine Type:	DYNERGY 180 KW			
Hub Height:	160 ft			
Swept Area:	308 M**2			
Est. Total Energy*:	294197 kWh			
Capacity Factor*:	0.164			
Efficiency Factor**:	0.210			
Alpha Factor Used:	0.100			

*Assuming 100% availability

Estimated monthly energy, kWh/(Available energy, kWh/M2)(Swept area, M**2)

4.0 WIND SPEED DISTRIBUTION VARIATIONS

4.1 Introduction

The wind speed distribution is an important requirement for an accurate wind resource assessment. The frequency of each wind speed is multiplied by the expected power output for the selected turbine to determine the annual energy output. Often however, the wind speed is measured at a lower height than the wind turbine hub height. The wind speeds and their distribution must be estimated. The general approach is to fit a theoretical distribution to the measured distribution and then adjust the theoretical distribution for the expected wind speed variation with height.

This section examines the variation the wind speed distribution with height. An inspection of the seasonal and interannual variation of the wind speed distribution reveals interesting variations. The practical implications of these variations in wind speed distribution is reflected in the error in estimates of gross annual energy output.

4.2 Background

In the absence of a measured wind speed distribution at wind turbine hub height an accepted practice is to use a unimodal probability function to estimate the distribution. One commonly used fitted probability distribution is the Weibull which is given by:

$$p(v) = (k/c) \cdot (v/c)^{k-1} \cdot \exp[-(v/c)^k]$$

where c is the scale factor which is related to the mean value of the wind speed v by:

$$v = c \cdot \Gamma \cdot (1 + 1/k)$$

where Γ is the gamma function and k is the shape factor. The shape factor is related to the variance of v , σ_v by:

$$\sigma_v = c \cdot [\Gamma(1 + 2/k) - (\Gamma(1 + 1/k))^2]$$

The Rayleigh distribution is a special case of the Weibull where $k = 2.0$.

Figure 4-1 shows a comparison of the fitted distribution to the actual measured distribution for Goodnoe Hills 1987 data. Since data recovery was only about 90% for that period at Goodnoe Hills, the number of hours was normalized to a full year. Note also that the Weibull fit does not account for calm wind speeds. Takle and Brown (1978) suggest that the analytic distribution be fit for the speeds between 1 and the highest speed with calm hours added. They warn that the mean speed estimate will be more accurate, but the additional error might be introduced to the distribution of wind speeds and estimates of energy output.

A method of adjusting the fitted Weibull distribution measured at anemometer height to the expected wind speed at wind turbine hub height was described by Justus (1976):

$$c_2 = c_1 \cdot (z_2/z_1)^\alpha \quad \text{and};$$

$$k_2 = k_1 \cdot [1 - 0.088 \cdot \ln(z_1/10)]/[1 - 0.088 \cdot \ln(z_2/10)]$$

where z_1 is the anemometer height, z_2 is the hub height, c_1 is the anemometer height fitted scale factor, k_1 is the anemometer height fitted shape factor, and c_2 and k_2 are the estimated scale and shape parameters at hub height z_2 .

Wade and Walker (1988) found that small errors are likely in estimating the variation of the wind speed distribution at hub height given an accurate measured distribution at anemometer height and an accurate estimate of the power law coefficient (α) given by:

$$\alpha = \ln(v_2/v_1)/\ln(z_2/z_1)$$

Their results suggest that the scale parameter c can be adjusted as recommended by Justus (1976) and the shape parameter can be considered to be invariant with height. (They found variations in the shape parameter with height, but they were small and unpredictable.)

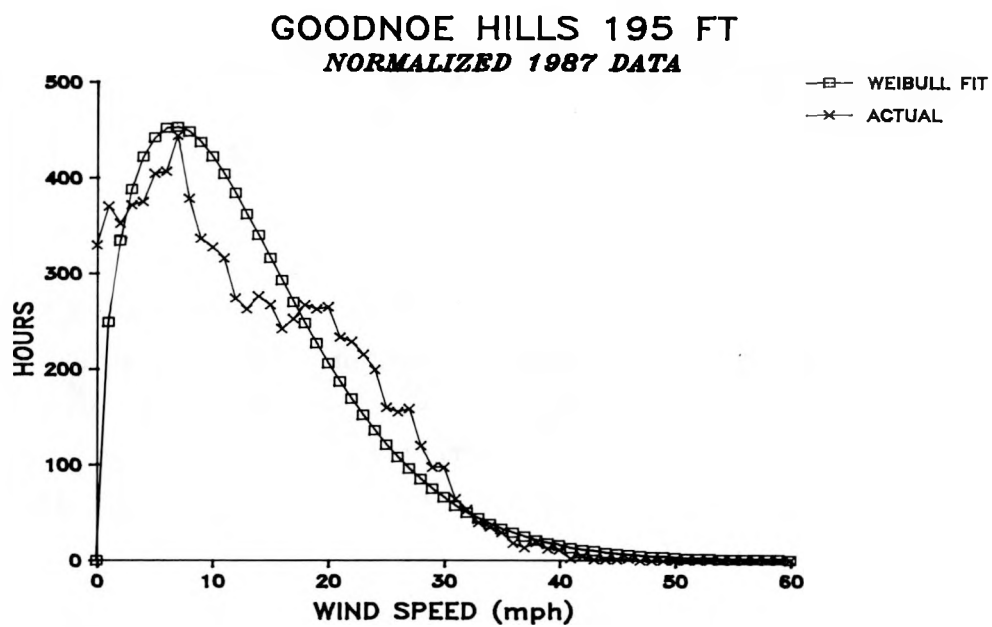


Figure 4-1. A comparison of the actual and Weibull fit of wind speed data at Goodnoe Hills.

4.3 Methodology

Data from seven sites where winds were measured at more than one level were analyzed to determine the variation of the wind speed distribution with height. Weibull parameters c and k define the scale and shape of the distributions.

At three widely spaced locations in the BPA service area the seasonal variation of the wind speed distribution is illustrated graphically by comparing the Weibull shape parameters for each month of the year.

Annual variations in the wind speed distribution are illustrated with plots of annual shape parameters at three sites having 12 years of wind records.

The significance of variations of the shape parameter is determined by computing the gross annual energy output for a 100 kW wind turbine given a fixed wind speed and a range of Weibull shape parameters found in the BPA data. Actual distributions were also compared. The mean annual wind speed in 1978 and 1987 at Pequop Summit were the same, but the wind speed distributions were different. The annual energy output for five wind turbines are contrasted for the two years to evaluate the effect of different distribution on gross annual energy output.

4.4 Results

Table 4.1 presents the variation of Weibull shape parameters with height at seven Pacific Northwest wind energy study sites. The results show the power law coefficients for the scale factor (α_c), are similar or the same as the power law coefficients for wind speed (α_v). The power law coefficients for the shape parameter (α_k) is variable and evidently not related to the other two power law coefficients in any way. Except for one site, there is little variation in k with height and it will usually be safe to assume the distribution shape does not change with height. As we show later, even large variations in the shape parameter are of little consequence in the estimate of annual energy output.

Table 4-1. The variation of Weibull parameters with height.

SITE	c_1	K_1	c_2	K_2	v_1	v_2	z_1	z_2	α_c	α_k	α_v
SEVEN MILE	16.4	1.43	18.5	1.53	14.9	16.7	50	150	.11	.06	.10
GOODNOE HILLS	12.4	1.77	16.5	1.72	11.0	14.7	50	195	.21	-.02	.21
BROWNING DEPOT	17.4	1.74	18.5	1.78	15.5	16.5	40	80	.09	.03	.09
KENNEWICK	16.3	1.35	17.1	1.45	14.9	15.5	80	105	.19	.26	.15
PEQUOP TOWER	17.3	1.61	18.1	1.84	15.5	16.1	50	150	.04	.12	.03
RAVEN TOWER	12.4	1.78	16.6	1.94	11.0	14.7	50	190	.22	.06	.22
WAHL TOWER	14.1	1.85	18.4	1.90	12.5	16.3	50	190	.20	.02	.20

The interannual variation of the shape parameter, k , is shown in Figures 4-2 through 4-4. All three sites show variation and Pequop's variation suggests a trend down. However, the lower shape parameters for 1984, 1986, 1987 and 1988 reflect more the poor data recovery during those years (see Appendix H). If large blocks of data are missing from certain seasons (particularly summer), the shape factor is smaller. At Cape Blanco the low value of k in 1976 is owing to the winter only data for that first year. Low shape parameters for 1983 at Cape Blanco and 1982 at Kennewick, reflect the influence of stronger than average winter month winds. Although the shape parameter is influenced by data recovery it is not correlated to the amount of data collected but rather to the season the data is collected.

The influence of the interannual variation at single site is not significant in terms of energy capture. At Pequop Summit 1978 and 1987 had the same mean wind speed but had shape parameters that were much different. The shape parameter for 1978 was 1.69 and for 1987 was 1.39. Gross annual energy output is presented for five wind turbines and two different years in Table 4-2. The results suggest that the difference in annual energy output is machine specific and less than 15%.

Seasonal variations in the shape parameter is greatest at locations where the wind regime differs widely from one season to another. Cape Blanco is an example of a site with a wide variation of shape parameter.

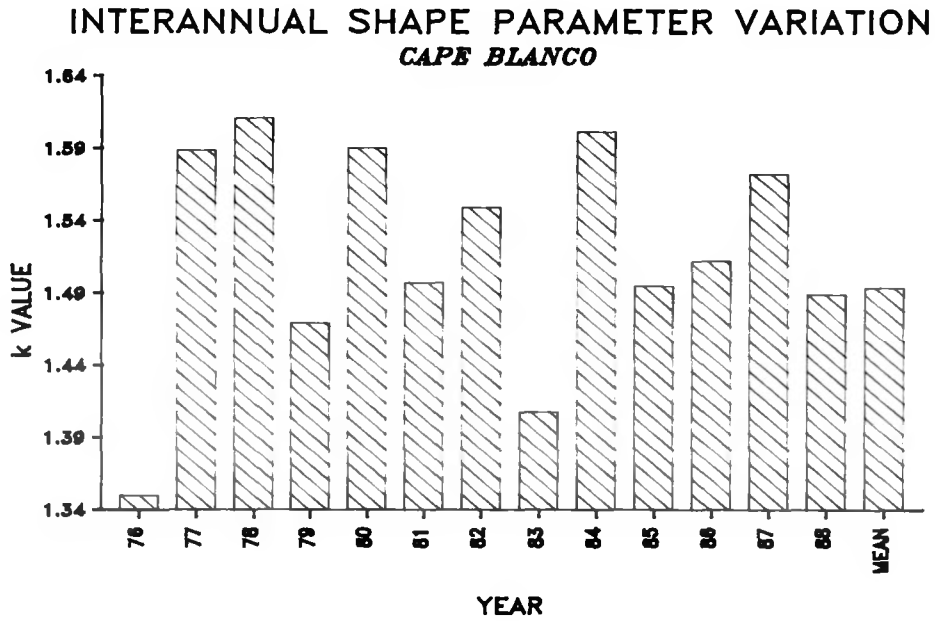


Figure 4-2. The interannual shape parameter variation at Cape Blanco, OR, 1976 through 1988. Data recovery is in parentheses.

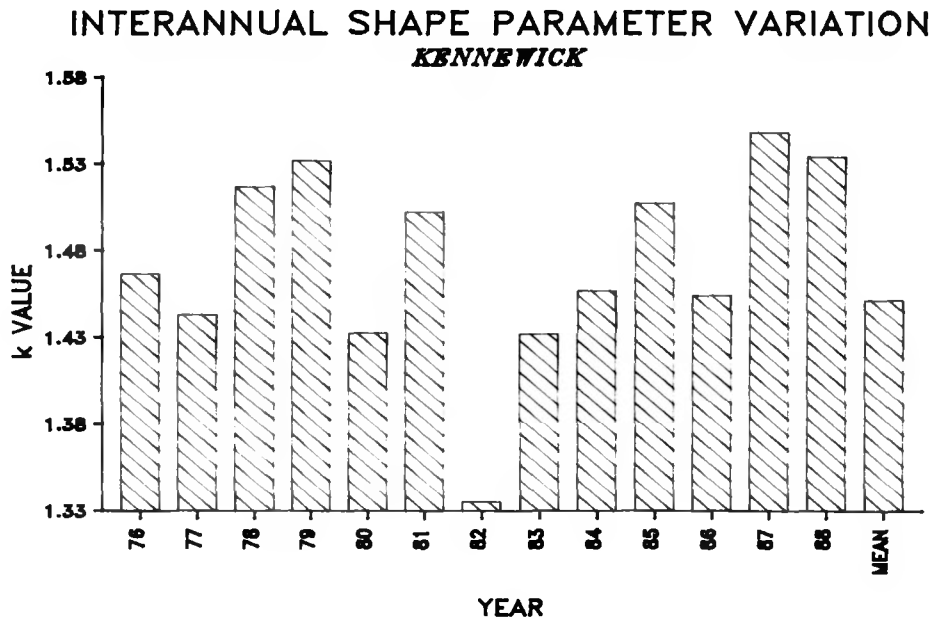


Figure 4-3. The interannual shape parameter variation at Kennewick MW, WA, 1976 through 1988. Data recovery is in parentheses.

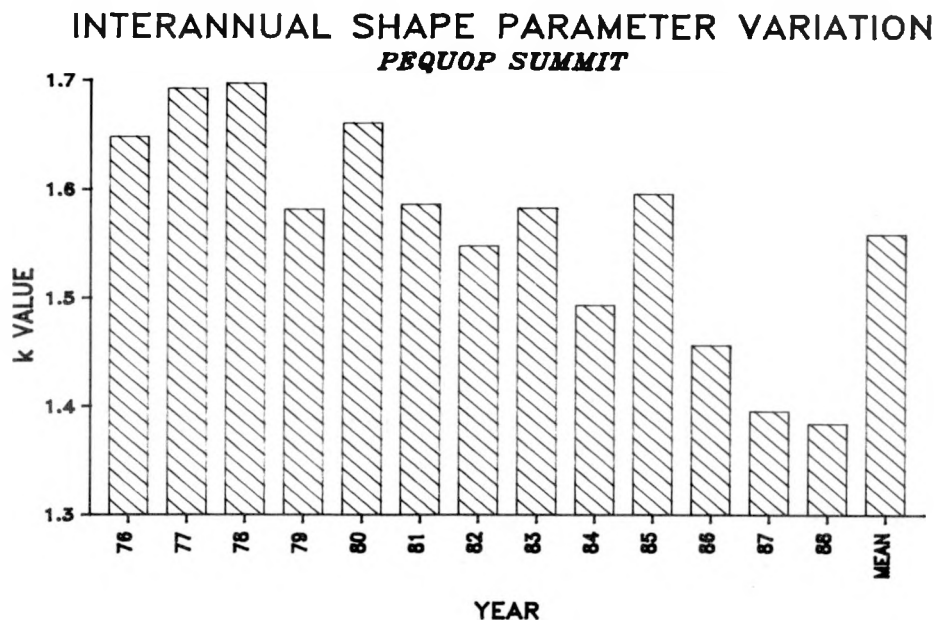


Figure 4-4. The interannual shape parameter variation at Pequop Summit, NV, 1976 through 1988. Data recovery is in parentheses.

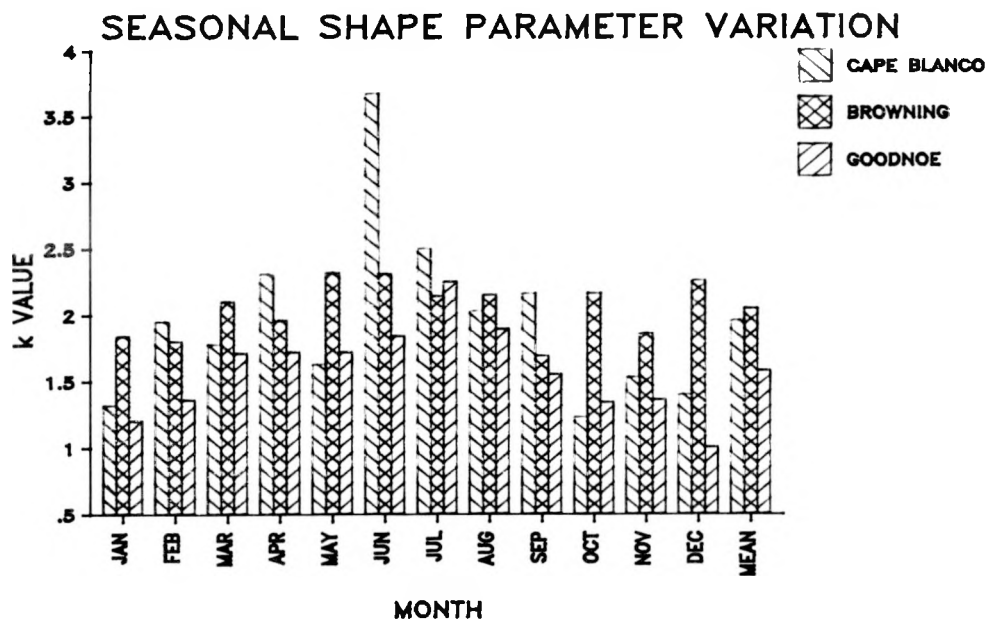


Figure 4-5. The seasonal shape parameter variation at Cape Blanco, Browning, and Pequop Summit. Mean wind speeds are shown above each bar.

Table 4-2. A comparison of gross annual energy output for five wind turbines at Pequop Summit. Two years are compared that have the same mean speed but different wind speed distributions.

YEAR	MEAN SPEED (mph)	k VALUE	GROSS ANNUAL ENERGY OUTPUT (mWhrs)				
			NDK	ET	FLO	USWP	DYNRG
1978	14.0	1.69	115.7	494.3	246.2	155.7	203.4
1987	14.0	1.39	122.8	526.5	277.2	165.8	221.5

*Nordtank 65 kW (NDK), Enertech 300 kW (ET), Flow Wind 190-300 kW (FLO), U.S. Wind Power 56-100 kW (USWP), Dynergy (DYNRG)

Summer shape parameters are large because the winds are driven by a persistent pressure difference between the ocean and the warm interior valleys of Northern California. The winds are often between 10 and 40 mph. During the winter months transient storms are responsible for most of the wind. The winter months distributions are characterized by more winds above 40 mph and below 10 mph than the summer months. Browning and Pequop show a seasonal variation of shape parameter similar to Cape Blanco but less dramatic variation.

5.0 REFERENCES

Justus, C.G., W.R. Hargraves and A. Mikhail, 1976: *Reference Wind Distribution and Height Profiles for Wind Turbine Design and Performance Applications*, Georgia Institute of Technology.

Wade, J.E. and S.N. Walker, 1988: Local Wind Measurements for Micrositing, PWE report to Solar Energy Research Institute, PWE-88-3, Corvallis, OR.

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APPENDIX A

**ALBION BUTTE
SUMMARY STATISTICS
JULY 1984 - MAY 1988**

STATION - ALBION BUTTE
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 7/1984 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1984	0.0	0.0	0.0	0.0	0.0	0.0	10.9	14.1	18.9	20.5	25.0	20.2	2800	19.20	13.01
# OBS	0	0	0	0	0	0	157	744	263	176	721	739			
1985	15.5	21.6	0.0	0.0	17.7	0.0	0.0	0.0	24.3	0.0	0.0	0.0	1527	18.02	13.23
# OBS	685	446	0	0	350	0	0	0	46	0	0	0			
1986	0.0	0.0	0.0	0.0	7.9	12.5	13.1	11.4	12.2	11.0	0.0	0.0	3698	11.82	7.89
# OBS	0	0	0	0	230	720	744	744	720	540	0	0			
1987	0.0	0.0	0.0	0.0	0.0	11.2	13.4	13.0	11.4	11.4	5.0	0.0	3336	12.06	8.80
# OBS	0	0	0	0	0	302	744	744	720	744	82	0			
1988	0.0	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119	19.18	11.03
# OBS	0	119	0	0	0	0	0	0	0	0	0	0			
AVG	15.5	21.1	0.0	0.0	13.8	12.1	13.0	12.9	13.2	12.3	22.9	20.2	11480	14.59	10.94
SD	0.0	1.7	0.0	0.0	6.9	0.9	1.4	1.4	6.1	5.4	14.1	0.0			

STATION - ALBION BUTTE

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 45.5%

MONTH	MEAN POWER (W/M**2)	NORMALIZED		NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)						
JAN	0.0	0	0	0	0	0	0.0	0.0
FEB	958.1	497200	83	36	0	0	23.6	69.7
MAR	0.0	0	0	0	0	0	0.0	0.0
APR	0.0	0	0	0	0	0	0.0	0.0
MAY	0.0	0	0	0	0	0	0.0	0.0
JUN	535.6	69628	130	172	0	0	19.7	43.0
JUL	468.2	183051	391	353	0	0	20.1	52.6
AUG	354.6	145388	410	334	0	0	18.8	55.1
SEP	563.1	168749	290	430	0	0	21.0	40.3
OCT	582.4	156658	269	475	0	0	21.1	36.2
NOV	129.3	8211	7	75	0	0	14.2	8.5
DEC	0.0	0	0	0	0	0	0.0	0.0
PERIOD								
TOTAL	231.1	1755921	1580	1875	0	0	20.2	45.7

STATION - ALBION BUTTE
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 7/1984 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG SPD
JAN	17.6	16.0	16.1	15.6	17.3	17.0	16.7	17.7	16.1	15.6	14.1	13.2	13.3	14.1	14.5	14.8	14.8	15.3	15.6	14.5	14.4	14.9	15.5	16.7	15.5
FEB	23.1	23.4	24.4	24.9	23.9	21.7	22.4	21.7	21.7	20.8	19.7	19.8	17.6	18.1	17.7	18.1	18.9	19.8	20.5	20.4	20.6	21.5	22.8	21.9	21.1
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAY	13.5	12.6	12.5	12.7	13.1	13.8	13.3	11.1	12.6	12.8	13.5	12.7	14.4	14.3	14.0	15.0	16.2	15.8	14.1	13.9	14.2	14.8	15.6	14.1	13.8
JUN	13.2	12.3	12.0	11.3	11.2	10.7	9.5	8.5	8.9	9.0	9.2	10.1	11.1	12.3	12.5	13.0	13.4	14.1	15.0	14.4	14.7	15.1	14.3	13.9	12.1
JUL	13.9	13.2	13.4	13.0	12.7	12.7	11.6	9.7	9.1	9.4	9.6	9.9	11.8	12.9	13.6	14.1	15.2	15.4	15.4	15.4	15.6	15.2	15.1	14.8	13.0
AUG	13.6	13.1	13.1	13.5	12.8	12.3	10.9	9.0	8.6	8.7	9.6	10.6	11.5	12.1	13.3	14.6	15.6	15.7	14.8	15.1	15.3	15.3	14.9	14.4	12.9
SEP	13.8	14.2	14.2	13.7	13.7	13.7	12.3	11.3	10.1	9.4	9.5	10.4	11.4	13.0	13.3	14.1	15.0	15.5	15.3	15.3	15.2	14.1	14.3	13.8	13.2
OCT	12.6	12.0	11.8	12.4	12.6	12.9	12.5	11.7	10.9	9.7	9.8	10.3	10.9	11.5	12.7	13.0	13.3	13.3	13.7	14.0	14.2	13.8	13.3	13.2	12.3
NOV	22.9	23.1	23.5	24.4	24.7	24.6	23.4	23.7	23.2	23.0	23.2	20.9	21.4	22.9	23.0	21.4	21.9	22.6	23.7	23.4	21.5	22.2	22.3	23.4	22.9
DEC	20.0	20.0	19.6	18.6	18.3	19.6	19.8	19.6	20.2	18.7	18.6	19.9	20.8	21.2	21.1	20.7	20.3	20.5	21.2	22.0	22.6	21.7	21.3	19.2	20.2
AUG																									
SPD	15.3	14.9	14.9	14.9	14.8	14.7	13.8	12.7	12.3	11.9	12.0	12.4	13.3	14.2	14.7	15.2	15.8	16.2	16.2	16.2	16.2	16.0	16.0	15.6	14.6

STATION - ALBION BUTTE

WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 7/1984 - 5/1988

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 14.6 MPH

NORMALIZED AVAILABLE ENERGY: 3876.5 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 11480

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	257	2.24	11480	100.00	0.0	46	16	0.14	196	1.71	52.5
1	387	3.37	11223	97.76	0.0	47	17	0.15	180	1.57	59.5
2	422	3.68	10836	94.39	0.1	48	14	0.12	163	1.42	52.2
3	493	4.29	10414	90.71	0.4	49	8	0.07	149	1.30	31.7
4	488	4.25	9921	86.42	1.1	50	17	0.15	141	1.23	71.7
5	466	4.06	9433	82.17	2.0	51	14	0.12	124	1.08	62.6
6	468	4.08	8967	78.11	3.4	52	17	0.15	110	0.96	80.6
7	394	3.43	8499	74.03	4.6	53	10	0.09	93	0.81	50.2
8	466	4.06	8105	70.60	8.0	54	10	0.09	83	0.72	53.1
9	480	4.18	7639	66.54	11.8	55	6	0.05	73	0.64	33.7
10	460	4.01	7159	62.36	15.5	56	8	0.07	67	0.58	47.4
11	419	3.65	6699	58.35	18.8	57	4	0.03	59	0.51	25.0
12	495	4.31	6280	54.70	28.9	58	8	0.07	55	0.48	52.7
13	465	4.05	5785	50.39	34.5	59	4	0.03	47	0.41	27.7
14	417	3.63	5320	46.34	38.6	60	6	0.05	43	0.37	43.7
15	407	3.55	4903	42.71	46.3	61	8	0.07	37	0.32	61.3
16	377	3.28	4496	39.16	52.1	62	6	0.05	29	0.25	48.2
17	355	3.09	4119	35.88	58.8	63	4	0.03	23	0.20	33.7
18	323	2.81	3764	32.79	63.5	64	3	0.03	19	0.17	26.5
19	366	3.19	3441	29.97	84.7	65	0	0.00	16	0.14	0.0
20	335	2.92	3075	26.79	90.4	66	3	0.03	16	0.14	29.1
21	259	2.26	2740	23.87	80.9	67	2	0.02	13	0.11	20.3
22	274	2.39	2481	21.61	98.4	68	3	0.03	11	0.10	31.8
23	226	1.97	2207	19.22	92.8	69	1	0.01	8	0.07	11.1
24	175	1.52	1981	17.26	81.6	70	1	0.01	7	0.06	11.6
25	185	1.61	1806	15.73	97.5	71	0	0.00	6	0.05	0.0
26	159	1.39	1621	14.12	94.3	72	1	0.01	6	0.05	12.6
27	144	1.25	1462	12.74	95.6	73	2	0.02	5	0.04	26.2
28	123	1.07	1318	11.48	91.1	74	2	0.02	3	0.03	27.3
29	111	0.97	1195	10.41	91.3	75	1	0.01	1	0.01	14.2
30	110	0.96	1084	9.44	100.2						
31	103	0.90	974	8.48	103.5						
32	90	0.78	871	7.59	99.5						
33	79	0.69	781	6.80	95.8						
34	65	0.57	702	6.11	86.2						
35	52	0.45	637	5.55	75.2						
36	64	0.56	585	5.10	100.7						
37	49	0.43	521	4.54	83.7						
38	47	0.41	472	4.11	87.0						
39	46	0.40	425	3.70	92.0						
40	39	0.34	379	3.30	84.2						
41	27	0.24	340	2.96	62.8						
42	43	0.37	313	2.73	107.5						
43	25	0.22	278	2.35	67.0						
44	24	0.21	245	2.13	69.0						
45	25	0.22	221	1.93	76.8						

STATION - ALBION BUTTE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG	TMP
JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
JUN	57.9	57.3	56.8	55.7	55.3	55.9	57.9	62.3	66.6	70.1	73.2	74.6	76.3	76.7	78.8	76.6	73.8	71.3	67.6	63.4	60.1	59.3	58.8	58.8	65.4	
JUL	59.3	58.9	58.5	57.8	57.4	57.8	58.9	62.0	65.7	68.6	73.1	75.5	74.9	74.1	73.1	72.8	71.9	69.5	66.5	63.0	61.1	60.7	60.5	60.0	65.0	
AUG	61.1	60.7	60.3	59.4	59.2	59.1	59.8	62.5	66.6	69.3	74.2	76.1	76.3	76.8	76.4	76.1	75.9	73.3	69.0	64.5	63.2	62.6	62.3	61.6	66.9	
SEP	57.9	57.5	57.2	56.4	55.7	55.0	54.9	56.7	61.8	66.6	70.8	73.6	74.8	74.7	73.5	71.0	68.5	65.4	61.3	59.8	59.3	58.7	58.1	57.8	62.8	
OCT	49.5	49.2	48.8	48.2	47.1	46.5	46.4	47.7	51.2	54.1	58.5	61.0	62.7	62.9	60.8	59.2	55.1	51.3	50.6	50.3	49.8	49.8	49.6	49.1	52.5	
NOV	41.1	41.2	41.0	40.5	39.3	38.7	39.7	39.7	42.0	44.1	45.0	45.3	44.8	46.1	46.3	46.2	44.3	42.8	42.3	42.3	41.9	41.6	41.8	41.1	42.3	
DEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
AUG																										
TMP	56.6	56.2	55.8	55.0	54.4	54.3	54.8	57.2	61.2	64.5	69.0	71.2	71.9	71.9	71.1	69.8	67.9	65.0	62.0	59.4	58.2	57.7	57.4	56.9	61.6	

DATA PERIOD OF RECORD - 1/1987 - 12/1987

[illegible]

STATION - ALBION BUTTE PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

[illegible]

APPENDIX B

**BROWNING DEPOT
SUMMARY STATISTICS
OCTOBER 1985 - MAY 1988**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	13.4	22.3	1489	17.93	11.32
# OBS	0	0	0	0	0	0	0	0	0	64	719	706			
1986	22.2	12.9	17.8	14.7	11.5	11.2	12.7	9.6	11.0	13.2	20.1	21.2	8367	14.87	9.32
# OBS	730	668	671	658	688	664	721	730	688	733	720	696			
1987	23.1	15.9	14.2	15.4	13.3	12.9	10.9	9.7	11.8	13.7	18.2	19.0	8260	15.07	8.64
# OBS	739	665	650	715	744	720	744	368	720	742	710	743			
1988	19.5	18.1	17.1	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2416	17.68	9.68
# OBS	706	629	729	0	352	0	0	0	0	0	0	0			
AVG	21.6	15.6	16.4	15.1	12.9	12.1	11.8	9.6	11.4	13.8	17.2	20.8	20532	15.50	9.32
SD	1.9	2.6	1.9	0.5	1.5	1.2	1.3	0.1	0.6	4.1	3.4	1.7			

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	13.3	22.3	1490	17.96	11.36
# OBS	0	0	0	0	0	0	0	0	0	64	720	706			
1986	24.3	13.7	19.0	15.6	12.2	12.3	14.0	10.5	11.9	14.7	21.6	22.8	8395	16.10	9.94
# OBS	738	667	696	655	686	665	717	731	690	737	720	693			
1987	24.5	17.4	15.2	16.5	14.4	14.0	11.7	11.2	13.2	15.0	19.2	20.1	8662	16.02	8.90
# OBS	737	667	676	715	744	720	744	744	720	742	710	743			
1988	20.2	18.8	17.8	0.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2416	18.30	9.90
# OBS	706	629	729	0	352	0	0	0	0	0	0	0			
AVG	23.1	16.6	17.4	16.1	13.6	13.2	12.9	10.8	12.6	15.1	18.0	21.7	20963	16.45	9.67
SD	2.4	2.6	2.0	0.7	1.4	1.2	1.6	0.5	0.9	4.3	4.2	1.4			

NOTE!

DATA IN BOTH TABLES ABOVE ARE FOR THE SAME LOCATION.
DATA IN THE FIRST TABLE WAS COLLECTED WHEN THE ANEMOMETER
WAS AT 105 FT AND IN THE SECOND TABLE THE ANEMOMETER WAS AT
80 FT. THE HEIGHT OF THE TEMPERATURE SENSOR REMAINED THE SAME.

STATION - BROWNING DEPOT

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 86.1%

MONTH	MEAN POWER (W/M**2)	NORMALIZED			MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE	
		TOTAL ENERGY (KWH/M**2)	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12			NO. DATA PTS. ABOVE 60
JAN	1054.8	580234	522	184	0	25.4	73.9
FEB	928.0	465390	424	205	0	25.1	67.4
MAR	628.6	343841	536	193	0	21.9	73.5
APR	0.0	0	0	0	0	0.0	0.0
MAY	282.3	146200	245	107	0	17.4	69.6
JUN	340.7	150911	443	277	0	18.0	61.5
JUL	269.9	93388	346	398	0	16.9	46.5
AUG	288.8	90404	313	431	0	16.9	42.1
SEP	313.4	132110	408	312	0	17.7	56.7
OCT	526.9	236700	448	294	0	20.6	60.4
NOV	734.6	421089	547	163	0	23.0	77.0
DEC	780.2	474202	607	136	0	22.9	81.7
PERIOD							
TOTAL	387.9	3397747	4839	2700	0	21.1	64.2

STATION - BROWNING DEPOT 80 FT
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 10/1985 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG SPD
JAN	23.1	23.0	22.5	22.8	22.8	24.0	24.3	23.7	23.0	22.6	23.5	24.0	23.3	23.5	22.1	21.8	22.4	22.8	23.4	24.1	23.3	22.5	22.3	22.8	23.1
FEB	17.2	17.0	16.8	16.9	16.6	16.3	16.2	16.1	16.3	16.6	17.5	17.0	17.8	17.2	16.3	15.8	15.9	16.5	16.6	16.2	16.2	16.1	16.4	16.5	16.6
MAR	16.1	16.2	17.5	18.3	18.0	18.1	18.1	17.7	17.6	18.0	18.6	18.8	18.0	17.8	17.0	16.8	16.4	16.4	16.8	17.2	16.9	16.8	16.7	16.8	17.4
APR	16.1	16.1	14.8	14.9	14.8	15.7	17.1	17.4	18.0	18.0	17.4	17.6	17.8	17.4	16.3	15.7	15.1	14.6	13.8	14.2	14.5	15.9	16.2	16.2	16.1
MAY	11.4	11.4	11.6	12.1	12.3	12.3	13.3	13.6	14.1	14.8	15.3	15.7	16.2	16.1	15.2	15.8	14.7	13.7	13.4	13.7	13.1	12.4	12.4	12.0	13.6
JUN	13.1	12.7	12.8	13.0	12.1	12.6	13.4	13.2	13.3	13.8	13.8	14.3	14.1	13.8	14.1	14.3	13.4	12.8	12.7	12.4	12.3	13.0	12.6	12.8	13.2
JUL	11.4	11.7	12.5	12.1	11.8	11.7	12.0	12.3	12.4	12.9	14.1	14.2	15.4	15.4	16.0	15.8	14.1	13.3	12.8	12.1	11.4	11.0	11.0	10.8	12.9
AUG	10.4	10.5	10.6	9.9	9.1	8.8	9.2	9.7	10.8	11.4	11.7	11.9	12.3	12.3	12.6	12.7	12.2	11.2	11.2	10.9	10.4	10.3	10.2	9.9	10.8
SEP	12.7	12.5	12.3	12.2	12.4	12.9	12.6	12.7	13.2	13.3	13.5	13.6	13.1	13.5	13.1	12.3	12.2	12.1	11.8	11.3	11.3	11.9	12.1	12.7	12.6
OCT	15.3	15.9	15.9	16.3	16.0	15.3	15.6	15.0	15.3	15.4	15.7	16.2	16.4	16.1	15.3	14.6	14.2	14.1	14.3	14.0	13.6	13.6	14.1	15.1	15.1
NOV	17.5	18.0	18.2	18.2	18.5	18.2	17.8	17.8	18.1	18.0	18.4	18.6	19.3	19.2	18.6	18.2	18.1	17.6	17.7	17.2	17.3	17.4	17.6	17.0	18.0
DEC	21.3	21.5	21.9	20.7	21.5	22.2	22.3	22.4	22.8	23.0	22.2	22.4	22.5	22.5	22.1	22.0	21.2	20.9	21.4	20.9	20.6	20.7	20.8	20.7	21.7
AUG																									
SPD	16.0	16.1	16.2	16.2	16.1	16.3	16.6	16.5	16.8	17.0	17.3	17.5	17.6	17.5	17.0	16.7	16.3	16.0	16.1	16.0	15.6	15.7	15.7	15.8	16.5

STATION - BROWNING DEPOT 80 FT
WIND SPEED-FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 5/1986 - 5/1988
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 16.0 MPH
NORMALIZED AVAILABLE ENERGY: 3656.5 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 16717

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	0	0.00	16717	100.00	0.0	46	16	0.10	76	0.45	39.1
1	47	0.28	16717	100.00	0.0	47	12	0.07	60	0.36	31.2
2	299	1.79	16670	99.72	0.1	48	5	0.03	48	0.29	13.9
3	527	3.15	16371	97.93	0.4	49	5	0.03	43	0.26	14.8
4	603	3.61	15844	94.78	1.0	50	7	0.04	38	0.23	21.9
5	680	4.07	15241	91.17	2.1	51	5	0.03	31	0.19	16.6
6	716	4.28	14561	87.10	3.9	52	2	0.01	26	0.16	7.1
7	644	3.85	13845	82.82	5.5	53	3	0.02	24	0.14	11.2
8	600	3.59	13201	78.97	7.7	54	6	0.04	21	0.13	23.7
9	577	3.45	12601	75.38	10.6	55	4	0.02	15	0.09	16.7
10	631	3.77	12024	71.93	15.8	56	3	0.02	11	0.07	13.2
11	586	3.51	11393	68.15	19.6	57	3	0.02	8	0.05	13.9
12	604	3.61	10807	64.65	26.2	58	0	0.00	5	0.03	0.0
13	652	3.90	10203	61.03	35.9	59	2	0.01	5	0.03	10.3
14	678	4.06	9551	57.13	46.7	60	1	0.01	3	0.02	5.4
15	707	4.23	8873	53.08	59.8	61	0	0.00	2	0.01	0.0
16	681	4.07	8166	48.85	70.0	62	1	0.01	2	0.01	6.0
17	760	4.55	7485	44.77	93.7	63	1	0.01	1	0.01	6.3
18	693	4.15	6725	40.23	101.4						
19	649	3.88	6032	36.08	111.7						
20	604	3.61	5383	32.20	121.2						
21	588	3.52	4779	28.59	136.6						
22	516	3.09	4191	25.07	137.8						
23	417	2.49	3675	21.98	127.3						
24	407	2.43	3258	19.49	141.1						
25	371	2.22	2851	17.05	145.4						
26	342	2.05	2480	14.84	150.8						
27	255	1.53	2138	12.79	125.9						
28	243	1.45	1883	11.26	133.8						
29	228	1.36	1640	9.81	139.5						
30	201	1.20	1412	8.45	136.1						
31	169	1.01	1211	7.24	126.3						
32	144	0.86	1042	6.23	118.4						
33	137	0.82	898	5.37	123.5						
34	116	0.69	761	4.55	114.4						
35	88	0.53	645	3.86	94.6						
36	91	0.54	557	3.33	106.5						
37	78	0.47	466	2.79	99.1						
38	75	0.45	388	2.32	103.2						
39	62	0.37	313	1.87	92.2						
40	54	0.32	251	1.50	86.7						
41	37	0.22	197	1.18	64.0						
42	36	0.22	160	0.96	66.9						
43	16	0.10	124	0.74	31.9						
44	19	0.11	108	0.65	40.6						
45	13	0.08	89	0.53	29.7						

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	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987 # OBS	29.6 640	31.8 668	30.8 744	46.6 714	51.8 744	60.3 720	60.6 744	56.0 744	58.0 720	46.9 742	38.4 710	27.3 743	8633	45.07	15.87
Avg SD	29.6 0.0	31.8 0.0	30.8 0.0	46.6 0.0	51.8 0.0	60.3 0.0	60.6 0.0	56.0 0.0	58.0 0.0	46.9 0.0	38.4 0.0	27.3 0.0	8633	45.07	15.87

STATION - BROWNING TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	28.3	28.3	28.2	28.6	28.5	28.7	28.5	29.5	30.4	31.6	32.1	32.8	32.7	32.4	31.5	29.5	28.9	28.7	28.6	28.3	28.4	28.3	28.3	28.3	29.6
FEB	29.5	29.4	29.6	29.6	29.4	29.2	30.1	31.0	32.9	34.5	35.7	36.8	37.0	36.7	35.8	33.7	32.0	31.3	30.5	30.2	30.0	30.1	29.6	29.2	31.8
MAR	28.5	28.4	28.1	28.2	27.9	28.5	29.4	30.6	31.7	32.7	33.5	34.1	34.5	34.4	34.5	33.1	31.7	30.8	30.2	29.7	29.5	29.6	29.5	29.0	30.8
APR	42.0	41.2	41.1	42.5	41.1	43.6	45.5	47.2	48.5	49.6	51.3	51.6	52.2	52.8	52.7	52.3	50.3	47.7	46.0	45.2	44.8	44.1	43.8	42.9	46.6
MAY	46.9	46.2	45.5	45.8	47.3	49.3	51.3	53.1	54.4	55.2	56.0	57.2	57.8	57.8	57.5	56.9	56.0	53.7	51.5	50.3	49.4	48.9	48.6	47.6	51.8
JUN	54.5	54.1	53.3	53.5	55.2	57.6	60.1	61.7	62.7	63.9	64.8	65.7	66.5	66.8	67.3	67.1	65.6	63.4	60.5	58.2	57.2	56.2	55.8	55.1	60.3
JUL	54.8	54.0	53.7	53.8	55.9	57.9	59.9	61.7	63.1	64.5	65.7	66.8	67.4	67.4	67.5	66.8	66.0	64.2	60.8	58.6	57.7	56.5	55.3	54.6	60.6
AUG	50.5	50.1	49.3	49.1	49.7	52.3	54.4	56.6	58.2	59.8	61.0	61.8	62.5	62.4	62.9	62.5	60.8	58.5	56.5	55.3	53.7	52.8	51.5	51.0	56.0
SEP	53.2	52.9	52.1	51.9	51.7	53.9	57.1	59.9	61.9	63.1	63.8	64.7	65.2	65.6	65.4	64.3	60.8	57.5	56.1	55.6	54.5	54.1	53.5	53.5	58.0
OCT	43.0	43.5	42.3	42.6	42.6	42.4	44.1	46.7	49.3	51.0	52.7	53.8	54.5	54.7	54.0	51.5	48.5	46.5	45.4	44.2	43.8	43.1	43.0	42.3	46.9
NOV	36.6	36.2	36.2	35.9	35.6	36.0	36.7	38.1	40.2	42.1	43.1	43.3	43.3	42.6	40.6	38.5	37.5	37.3	37.2	37.0	37.0	36.8	35.9	36.3	38.4
DEC	26.3	26.4	26.3	26.2	26.1	25.9	25.7	26.6	28.1	29.2	30.1	30.5	30.8	29.8	28.3	27.5	27.0	26.6	26.7	26.4	26.3	26.1	25.8	25.7	27.3
AUG																									
TMP	41.4	41.1	40.7	40.8	41.1	42.3	43.8	45.4	47.1	48.4	49.4	50.1	50.7	50.5	50.1	49.0	47.4	45.8	44.4	43.5	42.9	42.5	42.0	41.5	45.1

APPENDIX C

**CAPE BLANCO MICROWAVE
SUMMARY STATISTICS
OCTOBER 1976 - MAY 1988**

STATION - CAPE BLANCO 50 FT
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 10/1976 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.1	15.9	14.2	1996	14.48	11.01
# OBS	0	0	0	0	0	0	0	0	0	557	713	726			
1977	14.1	20.2	18.5	17.5	13.5	22.3	18.2	16.9	20.8	21.6	26.7	27.6	8418	19.64	12.77
# OBS	732	671	742	713	693	691	744	744	709	740	623	616			
1978	25.1	24.6	18.4	25.0	22.0	15.3	20.6	18.3	16.5	17.1	19.0	17.6	6677	19.67	12.71
# OBS	742	661	253	298	230	720	548	413	654	711	708	739			
1979	15.1	26.6	17.3	13.5	21.1	18.1	21.5	15.0	16.9	16.0	16.3	21.6	7712	18.12	12.67
# OBS	743	672	741	545	743	719	453	601	719	667	698	411			
1980	17.5	17.8	14.3	17.6	13.2	14.6	17.8	19.2	14.4	15.7	15.8	18.7	7993	16.38	10.65
# OBS	205	693	729	687	586	719	742	744	716	740	689	743			
1981	14.6	15.5	16.9	12.1	12.6	13.6	19.2	12.9	13.1	15.7	17.3	0.0	7199	14.53	9.99
# OBS	742	667	744	670	744	717	405	744	718	744	304	0			
1982	26.5	28.6	20.7	21.6	18.4	18.2	19.2	16.5	17.0	18.0	21.6	28.5	6582	20.24	13.48
# OBS	46	381	741	642	731	700	655	715	492	561	477	441			
1983	27.6	32.1	26.0	15.5	19.5	17.1	15.0	17.6	18.2	13.9	30.1	20.6	8464	21.11	15.42
# OBS	739	670	738	715	734	635	744	744	569	722	718	736			
1984	19.2	26.5	23.1	20.5	20.4	22.0	28.0	19.1	18.9	23.0	25.8	13.7	7698	21.62	14.02
# OBS	563	546	744	719	624	614	744	606	611	733	478	716			
1985	10.4	23.4	22.1	17.9	15.9	24.0	19.4	13.1	17.1	25.1	15.5	16.0	7176	18.13	12.53
# OBS	471	577	743	713	741	408	537	417	706	399	720	744			
1986	26.9	25.3	23.1	20.4	18.8	19.1	21.3	12.1	13.0	11.4	0.0	25.6	7474	19.85	13.57
# OBS	744	672	733	709	729	696	717	744	614	557	0	559			
1987	27.4	29.2	34.4	22.8	19.4	23.1	17.7	0.0	17.1	17.6	23.8	28.4	5227	22.60	14.94
# OBS	742	106	173	30	742	721	593	0	505	610	296	709			
1988	24.1	16.0	18.1	17.8	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3414	18.92	13.12
# OBS	695	677	694	629	719	0	0	0	0	0	0	0			
AUG	20.8	23.1	20.3	17.9	17.6	18.6	19.8	16.1	16.6	17.2	20.4	20.6	86030	19.07	13.19
SD	6.2	5.4	5.3	3.8	3.2	3.6	3.3	2.6	2.4	4.1	5.2	5.6			

STATION - CAPE BLANCO

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 78.4%

MONTH	MEAN POWER (W/M ²)	NORMALIZED TOTAL ENERGY (KJH/M ²)	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
JAN	2161.8	978925	423	226	46	28.7	60.9
FEB	657.2	312738	433	244	0	21.0	64.0
MAR	933.4	483303	483	209	2	22.9	69.6
APR	1193.1	574386	407	222	0	23.9	64.7
MAY	1469.2	650809	440	299	0	26.4	59.5
JUN	1206.8	722848	599	122	0	26.4	83.1
JUL	945.4	463784	391	202	0	23.7	65.9
AUG	0.0	0	0	0	0	0.0	0.0
SEP	765.2	377671	335	170	0	22.3	66.3
OCT	713.2	369699	425	185	0	22.6	69.7
NOV	2275.7	1035298	181	102	13	30.1	61.1
DEC	2201.4	1141184	494	154	61	29.7	69.7
PERIOD TOTAL	863.9	7568606	4611	2135	122	25.1	67.1

STATION - CAPE BLANCO

DIURNAL WIND SPEEDS (MPH)

DATA PERIOD OF RECORD - 10/1976 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG SPD
JAN	19.9	19.8	19.7	19.6	19.4	19.5	19.6	19.5	20.1	20.6	21.3	22.3	22.4	22.3	22.7	22.7	22.3	21.7	21.2	21.0	20.6	20.4	20.6	20.2	20.8
FEB	23.4	23.4	23.7	23.2	22.6	22.5	22.3	22.9	22.8	22.9	23.4	23.9	24.2	24.0	24.0	23.9	23.5	22.9	22.5	22.6	22.4	22.3	22.7	23.0	23.1
MAR	19.2	18.9	18.7	18.8	18.7	18.1	18.1	18.5	19.4	20.7	21.7	22.4	22.1	22.2	22.2	22.2	22.3	22.1	21.5	20.9	20.0	19.3	19.3	19.5	20.3
APR	16.7	16.2	15.9	15.4	15.2	15.3	15.6	16.5	17.3	18.8	19.6	20.0	20.4	20.3	20.3	20.1	19.5	19.1	19.1	18.4	17.9	17.3	17.1	16.6	17.9
MAY	16.2	16.0	15.8	15.7	15.3	14.9	15.2	16.1	17.2	18.4	19.1	19.5	19.4	19.5	19.4	19.6	19.5	19.3	19.1	18.6	17.7	17.0	16.7	16.1	17.6
JUN	17.0	17.1	16.9	17.0	16.8	16.4	17.0	17.5	18.5	19.6	19.8	20.1	20.1	20.0	20.5	20.6	20.4	20.1	19.8	19.5	18.8	18.1	17.4	17.3	18.6
JUL	18.6	18.6	18.1	17.8	17.5	17.5	17.6	17.9	19.2	20.3	21.2	21.1	20.9	21.2	21.6	21.8	22.1	21.8	21.6	21.4	20.5	19.4	19.0	18.7	19.8
AUG	14.9	14.7	14.6	14.6	14.3	14.3	14.2	14.6	15.8	16.9	17.7	17.8	17.6	17.5	17.5	17.3	17.4	17.5	17.3	17.0	16.3	15.7	15.1	14.8	16.1
SEP	15.5	15.3	15.2	15.1	15.1	15.2	15.1	15.2	15.8	16.7	17.7	18.3	18.3	18.4	18.4	18.3	18.1	17.7	17.7	17.1	16.4	16.2	15.7	15.6	16.6
OCT	16.3	16.5	16.6	16.7	16.5	16.4	15.8	15.7	16.1	17.1	17.9	18.6	19.0	18.7	19.0	18.6	18.4	18.0	17.9	17.3	16.8	16.8	16.5	16.6	17.2
NOV	20.1	19.9	19.3	19.3	19.1	18.8	19.3	19.6	19.9	20.0	21.0	21.9	22.2	22.0	21.9	21.5	21.4	21.1	20.7	20.4	20.2	20.5	20.2	20.4	20.4
DEC	19.6	19.5	19.6	19.7	19.9	19.7	20.0	19.9	19.9	20.3	21.2	21.7	22.3	22.4	22.0	21.7	21.4	21.0	20.8	20.7	20.7	20.2	20.1	19.9	20.6
AUG SPD	18.1	18.0	17.8	17.7	17.5	17.4	17.5	17.8	18.5	19.4	20.1	20.6	20.7	20.7	20.8	20.7	20.5	20.2	19.9	19.5	19.0	18.6	18.4	18.2	19.1

STATION - CAPE BLANCO 50 FT
WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 5/1977 - 5/1988
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 19.2 MPH
NORMALIZED AVAILABLE ENERGY: 9610.9 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 81176

NORMALIZED						NORMALIZED						
SPD	HOURS/					AVAIL. ENERGY	SPD	HOURS/				
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR		MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	478	0.59	81176	100.00	0.0		46	303	0.37	4078	5.02	173.1
1	1157	1.43	80698	99.41	0.0		47	295	0.36	3775	4.65	179.7
2	1815	2.24	79541	97.99	0.1		48	265	0.33	3480	4.29	172.0
3	2097	2.58	77726	95.75	0.3		49	227	0.28	3215	3.96	156.7
4	2288	2.82	75629	93.17	0.9		50	223	0.27	2988	3.68	163.6
5	2451	3.02	73341	90.35	1.8		51	212	0.26	2765	3.41	165.0
6	2507	3.09	70890	87.33	3.2		52	212	0.26	2553	3.15	174.9
7	2658	3.27	68383	84.24	5.4		53	190	0.23	2341	2.88	166.0
8	2655	3.27	65725	80.97	8.0		54	183	0.23	2151	2.65	169.1
9	2599	3.20	63070	77.70	11.1		55	173	0.21	1968	2.42	168.9
10	2481	3.06	60471	74.49	14.6		56	160	0.20	1795	2.21	164.9
11	2745	3.38	57990	71.44	21.4		57	145	0.18	1635	2.01	157.6
12	2619	3.23	55245	68.06	26.6		58	140	0.17	1490	1.84	160.3
13	2586	3.19	52626	64.83	33.3		59	131	0.16	1350	1.66	157.9
14	2578	3.18	50040	61.64	41.5		60	127	0.16	1219	1.50	161.0
15	2594	3.20	47462	58.47	51.4		61	117	0.14	1092	1.35	155.8
16	2605	3.21	44868	55.27	62.6		62	105	0.13	975	1.20	146.8
17	2599	3.20	42263	52.06	74.9		63	94	0.12	870	1.07	137.9
18	2505	3.09	39664	48.86	85.7		64	101	0.12	776	0.96	155.4
19	2564	3.16	37159	45.78	103.2		65	79	0.10	675	0.83	127.3
20	2556	3.15	34595	42.62	120.0		66	73	0.09	596	0.73	123.2
21	2461	3.03	32039	39.47	133.7		67	61	0.08	523	0.64	107.7
22	2412	2.97	29578	36.44	150.7		68	55	0.07	462	0.57	101.5
23	2278	2.81	27166	33.47	162.6		69	51	0.06	407	0.50	98.3
24	2232	2.75	24888	30.66	181.1		70	41	0.05	356	0.44	82.5
25	2012	2.48	22656	27.91	184.5		71	38	0.05	315	0.39	79.8
26	1925	2.37	20644	25.43	198.5		72	46	0.06	277	0.34	100.8
27	1769	2.18	18719	23.06	204.3		73	31	0.04	231	0.28	70.8
28	1585	1.95	16950	20.88	204.2		74	21	0.03	200	0.25	49.9
29	1365	1.68	15365	18.93	195.4		75	27	0.03	179	0.22	66.8
30	1241	1.53	14000	17.25	196.6		76	19	0.02	152	0.19	48.9
31	1050	1.29	12759	15.72	183.6		77	13	0.02	133	0.16	34.8
32	994	1.22	11709	14.42	191.1		78	17	0.02	120	0.15	47.3
33	836	1.03	10715	13.20	176.3		79	12	0.01	103	0.13	34.7
34	757	0.93	9879	12.17	174.6		80	14	0.02	91	0.11	42.1
35	696	0.86	9122	11.24	175.1		81	9	0.01	77	0.09	28.1
36	615	0.76	8426	10.38	168.4		82	15	0.02	68	0.08	48.5
37	537	0.66	7811	9.62	159.6		83	9	0.01	53	0.07	30.2
38	516	0.64	7274	8.96	166.2		84	7	0.01	44	0.05	24.3
39	455	0.56	6758	8.33	158.4		85	3	0.00	37	0.05	10.8
40	440	0.54	6303	7.76	165.2		86	9	0.01	34	0.04	33.6
41	410	0.51	5863	7.22	165.8		87	6	0.01	25	0.03	23.2
42	393	0.48	5453	6.72	170.9		88	3	0.00	19	0.02	12.0
43	332	0.41	5060	6.23	154.9		89	3	0.00	16	0.02	12.4
44	364	0.45	4728	5.82	182.0		90	0	0.00	13	0.02	0.0
45	286	0.35	4364	5.38	152.9		91	1	0.00	13	0.02	4.4

STATION - CAPE BLANCO TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1987	54.2	0.0	0.0	52.8	55.4	55.3	58.9	55.1	57.1	56.0	48.6	47.3	5938	54.25	7.06
# OBS	47	0	0	41	744	720	742	743	720	744	701	736			
AUG	54.2	0.0	0.0	52.8	55.4	55.3	58.9	55.1	57.1	56.0	48.6	47.3	5938	54.25	7.06
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - CAPE BLANCO TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG	TMP
JAN	52.2	52.6	53.6	54.0	53.7	54.0	52.8	53.1	54.0	54.4	54.9	54.6	54.9	55.0	54.9	54.9	55.1	55.7	54.6	54.7	54.9	54.9	54.5	0.0	54.2	
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.4	53.1	52.2	53.9	56.5	56.4	55.3	57.4	54.6	52.1	51.7	49.3	49.1	49.5	49.6	50.4	50.4	52.8	
MAY	51.7	51.4	51.0	50.7	50.6	51.7	53.5	55.4	57.2	59.2	60.8	61.4	61.4	61.5	60.5	59.1	57.9	56.7	54.9	53.8	53.3	52.8	52.4	52.0	55.4	
JUN	51.7	51.3	51.2	51.0	51.2	52.7	54.4	56.0	57.7	58.8	60.5	61.1	61.0	60.1	59.4	58.6	57.5	56.4	54.8	53.5	53.0	52.3	52.1	51.9	55.3	
JUL	54.6	54.1	53.7	53.4	53.7	55.2	57.0	59.6	62.2	63.6	65.2	65.6	65.7	65.0	64.1	62.6	61.2	60.0	58.2	57.0	56.5	55.5	55.6	55.1	58.9	
AUG	52.2	52.1	51.9	51.9	51.8	52.4	53.9	55.7	57.1	58.1	59.4	59.9	59.4	58.7	57.8	57.2	56.1	55.4	54.3	54.2	53.9	53.0	53.0	52.7	55.1	
SEP	54.4	54.1	53.9	53.7	53.7	53.8	55.5	57.2	59.0	60.4	62.5	62.6	62.1	61.3	60.3	59.3	58.3	57.1	56.2	55.6	55.1	54.4	54.6	54.4	57.1	
OCT	54.4	54.3	54.2	54.0	53.8	53.8	54.4	56.1	57.8	59.3	60.4	60.9	59.9	59.2	58.3	57.3	56.0	55.2	54.7	54.4	54.2	53.9	54.2	54.1	56.0	
NOV	47.8	47.1	47.7	47.4	47.1	47.2	47.1	47.5	48.2	49.0	49.5	49.7	49.5	49.4	49.8	49.9	49.7	50.0	50.0	49.5	48.9	48.4	47.8	47.8	48.6	
DEC	45.6	45.8	45.8	46.1	46.3	46.3	46.1	46.6	47.8	48.4	49.3	49.8	49.9	49.9	49.6	48.9	48.0	47.4	47.0	46.6	46.6	45.6	45.9	45.8	47.3	
AUG																										
SPD	51.6	51.3	51.2	51.1	51.1	51.7	52.8	54.3	55.9	57.1	58.4	58.9	58.6	58.2	57.5	56.6	55.6	54.7	53.7	53.1	52.7	52.0	52.0	51.8	54.3	

DATA PERIOD OF RECORD - 1/1987 - 12/1987

DATA PERIOD OF RECORD - 1/1987 - 12/1987

[illegible]

APPENDIX D

**GOODNOE HILLS
SUMMARY STATISTICS
MAY 1980 - MAY 1988**

STATION - GOODNOE HILLS 50 FT
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 5/1980 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1980	0.0	0.0	0.0	0.0	14.6	13.5	12.4	13.5	12.6	9.0	9.3	9.2	5529	11.71	6.36
# OBS	0	0	0	0	564	720	738	743	665	735	704	660			
1981	8.6	9.3	11.5	14.2	13.8	15.5	13.6	12.1	11.2	9.4	9.8	10.9	7973	11.67	6.41
# OBS	511	665	736	719	742	687	454	587	719	736	704	713			
1982	15.0	12.5	12.4	12.9	12.8	10.8	11.5	11.1	9.7	9.2	8.8	9.5	7632	11.21	6.53
# OBS	723	671	406	84	739	709	741	734	709	721	706	689			
1983	11.2	8.2	9.2	8.4	9.5	10.9	13.6	11.7	12.8	10.8	12.8	8.6	8114	10.63	5.71
# OBS	726	659	743	703	704	673	725	702	648	559	626	646			
1984	11.0	9.2	10.9	14.2	13.5	13.2	11.2	13.0	10.1	10.2	13.5	11.0	7960	11.65	6.64
# OBS	743	688	728	711	659	717	734	739	716	740	156	629			
1985	5.1	11.4	10.6	13.4	13.5	13.3	11.9	13.3	10.8	11.4	15.3	3.5	7041	10.90	6.65
# OBS	523	639	743	665	461	718	742	740	714	340	105	651			
1986	11.2	9.4	10.0	13.0	14.2	13.5	12.8	11.2	10.3	6.8	11.3	6.5	8516	10.95	6.87
# OBS	730	670	729	718	738	714	744	744	720	744	720	545			
1987	7.0	10.4	11.0	10.9	10.8	9.8	11.8	9.1	10.2	9.2	8.6	8.9	7811	9.90	6.54
# OBS	740	671	744	696	741	720	743	736	589	546	251	634			
1988	9.4	9.8	10.6	11.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3530	10.27	7.03
# OBS	708	660	744	674	744	0	0	0	0	0	0	0			
AVG	10.1	10.0	10.7	12.2	12.5	12.6	12.3	11.9	11.0	9.3	10.5	8.6	64106	11.01	6.53
SD	3.0	1.4	0.9	2.0	1.8	1.9	0.9	1.4	1.2	1.4	2.5	2.5			

STATION - GOODNOE HILLS 195 FT
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 5/1980 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1980	0.0	0.0	0.0	0.0	19.2	17.7	16.9	17.5	15.5	12.1	11.9	11.7	5560	15.23	8.39
# OBS	0	0	0	0	565	720	741	743	659	708	710	714			
1981	10.9	12.1	14.9	17.8	17.4	18.6	17.2	15.5	13.9	12.1	12.3	14.4	7926	14.75	8.21
# OBS	520	661	738	688	742	688	456	540	720	742	718	713			
1982	19.7	16.7	15.7	15.1	16.7	12.6	14.9	14.7	12.9	11.9	11.5	12.3	8307	14.55	8.52
# OBS	716	585	638	708	741	626	733	735	704	715	707	699			
1983	14.5	12.8	14.8	14.1	17.3	18.2	16.7	14.4	15.1	11.9	15.0	10.1	8280	14.58	8.12
# OBS	729	651	707	675	697	655	724	707	674	659	700	702			
1984	14.5	12.8	15.3	19.5	19.7	19.6	17.3	19.8	16.8	15.8	12.8	13.9	8603	16.51	9.52
# OBS	743	675	743	719	744	718	744	740	621	706	716	734			
1985	6.7	14.7	13.9	17.8	17.6	17.5	16.0	17.8	14.1	16.1	13.2	5.6	7957	14.50	9.00
# OBS	499	667	743	665	461	719	742	744	719	737	688	573			
1986	14.9	13.2	13.2	16.9	17.2	17.1	17.5	14.6	13.7	9.0	9.3	7.3	7593	14.31	9.25
# OBS	694	663	722	712	738	712	744	744	717	501	124	522			
1987	8.2	11.7	12.1	15.0	16.5	14.9	17.2	13.2	12.3	10.4	10.5	10.6	7731	12.97	9.06
# OBS	686	644	733	720	743	719	742	738	575	546	251	634			
1988	11.5	14.3	16.5	16.7	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3530	15.01	10.00
# OBS	708	660	744	674	744	0	0	0	0	0	0	0			
AUG	12.9	13.5	14.5	16.6	17.5	17.1	16.7	16.0	14.3	12.6	12.6	11.0	65487	14.70	8.90
SD	4.2	1.6	1.4	1.8	1.2	2.2	0.9	2.2	1.5	2.4	1.7	3.1			

STATION - GOODNOE HILLS 50°

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 88.5%

MONTH	MEAN POWER (W/M**2)	NORMALIZED TOTAL ENERGY (KWH/M**2)	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
JAN	382.0	77876	194	514	0	18.3	27.4
FEB	382.9	98851	229	430	1	18.2	34.7
MAR	339.6	104951	309	435	0	17.7	41.5
APR	296.4	93249	285	389	0	17.3	42.3
MAY	321.3	91563	285	459	0	17.4	38.3
JUN	269.5	67387	250	470	0	16.6	34.7
JUL	271.2	103740	382	361	0	16.9	51.4
AUG	276.7	67121	240	496	0	17.0	32.6
SEP	403.7	100958	198	391	0	18.8	33.6
OCT	233.4	43258	136	410	0	16.1	24.9
NOV	215.3	35105	55	196	0	15.3	21.9
DEC	357.1	72073	172	462	0	17.4	27.1
PERIOD TOTAL	111.6	977975	2735	5013	1	17.4	35.3

STATION - GOODNOE HILLS 195'

DIURNAL WIND SPEEDS (MPH)

DATA PERIOD OF RECORD - 5/1980 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	13.5	13.1	12.8	12.9	12.7	12.9	13.0	13.1	12.9	12.4	12.3	12.3	12.1	11.9	12.5	12.9	13.1	13.5	13.4	13.5	13.8	13.7	13.4	13.2	12.9
FEB	13.6	13.9	14.1	13.7	14.0	14.1	14.4	13.6	12.6	12.4	12.5	12.5	12.7	13.3	13.4	13.6	13.9	14.0	14.0	13.7	13.7	13.4	13.4	13.3	13.5
MAR	15.4	15.3	15.1	15.3	15.0	14.5	14.4	13.0	12.5	12.3	12.5	13.2	13.6	13.9	14.5	14.5	14.7	15.3	16.1	15.9	15.6	15.6	15.4	15.3	14.5
APR	17.5	17.5	17.5	17.4	16.7	15.9	14.9	13.8	13.5	13.6	14.4	15.0	15.8	16.0	16.7	17.5	17.5	18.1	19.0	18.6	18.2	18.0	17.8	18.0	16.6
MAY	19.6	19.1	19.0	18.3	17.6	16.4	14.8	14.0	13.5	13.7	14.1	14.7	15.4	16.2	16.7	17.2	18.1	19.2	19.9	20.7	20.4	20.3	20.2	19.9	17.5
JUN	19.5	19.1	18.3	18.0	17.3	15.7	13.8	12.9	12.8	12.9	13.3	14.1	14.7	15.3	16.3	17.5	18.5	18.9	19.8	20.7	20.8	20.3	20.2	19.6	17.1
JUL	18.8	18.3	17.8	17.5	17.0	15.2	13.5	12.6	12.2	12.1	12.7	13.5	14.3	15.0	16.1	17.2	18.0	18.8	19.8	20.5	20.6	20.0	19.5	19.3	16.7
AUG	17.6	17.7	17.1	16.8	16.3	15.3	13.3	12.1	11.5	11.4	12.0	12.9	13.5	14.3	15.3	16.4	17.2	18.3	19.4	20.0	19.4	18.9	18.4	17.8	16.0
SEP	15.1	14.7	14.1	14.0	13.9	13.9	13.0	11.7	11.1	11.3	11.7	12.4	12.9	14.0	14.6	15.1	15.4	16.6	17.3	16.7	16.1	16.2	15.8	15.5	14.3
OCT	13.0	13.1	13.2	12.8	12.7	12.7	12.4	11.3	10.7	10.6	10.9	11.2	11.7	12.0	12.5	12.9	13.4	13.8	13.9	13.9	13.7	13.5	13.5	13.4	12.6
NOV	12.7	12.8	13.2	12.9	13.2	12.8	12.4	11.9	11.5	11.5	11.4	11.5	11.8	11.9	12.2	12.5	13.0	13.2	13.2	13.3	13.3	13.2	12.8	12.6	12.6
DEC	11.4	11.2	11.4	11.9	11.8	11.9	11.7	11.2	10.7	10.2	10.0	10.4	10.5	10.8	10.7	10.8	11.0	10.8	10.9	11.1	10.8	10.8	10.8	11.3	11.0
AUG																									
SPD	15.8	15.6	15.4	15.2	14.9	14.3	13.5	12.6	12.2	12.1	12.3	12.9	13.3	13.8	14.4	14.9	15.4	16.0	16.5	16.7	16.5	16.3	16.1	15.9	14.7

STATION - GOODNOE HILLS 50 FT

DIURNAL WIND SPEEDS (MPH)

DATA PERIOD OF RECORD - 5/1980 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	10.2	9.9	9.7	9.8	9.8	10.0	9.9	9.9	9.8	9.8	9.6	9.9	10.2	9.9	10.0	10.1	10.3	10.4	10.4	10.4	10.5	10.4	10.2	10.2	10.1
FEB	9.7	10.1	10.0	9.8	10.0	10.2	10.2	9.7	9.4	9.7	10.2	10.3	10.4	10.8	10.7	10.6	10.1	10.2	10.2	9.9	9.7	9.6	9.4	9.5	10.0
MAR	10.5	10.4	10.3	10.3	10.1	9.8	9.8	9.3	9.8	10.2	10.5	11.1	11.4	11.6	12.1	11.8	11.3	11.1	11.3	10.9	10.8	10.7	10.5	10.5	10.7
APR	11.6	11.6	11.6	11.3	11.2	10.9	10.5	10.7	11.1	11.4	12.1	12.7	13.2	13.3	13.8	14.2	13.7	13.2	13.2	12.6	12.3	11.9	12.0	12.0	12.2
MAY	12.5	12.2	12.2	11.7	11.3	10.7	10.6	10.8	10.8	11.2	11.6	12.1	12.5	13.2	13.5	13.7	14.1	14.3	13.8	13.7	13.5	13.5	13.1	13.0	12.5
JUN	13.0	12.6	12.1	11.7	11.2	10.6	10.2	10.2	10.4	10.8	11.2	11.9	12.3	12.8	13.5	14.4	14.8	14.9	14.6	14.4	14.1	13.7	13.4	13.1	12.6
JUL	12.6	12.1	11.5	11.3	11.0	10.4	9.9	9.9	10.1	10.3	10.8	11.6	12.2	12.7	13.4	14.1	14.5	14.6	14.4	14.2	14.0	13.5	12.9	12.8	12.3
AUG	12.0	11.8	11.7	11.3	10.9	10.5	9.6	9.6	9.7	9.9	10.3	11.1	11.8	12.3	13.0	13.6	13.8	14.0	13.8	13.8	13.4	12.9	12.5	11.9	11.9
SEP	10.6	10.4	10.0	9.8	9.8	9.7	9.3	9.2	9.5	9.9	10.4	11.0	11.4	12.2	12.5	12.7	12.4	12.7	12.5	12.0	11.4	11.5	11.2	10.9	11.0
OCT	9.2	9.2	9.1	9.1	8.8	8.7	8.5	8.1	8.3	8.6	9.0	9.4	9.6	9.8	10.2	10.1	10.2	10.2	10.0	9.8	9.8	9.5	9.4	9.3	9.3
NOV	10.4	10.7	10.7	10.4	10.6	10.5	10.5	9.9	9.7	9.8	10.1	10.3	10.7	10.5	10.7	10.6	10.7	10.6	10.6	10.8	10.7	10.9	10.9	10.6	10.5
DEC	8.8	8.7	8.9	9.1	9.3	9.1	8.8	8.6	8.3	8.1	7.9	8.5	8.6	8.8	8.9	8.5	8.5	8.3	8.4	8.5	8.3	8.3	8.2	8.4	8.6
AUG																									
SPD	11.0	10.9	10.7	10.5	10.3	10.1	9.8	9.7	9.8	10.0	10.3	10.9	11.2	11.5	11.9	12.1	12.1	12.1	12.0	11.8	11.6	11.4	11.2	11.1	11.0

STATION - GOODNOE HILLS 50 FT

WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 5/1980 - 5/1988

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 11.0 MPH

NORMALIZED AVAILABLE ENERGY: 1294.3 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 64106

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	1004	1.57	64106	100.00	0.0	46	3	0.00	10	0.02	2.0
1	1686	2.63	63102	98.43	0.0	47	0	0.00	7	0.01	0.0
2	2335	3.64	61416	95.80	0.1	48	1	0.00	7	0.01	0.8
3	2722	4.25	59081	92.16	0.5	49	1	0.00	6	0.01	0.8
4	3272	5.10	56359	87.92	1.5	50	0	0.00	5	0.01	0.0
5	3771	5.88	52787	82.81	3.3	51	0	0.00	5	0.01	0.0
6	3802	5.93	49316	76.93	5.7	52	1	0.00	5	0.01	1.0
7	3770	5.88	45514	71.00	9.0	53	0	0.00	4	0.01	0.0
8	3689	5.75	41744	65.12	13.1	54	0	0.00	4	0.01	0.0
9	3463	5.40	38055	59.36	17.5	55	1	0.00	4	0.01	1.2
10	3237	5.05	34592	53.96	22.5	56	1	0.00	3	0.00	1.2
11	3304	5.15	31355	48.91	30.5	57	1	0.00	2	0.00	1.3
12	3199	4.99	28051	43.76	38.3	58	0	0.00	1	0.00	0.0
13	2968	4.63	24852	38.77	45.2	59	0	0.00	1	0.00	0.0
14	2887	4.50	21884	34.14	55.0	60	0	0.00	1	0.00	0.0
15	2811	4.38	18997	29.63	65.8	61	0	0.00	1	0.00	0.0
16	2673	4.17	16186	25.25	75.9	62	0	0.00	1	0.00	0.0
17	2476	3.86	13513	21.08	84.4	63	0	0.00	1	0.00	0.0
18	2159	3.37	11037	17.22	87.3	64	0	0.00	1	0.00	0.0
19	1852	2.89	8878	13.85	88.1	65	0	0.00	1	0.00	0.0
20	1567	2.44	7026	10.96	87.0	66	0	0.00	1	0.00	0.0
21	1323	2.06	5459	8.52	85.0	67	0	0.00	1	0.00	0.0
22	1011	1.58	4136	6.45	74.7	68	0	0.00	1	0.00	0.0
23	805	1.26	3125	4.87	67.9	69	0	0.00	1	0.00	0.0
24	612	0.95	2320	3.62	58.7	70	0	0.00	1	0.00	0.0
25	449	0.70	1708	2.66	48.7	71	0	0.00	1	0.00	0.0
26	323	0.50	1259	1.96	39.4	72	0	0.00	1	0.00	0.0
27	255	0.40	936	1.46	34.8	73	0	0.00	1	0.00	0.0
28	179	0.28	681	1.06	27.3	74	0	0.00	1	0.00	0.0
29	125	0.19	502	0.78	21.1	75	0	0.00	1	0.00	0.0
30	109	0.17	377	0.59	20.4	76	0	0.00	1	0.00	0.0
31	58	0.09	268	0.42	12.0	77	0	0.00	1	0.00	0.0
32	45	0.07	210	0.33	10.2	78	0	0.00	1	0.00	0.0
33	42	0.07	165	0.26	10.5	79	0	0.00	1	0.00	0.0
34	26	0.04	123	0.19	7.1	80	0	0.00	1	0.00	0.0
35	21	0.03	97	0.15	6.2	81	0	0.00	1	0.00	0.0
36	19	0.03	76	0.12	6.1	82	0	0.00	1	0.00	0.0
37	13	0.02	57	0.09	4.6	83	0	0.00	1	0.00	0.0
38	8	0.01	44	0.07	3.0	84	0	0.00	1	0.00	0.0
39	7	0.01	36	0.06	2.9	85	0	0.00	1	0.00	0.0
40	7	0.01	29	0.05	3.1	86	0	0.00	1	0.00	0.0
41	2	0.00	22	0.03	1.0	87	0	0.00	1	0.00	0.0
42	2	0.00	20	0.03	1.0	88	0	0.00	1	0.00	0.0
43	3	0.00	18	0.03	1.7	89	0	0.00	1	0.00	0.0
44	4	0.01	15	0.02	2.4	90	1	0.00	1	0.00	5.1
45	1	0.00	11	0.02	0.6						

STATION - 6000MO HILLS PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1987	27.3	27.2	27.1	27.2	27.2	27.2	27.1	27.2	26.7	26.6	27.3	27.2	8138	27.12	0.59
# OBS	744	672	744	720	744	720	744	744	721	700	251	634			
AUG	27.3	27.2	27.1	27.2	27.2	27.2	27.1	27.2	26.7	26.6	27.3	27.2	8138	27.12	0.59
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - 6000MOE HILLS TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1987	29.9	35.3	41.2	49.3	54.7	63.3	61.7	67.3	64.8	52.8	46.4	28.0	7843	49.78	16.11
# OBS	744	672	741	715	744	720	744	744	588	546	251	634			
AUG	29.9	35.3	41.2	49.3	54.7	63.3	61.7	67.3	64.8	52.8	46.4	28.0	7843	49.78	16.11
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - 6000MOE HILLS TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG	TMP
JAN	29.2	29.5	29.3	29.1	29.0	28.7	28.7	28.5	28.9	29.5	30.4	31.1	31.8	31.6	31.5	31.0	30.4	30.1	30.0	29.8	29.6	29.7	29.7	29.7		29.9
FEB	34.6	34.2	34.0	33.9	33.8	33.3	33.1	33.3	34.5	35.7	37.0	38.0	38.2	38.3	37.6	36.7	36.2	35.9	35.6	35.2	34.9	34.6	34.4		35.3	
MAR	38.5	38.8	38.6	38.6	38.5	38.5	38.7	39.2	40.1	41.4	42.5	43.6	44.7	45.1	45.4	45.1	44.5	43.3	42.2	41.5	41.1	40.0	39.5	39.2		41.2
APR	46.7	46.1	45.9	45.4	45.2	44.9	45.5	46.5	47.2	49.5	51.1	51.9	54.3	54.9	54.6	54.9	54.2	52.8	50.8	49.7	48.9	48.2	47.4	46.8		49.3
MAY	50.7	50.4	50.1	49.6	49.1	49.1	50.4	52.2	53.9	55.7	57.2	59.1	60.8	61.4	61.9	61.7	60.5	58.8	56.6	54.9	53.7	52.7	52.0	51.3		54.7
JUN	57.8	56.9	56.2	55.5	55.4	56.0	57.8	59.8	61.7	63.6	65.9	68.0	69.7	71.1	71.8	71.8	71.7	70.2	67.9	65.2	63.6	62.0	60.8	59.8		63.3
JUL	56.6	55.9	55.4	54.9	54.8	54.9	56.8	59.1	61.2	62.9	64.5	66.5	68.2	69.3	70.2	70.3	69.7	68.0	65.4	62.4	60.5	59.3	58.0	57.0		61.7
AUG	62.6	61.7	60.9	60.3	60.3	60.5	61.8	63.9	65.8	67.5	69.7	71.8	73.6	74.8	75.5	75.5	74.7	73.0	70.6	68.5	67.4	66.1	65.2	64.2		67.3
SEP	61.1	60.5	59.7	59.0	58.3	58.4	59.4	61.2	63.3	65.6	67.7	69.8	71.1	73.0	73.3	72.9	71.7	69.2	66.8	65.4	63.8	62.7	61.9	61.0		64.8
OCT	50.3	50.0	49.9	49.7	49.3	48.9	49.1	49.7	50.8	52.7	55.1	57.0	58.4	58.6	58.3	57.9	55.8	54.0	53.5	52.6	51.9	51.6	51.1	50.5		52.8
NOV	45.6	45.3	45.2	45.2	44.8	44.3	44.1	44.3	45.1	46.4	47.6	48.9	50.2	50.3	49.9	46.7	47.8	47.0	46.3	46.4	46.1	46.0	45.8	44.8		46.4
DEC	27.3	26.5	26.4	26.3	26.7	26.8	27.0	26.8	27.7	28.2	28.8	29.5	30.3	30.4	30.6	29.9	29.6	29.3	27.8	27.7	27.6	27.6	27.0	26.9		28.0
AUG																										
TMP	46.9	46.4	46.0	45.6	45.6	45.6	46.3	47.3	48.4	49.9	51.5	53.0	54.6	55.3	55.4	55.1	54.3	53.0	51.5	50.2	49.2	48.5	47.9	47.3		49.8

APPENDIX E
HAMPTON BUTTE
SUMMARY STATISTICS
OCTOBER 1983 - MAY 1988

STATION - HAMPTON BUTTE
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 10/1983 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	21.2	14.3	1203	18.04	10.18
# OBS	0	0	0	0	0	0	0	0	0	140	600	463			
1984	16.2	19.5	17.3	0.0	17.7	15.3	13.0	13.0	13.7	18.4	0.0	0.0	5277	15.59	8.39
# OBS	672	693	651	0	282	700	688	719	715	157	0	0			
1985	0.0	0.0	0.0	16.3	14.4	12.4	10.5	13.2	13.5	16.0	14.9	19.7	4899	14.15	7.59
# OBS	0	0	0	191	697	693	672	678	583	598	531	256			
1986	0.0	0.0	15.9	14.9	14.9	12.8	14.2	11.8	12.3	12.5	17.6	14.3	5684	14.00	6.97
# OBS	0	0	246	467	607	494	590	695	650	598	685	652			
1987	17.2	17.0	19.5	0.0	14.2	11.2	12.5	11.5	10.2	10.3	14.8	18.7	7352	14.14	8.05
# OBS	683	658	589	0	290	720	744	744	721	744	719	740			
1988	16.2	14.0	17.7	16.1	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3646	15.66	8.40
# OBS	742	696	744	720	744	0	0	0	0	0	0	0			
AVG	16.5	16.8	17.9	15.7	14.8	12.9	12.5	12.4	12.4	13.9	17.1	16.5	28061	14.75	8.04
SD	0.6	2.7	1.5	0.8	1.5	1.7	1.5	0.9	1.6	3.6	3.0	2.9			

STATION - HAMPTON BUTTE

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 100.2%

MONTH	MEAN POWER (W/M**2)	NORMALIZED	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)					
JAN	577.1	276597	478	264	0	20.9	64.4
FEB	499.2	186762	350	346	0	20.2	50.3
MAR	688.3	355865	517	227	0	22.2	69.5
APR	474.5	238300	486	234	0	20.2	67.5
MAY	374.1	167583	448	296	0	18.9	60.2
JUN	319.1	93188	292	428	0	18.0	40.6
JUL	367.7	129421	352	392	0	18.7	47.3
AUG	292.8	96918	331	413	0	17.7	44.5
SEP	258.2	66619	250	471	0	17.0	34.7
OCT	235.9	61091	259	485	0	16.6	34.8
NOV	352.0	174472	479	240	0	18.4	66.6
DEC	805.5	437314	540	200	0	22.8	73.0
PERIOD							
TOTAL	256.7	2248756	4782	3996	0	19.7	54.5

STATION - HAMPTON BUTTE
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 10/1983 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	16.9	16.4	16.2	16.1	16.3	16.2	16.5	16.3	15.9	16.0	15.7	16.4	16.9	16.5	16.6	16.8	16.7	17.0	17.3	17.1	17.0	16.5	16.4	16.7	16.5
FEB	17.6	17.7	17.3	17.1	17.4	17.2	16.6	16.2	15.7	16.0	15.6	15.9	16.3	16.1	16.4	16.4	16.9	17.4	17.6	17.6	17.7	17.4	17.2	16.8	16.8
MAR	17.6	17.2	17.3	17.1	16.8	16.5	15.9	15.6	16.0	16.2	16.9	17.9	18.5	19.1	19.5	19.7	19.4	19.4	19.5	19.3	19.4	18.5	17.9	17.6	17.9
APR	14.8	14.6	14.0	14.4	14.0	13.6	13.6	13.4	14.1	14.8	16.2	16.4	17.0	16.8	17.2	17.9	17.2	16.3	16.8	17.4	16.5	16.5	16.5	15.7	15.7
MAY	14.0	13.5	13.2	13.2	13.0	12.3	11.9	11.3	12.2	13.0	13.7	14.2	15.0	15.6	15.9	16.5	16.6	17.2	18.4	18.9	17.8	16.7	15.5	14.8	14.8
JUN	12.4	12.2	11.5	11.2	11.3	10.4	9.7	9.4	9.9	10.8	11.4	12.2	13.3	13.5	14.2	14.3	15.0	16.0	16.7	16.8	16.5	15.4	14.0	12.8	12.9
JUL	12.7	12.1	11.6	11.1	10.7	10.0	8.8	7.9	7.9	8.7	10.0	10.7	11.6	12.0	12.8	13.2	14.2	15.7	17.4	18.2	17.3	15.8	14.4	13.5	12.5
AUG	12.0	11.5	10.7	10.0	9.8	9.5	9.0	7.9	8.0	8.8	10.0	10.9	11.3	12.0	12.4	13.1	14.5	15.9	18.1	19.0	17.5	16.0	14.4	13.5	12.4
SEP	12.3	11.9	11.8	11.6	11.4	10.9	10.3	9.6	9.0	9.4	10.7	11.6	11.8	12.5	13.1	13.1	13.5	14.8	16.0	16.3	15.2	14.5	13.8	12.8	12.4
OCT	14.4	14.4	14.4	14.4	14.5	14.3	13.7	12.9	12.0	11.7	12.2	12.6	13.2	13.1	13.2	13.3	14.0	14.3	14.8	15.2	15.4	15.2	15.4	15.1	13.9
NOV	16.9	16.8	16.7	17.0	17.0	17.4	17.2	17.0	16.5	16.5	16.7	16.9	17.5	17.4	17.2	16.8	17.1	17.3	18.1	17.7	17.4	17.5	17.1	16.7	17.1
DEC	16.8	16.0	15.9	15.7	15.4	15.9	15.8	16.0	15.7	15.8	16.2	16.6	16.8	16.0	16.5	17.0	16.8	16.9	17.4	17.4	17.7	17.5	17.2	16.9	16.5
AUG																									
SPD	14.7	14.3	14.0	13.8	13.7	13.4	12.9	12.5	12.4	12.9	13.5	14.1	14.7	14.9	15.2	15.5	15.8	16.4	17.3	17.6	17.1	16.4	15.7	15.1	14.8

STATION - HAMPTON BUTTE

WIND SPEED-FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 10/1983 - 5/1988

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 14.8 MPH

NORMALIZED AVAILABLE ENERGY: 2543.8 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 28061

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	RELFREQ	CUMHRS	CUMRELFREQ	KWH/M**2/YEAR	MPH	PERIOD	RELFREQ	CUMHRS	CUMRELFREQ	KWH/M**2/YEAR
0	197	0.70	28061	100.00	0.0	46	12	0.04	57	0.20	16.5
1	296	1.05	27864	99.30	0.0	47	12	0.04	45	0.16	17.6
2	426	1.52	27568	98.24	0.0	48	9	0.03	33	0.12	14.1
3	628	2.24	27142	96.72	0.2	49	7	0.02	24	0.09	11.6
4	802	2.86	26514	94.49	0.7	50	4	0.01	17	0.06	7.1
5	1020	3.63	25712	91.63	1.8	51	3	0.01	13	0.05	5.6
6	1142	4.07	24692	87.99	3.5	52	3	0.01	10	0.04	6.0
7	1222	4.35	23550	83.92	5.9	53	2	0.01	7	0.02	4.2
8	1200	4.28	22328	79.57	8.7	54	2	0.01	5	0.02	4.4
9	1178	4.20	21128	75.29	12.1	55	0	0.00	3	0.01	0.0
10	1289	4.59	19950	71.10	18.2	56	1	0.00	3	0.01	2.5
11	1273	4.54	18661	66.50	23.9	57	2	0.01	2	0.01	5.2
12	1304	4.65	17388	61.97	31.8						
13	1313	4.68	16084	57.32	40.8						
14	1322	4.71	14771	52.64	51.3						
15	1295	4.61	13449	47.93	61.8						
16	1334	4.75	12154	43.31	77.2						
17	1186	4.23	10820	38.56	82.3						
18	1238	4.41	9634	34.33	102.0						
19	997	3.55	8396	29.92	96.6						
20	1033	3.68	7399	26.37	116.8						
21	913	3.25	6366	22.69	119.5						
22	874	3.11	5453	19.43	131.5						
23	710	2.53	4579	16.32	122.1						
24	644	2.30	3869	13.79	125.8						
25	572	2.04	3225	11.49	126.3						
26	457	1.63	2653	9.45	113.5						
27	365	1.30	2196	7.83	101.5						
28	320	1.14	1831	6.53	99.3						
29	280	1.00	1511	5.38	96.5						
30	222	0.79	1231	4.39	84.7						
31	184	0.66	1009	3.60	77.4						
32	156	0.56	825	2.94	72.2						
33	104	0.37	669	2.38	52.8						
34	83	0.30	565	2.01	46.1						
35	67	0.24	482	1.72	40.6						
36	70	0.25	415	1.48	46.1						
37	59	0.21	345	1.23	42.2						
38	52	0.19	286	1.02	40.3						
39	43	0.15	234	0.83	36.0						
40	41	0.15	191	0.68	37.1						
41	31	0.11	150	0.53	30.2						
42	17	0.06	119	0.42	17.8						
43	18	0.06	102	0.36	20.2						
44	14	0.05	84	0.30	16.9						
45	13	0.05	70	0.25	16.7						

STATION - HAMPTON TEMPERATURES (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG	TMP
JAN	25.4	25.2	25.1	25.0	24.9	25.1	25.3	29.0	38.0	42.6	43.7	42.4	41.1	39.4	36.1	32.5	29.7	28.5	27.8	27.2	27.0	26.5	26.4	25.7		31.0
FEB	29.1	29.0	28.7	28.5	28.1	27.5	27.5	32.8	39.7	42.8	43.9	43.6	43.4	42.9	40.5	37.7	35.1	32.6	31.3	30.7	30.4	30.3	30.2	30.0		34.0
MAR	30.7	30.2	29.7	29.1	28.7	28.4	30.4	34.7	41.4	45.0	46.2	46.4	45.8	44.9	43.3	41.5	38.7	35.6	34.4	33.4	32.9	32.2	31.4	31.0		36.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
MAY	38.6	38.5	38.1	37.5	37.7	39.2	43.0	46.2	48.3	52.2	54.4	56.5	55.7	55.0	53.9	52.4	51.6	49.1	45.6	42.8	41.1	39.8	38.8	38.4		45.8
JUN	53.1	52.9	52.6	52.3	52.7	54.2	57.7	60.2	63.1	66.4	69.2	71.9	72.5	71.1	70.8	68.2	65.8	62.4	59.3	57.5	56.2	55.1	54.6			61.3
JUL	51.5	50.8	50.4	49.9	50.0	51.2	54.8	58.4	61.8	64.8	67.9	70.8	71.6	72.1	71.0	69.6	67.6	64.7	60.6	56.8	54.8	53.6	52.6	51.8		59.5
AUG	56.4	56.0	55.8	55.5	55.6	56.8	61.2	65.6	70.1	73.3	75.9	80.1	82.7	82.8	80.6	78.6	76.3	71.8	66.3	62.7	61.3	59.6	58.7	57.5		66.7
SEP	56.4	55.9	55.2	55.0	54.3	54.5	57.6	62.5	67.3	71.1	73.1	76.9	78.6	78.8	76.9	74.8	71.6	67.0	63.1	60.8	59.1	58.3	57.4	57.0		64.3
OCT	51.6	51.2	50.6	50.2	50.0	49.6	52.1	57.5	61.3	63.5	67.4	69.5	70.7	69.7	67.2	63.6	59.3	56.5	54.9	53.8	53.3	52.5	51.7	51.0		57.5
NOV	34.0	33.5	33.4	33.1	32.9	32.6	32.7	34.3	36.7	38.9	40.8	42.2	42.3	41.6	40.3	38.1	36.1	35.7	35.2	34.8	34.7	34.2	33.9	33.6		36.1
DEC	24.9	25.0	24.7	24.5	24.4	24.1	23.7	25.1	26.9	29.2	30.4	31.5	31.5	31.1	29.3	27.3	26.1	25.9	25.8	25.5	25.2	24.9	24.8	24.7		26.5
AUG																										
TMP	41.8	41.4	41.1	40.8	40.5	40.8	42.7	46.5	50.9	54.1	56.2	57.9	58.4	58.0	56.1	53.8	51.5	49.0	46.7	44.8	44.0	43.2	42.5	42.1		47.7

STATION - HAMPTON BUTTE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	31.0	34.0	36.0	0.0	45.8	61.3	59.5	66.7	64.3	57.5	36.1	26.5	7347	47.72	18.27
# OBS	679	658	589	0	289	720	744	744	721	744	719	740			
AVG	31.0	34.0	36.0	0.0	45.8	61.3	59.5	66.7	64.3	57.5	36.1	26.5	7347	47.72	18.27
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - HAMPTON BUTTE PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	24.6	24.5	24.4	0.0	24.5	24.6	24.5	24.6	24.7	24.7	24.6	24.4	7350	24.56	0.57
# OBS	681	658	589	0	290	720	744	744	721	744	719	740			
AVG	24.6	24.5	24.4	0.0	24.5	24.6	24.5	24.6	24.7	24.7	24.6	24.4	7350	24.56	0.57
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

APPENDIX F

**KENNEWICK MICROWAVE
SUMMARY STATISTICS
JUNE 1976 - MAY 1988**

STATION - KENNEWICK 80°
 MONTHLY WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 6/1987 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1987	0.0	0.0	0.0	0.0	0.0	0.0	16.6	10.5	10.8	8.9	16.6	24.5	3318	12.81	10.55
# OBS	0	0	0	0	0	0	205	729	708	744	715	217			
1988	17.0	18.5	17.8	14.5	18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2982	17.20	11.56
# OBS	83	696	744	720	739	0	0	0	0	0	0	0			
AUG	17.0	18.5	17.8	14.5	18.1	0.0	16.6	10.5	10.8	8.9	16.6	24.5	6300	14.89	11.26
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - KENNEWICK M/W 105°
 MONTHLY WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 6/1976 - 9/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1976	0.0	0.0	0.0	0.0	0.0	15.4	0.0	15.9	13.2	13.5	12.9	13.2	3058	13.76	9.73
# OBS	0	0	0	0	0	180	0	480	633	735	720	310			
1977	8.2	20.7	23.7	15.9	21.9	14.5	15.6	15.5	13.5	15.2	21.8	19.9	7990	17.05	12.15
# OBS	645	515	744	718	384	582	744	744	720	739	720	735			
1978	11.2	14.4	14.9	18.4	17.2	17.2	14.4	11.5	15.8	12.9	19.8	17.9	7088	15.65	10.72
# OBS	565	671	744	710	700	672	738	227	94	734	491	742			
1979	8.0	18.4	11.8	13.1	15.7	17.3	22.1	18.1	13.5	15.2	10.9	19.1	7530	15.41	10.44
# OBS	563	493	744	706	743	688	682	709	390	615	556	641			
1980	12.9	11.7	19.6	16.8	16.0	15.1	11.1	12.8	0.0	10.7	14.5	13.2	6943	14.18	10.24
# OBS	689	693	744	705	430	718	699	511	0	399	719	636			
1981	6.7	9.8	10.8	15.3	0.0	21.6	15.7	13.2	13.0	15.2	17.5	17.1	7226	14.35	9.85
# OBS	494	643	702	514	0	630	743	649	696	742	720	693			
1982	24.8	20.8	20.4	19.4	14.1	13.9	13.5	10.9	11.2	12.3	13.1	13.8	8206	15.40	11.77
# OBS	532	644	638	715	690	719	740	697	693	719	700	719			
1983	22.4	17.3	15.3	10.4	15.2	17.9	18.7	14.0	14.2	12.2	22.4	11.5	8224	16.03	11.53
# OBS	741	637	727	716	708	709	626	637	694	698	718	613			
1984	18.0	15.3	17.0	17.7	18.0	16.0	11.3	14.6	15.6	17.9	20.5	14.5	8335	16.37	11.62
# OBS	729	664	744	720	663	719	740	556	699	695	689	717			
1985	5.3	14.7	15.2	20.8	18.5	15.6	12.5	14.5	13.8	19.5	18.5	11.9	7721	15.88	10.93
# OBS	162	671	737	721	744	720	744	744	721	661	721	375			
1986	0.0	0.0	0.0	12.6	16.6	13.4	16.4	12.8	17.1	11.5	21.0	11.9	5435	15.12	10.72
# OBS	0	0	0	24	694	649	670	685	648	744	720	601			
1987	16.6	16.8	18.7	17.8	17.1	14.4	16.6	11.6	11.9	0.0	0.0	0.0	6495	15.74	10.48
# OBS	729	669	743	720	744	720	744	729	697	0	0	0			
AUG	14.4	15.8	16.7	16.6	16.8	16.0	15.2	13.9	13.7	14.3	17.6	15.3	84251	15.54	11.01
SD	6.8	3.6	4.0	3.1	2.2	2.2	3.3	2.1	1.7	2.7	4.0	3.1			

STATION - KENNEWICK M/W

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 78.4%

MONTH	MEAN POWER (W/M**2)	NORMALIZED TOTAL ENERGY (KWH/M**2)	NO. DATA PTS.	NO. DATA PTS.	NO. DATA PTS.	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
			WITHIN RANGE	BELOW 12	ABOVE 60		
JAN	683.9	343312	56	27	0	21.8	67.5
FEB	1489.6	638532	401	295	0	27.1	57.6
MAR	1241.7	547572	441	303	0	25.7	59.3
APR	781.1	297014	368	352	0	22.7	51.1
MAY	948.9	451875	473	263	3	23.8	64.0
JUN	0.0	0	0	0	0	0.0	0.0
JUL	822.8	355372	119	86	0	23.5	58.0
AUG	581.7	132388	223	506	0	20.0	30.6
SEP	1006.1	217802	206	502	0	23.7	29.1
OCT	528.0	89224	169	575	0	19.7	22.7
NOV	1200.8	462301	370	345	0	25.6	51.7
DEC	1741.5	1026965	172	43	2	28.8	79.3
PERIOD							
TOTAL	505.9	4067750	2998	3297	5	24.3	47.6

STATION - KENNEWICK 80'

DIURNAL WIND SPEEDS (MPH)

DATA PERIOD OF RECORD - 6/1987 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	14.2	14.2	14.0	13.9	15.2	14.9	16.0	17.4	17.9	18.4	24.6	19.6	23.5	23.3	20.4	18.9	18.5	17.3	13.8	15.2	16.0	14.7	14.0	13.8	17.0
FEB	17.8	19.0	18.5	18.2	18.8	18.9	19.1	18.8	18.5	18.3	18.5	19.2	19.8	20.0	18.8	18.5	18.2	18.3	18.1	17.7	17.8	17.0	17.8	17.8	18.5
MAR	18.4	18.8	19.0	18.7	19.6	18.7	17.6	17.7	17.8	17.6	18.6	18.1	17.7	17.2	16.7	15.9	15.3	16.3	16.9	17.2	17.4	18.2	18.2	18.4	17.8
APR	14.3	14.0	14.6	15.2	14.6	15.3	16.0	15.5	15.2	14.4	15.0	14.9	14.2	14.3	14.5	13.9	13.8	14.0	14.7	15.2	13.7	13.3	13.7	13.7	14.5
MAY	19.7	18.2	18.8	18.6	18.3	18.6	18.0	17.5	16.8	17.0	17.0	17.4	16.9	15.8	16.0	16.6	17.6	17.3	17.6	19.2	20.0	20.7	20.7	19.8	18.1
JUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL	17.7	19.9	20.3	21.8	22.6	22.4	21.5	22.3	21.1	19.5	18.3	13.5	11.7	12.3	11.7	10.8	10.6	11.6	13.6	16.4	16.6	14.7	15.5	16.8	16.6
AUG	10.0	8.9	8.4	9.0	9.2	9.4	9.1	10.2	10.3	10.6	10.6	11.0	11.8	11.5	12.0	12.4	12.1	12.2	11.4	11.9	11.2	10.2	9.3	10.2	10.5
SEP	11.6	11.8	11.5	11.8	12.6	12.6	12.4	12.2	11.5	9.7	9.9	9.5	9.7	9.6	10.0	10.1	9.7	9.4	9.7	9.7	11.1	11.1	11.1	11.4	10.8
OCT	8.0	8.7	9.4	10.2	10.6	10.5	10.8	11.2	11.1	10.0	9.5	9.1	8.5	8.3	7.7	8.2	7.9	7.0	7.3	7.3	7.2	7.8	8.0	8.1	8.9
NOV	17.3	17.2	17.9	17.6	17.6	17.2	17.3	16.4	15.3	15.0	15.2	15.4	15.5	15.6	15.9	15.9	16.3	15.8	16.8	17.2	16.9	17.5	17.7	18.0	16.6
DEC	24.1	24.0	25.9	26.2	23.2	24.2	26.2	23.8	25.8	23.8	24.3	25.8	22.9	22.4	23.9	24.2	24.8	25.3	26.7	28.1	26.0	23.7	20.9	21.9	24.5
AUG																									
SPD	15.1	15.0	15.3	15.5	15.6	15.6	15.6	15.5	15.2	14.6	14.8	14.7	14.7	14.4	14.3	14.2	14.2	14.1	14.5	15.0	14.9	14.8	14.8	14.9	14.9

STATION - KENNEWICK M/W 105

DIURNAL WIND SPEEDS (MPH)

DATA PERIOD OF RECORD - 6/1976 - 9/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG SPD
JAN	14.7	14.7	14.6	14.2	14.1	13.9	14.2	14.3	14.4	14.2	14.2	14.3	14.4	14.5	14.3	14.1	14.5	14.2	14.5	14.3	14.5	14.7	14.8	14.9	14.4
FEB	16.1	15.8	15.5	15.4	15.5	15.7	16.1	15.9	16.0	16.0	15.8	16.0	16.2	15.9	15.6	15.2	15.2	15.3	15.9	15.8	15.9	15.8	16.1	16.1	15.8
MAR	17.2	17.0	17.3	17.3	17.3	17.6	17.5	16.6	16.2	16.4	16.5	16.9	16.8	16.6	16.1	15.8	15.5	16.0	16.6	16.6	16.9	16.7	16.9	16.7	16.7
APR	16.9	16.8	16.7	16.9	17.1	17.0	16.5	16.3	16.6	16.5	16.2	16.4	16.5	16.4	16.3	16.0	16.1	16.1	16.7	16.9	16.7	16.9	16.9	16.9	16.6
MAY	17.2	17.0	17.1	16.8	16.7	16.6	16.4	16.2	16.4	16.6	16.6	16.6	16.4	16.6	16.6	16.4	16.9	17.2	17.3	17.4	17.4	17.2	17.1	17.2	16.8
JUN	15.7	15.5	15.8	16.0	16.2	16.2	16.0	16.0	16.1	16.1	16.1	15.6	15.7	15.5	15.2	15.6	15.8	16.4	16.2	16.5	16.8	16.9	16.6	16.5	16.0
JUL	15.0	15.0	15.2	15.5	15.5	15.6	15.2	15.3	15.5	15.4	15.2	15.0	14.8	14.9	14.8	14.8	14.8	15.0	14.9	15.4	15.3	15.3	15.2	15.2	15.2
AUG	13.8	14.0	14.0	14.4	14.6	14.9	14.8	14.5	14.2	13.9	13.6	13.4	13.0	13.2	13.3	13.3	13.1	13.3	13.4	14.1	14.4	14.2	14.3	14.2	13.9
SEP	14.3	14.5	14.4	14.4	14.3	14.2	14.1	13.7	13.7	13.4	13.6	13.4	13.5	13.4	13.3	13.1	13.1	13.1	13.7	13.4	13.7	13.8	13.6	13.6	13.7
OCT	13.9	14.3	14.7	14.7	15.0	15.1	15.1	14.9	14.6	14.4	14.5	14.4	14.3	13.9	13.6	13.4	13.6	14.0	14.0	14.0	14.0	14.0	14.0	14.3	14.3
NOV	18.4	18.0	18.1	18.3	18.6	18.4	18.3	18.3	17.8	17.6	17.7	17.6	17.5	17.1	16.5	16.3	16.8	17.0	16.7	16.9	17.3	17.5	17.7	18.0	17.6
DEC	15.1	15.4	15.6	15.8	15.9	15.7	15.8	15.9	16.0	15.5	15.4	15.2	14.9	14.8	14.6	14.7	14.7	14.7	14.8	14.9	15.1	15.3	15.5	14.8	15.3
AVG																									
SPD	15.7	15.7	15.8	15.8	15.9	15.9	15.9	15.7	15.6	15.5	15.5	15.4	15.3	15.2	15.0	14.9	15.0	15.2	15.4	15.5	15.7	15.7	15.7	15.7	15.5

STATION - KENNEWICK M/W 80°

WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 7/1987 - 5/1988

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 14.9 MPH

NORMALIZED AVAILABLE ENERGY: 4619.5 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 6300

NORMALIZED						NORMALIZED					
SPD HOURS/		REL FREQ		CUM HRS		AVAIL. ENERGY		SPD HOURS/		REL FREQ	
MPH	PERIOD	REL FREQ	CUM HRS	CUM REL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUM HRS	CUM REL FREQ	KWH/M**2/YEAR
0	140	2.22	6300	100.00	0.0	46	6	0.10	55	0.87	41.6
1	158	2.51	6160	97.78	0.0	47	6	0.10	49	0.78	44.4
2	178	2.83	6002	95.27	0.1	48	7	0.11	43	0.68	55.2
3	249	3.95	5824	92.44	0.5	49	5	0.08	36	0.57	41.9
4	284	4.51	5575	88.49	1.3	50	6	0.10	31	0.49	53.5
5	336	5.33	5291	83.98	3.0	51	3	0.05	25	0.40	28.4
6	343	5.44	4955	78.65	5.3	52	3	0.05	22	0.35	30.1
7	362	5.75	4612	73.21	8.9	53	4	0.06	19	0.30	42.5
8	355	5.63	4250	67.46	13.0	54	2	0.03	15	0.24	22.5
9	289	4.59	3895	61.83	15.0	55	0	0.00	13	0.21	0.0
10	277	4.40	3606	57.24	19.8	56	5	0.08	13	0.21	62.6
11	221	3.51	3329	52.84	21.0	57	3	0.05	8	0.13	39.6
12	200	3.17	3108	49.33	24.6	58	0	0.00	5	0.08	0.0
13	176	2.79	2908	46.16	27.6	59	0	0.00	5	0.08	0.0
14	162	2.57	2732	43.37	31.7	60	0	0.00	5	0.08	0.0
15	139	2.21	2570	40.79	33.5	61	1	0.02	5	0.08	16.2
16	152	2.41	2431	38.59	44.4	62	3	0.05	4	0.06	51.0
17	139	2.21	2279	36.17	48.7	63	0	0.00	1	0.02	0.0
18	134	2.13	2140	33.97	55.7	64	0	0.00	1	0.02	0.0
19	107	1.70	2006	31.84	52.3	65	0	0.00	1	0.02	0.0
20	104	1.65	1899	30.14	59.3	66	0	0.00	1	0.02	0.0
21	109	1.73	1795	28.49	72.0	67	1	0.02	1	0.02	21.4
22	113	1.79	1686	26.76	85.8						
23	132	2.10	1573	24.97	114.5						
24	112	1.78	1441	22.87	110.4						
25	109	1.73	1329	21.10	121.4						
26	87	1.38	1220	19.37	109.0						
27	91	1.44	1133	17.98	127.7						
28	101	1.60	1042	16.54	158.1						
29	93	1.48	941	14.94	161.7						
30	109	1.73	848	13.46	209.8						
31	86	1.37	739	11.73	182.7						
32	73	1.16	653	10.37	170.6						
33	76	1.21	580	9.21	194.7						
34	79	1.25	504	8.00	221.4						
35	65	1.03	425	6.75	198.7						
36	45	0.71	360	5.71	149.7						
37	46	0.73	315	5.00	166.1						
38	40	0.63	269	4.27	156.5						
39	33	0.52	229	3.63	139.6						
40	32	0.51	196	3.11	146.0						
41	30	0.48	164	2.60	147.4						
42	22	0.35	134	2.13	116.2						
43	22	0.35	112	1.78	124.7						
44	22	0.35	90	1.43	133.6						
45	13	0.21	68	1.08	84.5						

STATION - KENNEWICK M/W 105'

WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 6/1976 - 9/1987

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 15.5 MPH

NORMALIZED AVAILABLE ENERGY: 4834.0 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 84251

NORMALIZED						NORMALIZED						
SPD	HOURS/					AVAIL. ENERGY	SPD	HOURS/				
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR		MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	750	0.89	84251	100.00	0.0		46	173	0.21	1149	1.36	89.8
1	1564	1.86	83501	99.11	0.0		47	170	0.20	976	1.16	94.1
2	2028	2.41	81937	97.25	0.1		48	118	0.14	806	0.96	69.6
3	2780	3.30	79909	94.85	0.4		49	104	0.12	688	0.82	65.2
4	3384	4.02	77129	91.55	1.2		50	82	0.10	584	0.69	54.7
5	3754	4.46	73745	87.53	2.5		51	93	0.11	502	0.60	65.8
6	4140	4.91	69991	83.07	4.8		52	54	0.06	409	0.49	40.5
7	4256	5.05	65851	78.16	7.8		53	66	0.08	355	0.42	52.4
8	3957	4.70	61595	73.11	10.8		54	53	0.06	289	0.34	44.5
9	4124	4.89	57638	68.41	16.0		55	53	0.06	236	0.28	47.0
10	3971	4.71	53514	63.52	21.2		56	38	0.05	183	0.22	35.6
11	3651	4.33	49543	58.80	25.9		57	24	0.03	145	0.17	23.7
12	3307	3.93	45892	54.47	30.5		58	33	0.04	121	0.14	34.3
13	3206	3.81	42585	50.55	37.6		59	14	0.02	88	0.10	15.3
14	2938	3.49	39379	46.74	43.0		60	13	0.02	74	0.09	15.0
15	2535	3.01	36441	43.25	45.6		61	16	0.02	61	0.07	19.4
16	2426	2.88	33906	40.24	53.0		62	13	0.02	45	0.05	16.5
17	2286	2.71	31480	37.36	59.9		63	11	0.01	32	0.04	14.7
18	1986	2.36	29194	34.65	61.8		64	4	0.00	21	0.02	5.6
19	1985	2.36	27208	32.29	72.6		65	4	0.00	17	0.02	5.9
20	1837	2.18	25223	29.94	78.4		66	5	0.01	13	0.02	7.7
21	1620	1.92	23386	27.76	80.0		67	3	0.00	8	0.01	4.8
22	1620	1.92	21766	25.83	92.0		68	1	0.00	5	0.01	1.7
23	1571	1.86	20146	23.91	101.9		69	1	0.00	4	0.00	1.8
24	1411	1.67	18575	22.05	104.0		70	2	0.00	3	0.00	3.7
25	1436	1.70	17164	20.37	119.6		71	0	0.00	1	0.00	0.0
26	1424	1.69	15728	18.67	133.4		72	1	0.00	1	0.00	2.0
27	1251	1.48	14304	16.98	131.3							
28	1151	1.37	13053	15.49	134.7							
29	1150	1.36	11902	14.13	149.5							
30	1029	1.22	10752	12.76	148.1							
31	955	1.13	9723	11.54	151.7							
32	983	1.17	8768	10.41	171.7							
33	847	1.01	7785	9.24	162.3							
34	826	0.98	6938	8.23	173.1							
35	705	0.84	6112	7.25	161.2							
36	665	0.79	5407	6.42	165.4							
37	588	0.70	4742	5.63	158.8							
38	628	0.75	4154	4.93	183.7							
39	500	0.59	3526	4.19	158.1							
40	455	0.54	3026	3.59	155.3							
41	363	0.43	2571	3.05	133.4							
42	318	0.38	2208	2.62	125.6							
43	279	0.33	1890	2.24	118.3							
44	238	0.28	1611	1.91	108.1							
45	224	0.27	1373	1.63	108.8							

STATION - KENNEWICK TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG	TMP
JAN	29.6	29.7	29.8	29.7	29.5	29.7	28.8	29.1	28.8	29.6	30.7	31.0	31.6	31.4	30.9	30.4	29.7	29.3	29.3	29.5	29.5	29.6	29.4	29.9	29.9	
FEB	35.6	35.4	35.1	35.0	34.0	33.7	33.3	34.2	34.9	35.7	37.4	38.9	39.7	40.2	40.4	39.6	38.7	37.3	36.9	36.9	36.7	36.8	36.1	35.6	36.6	
MAR	41.8	41.4	41.0	40.5	40.1	39.6	41.0	42.0	43.7	45.6	47.6	49.3	50.0	50.6	50.4	50.0	48.6	47.1	46.2	45.5	44.7	44.1	43.4	43.0	44.9	
APR	49.7	49.0	48.4	47.4	46.6	48.1	50.0	51.8	53.4	55.4	58.1	59.1	60.5	60.9	60.5	59.8	58.8	56.9	54.6	53.6	52.2	51.6	50.7	49.6	53.6	
MAY	54.3	53.4	52.4	51.7	51.6	53.8	55.4	58.1	60.6	62.8	65.3	66.7	67.5	67.9	68.3	67.6	66.4	64.5	62.2	60.1	58.2	57.0	56.0	55.2	59.9	
JUN	58.5	57.7	56.2	55.2	56.2	58.7	61.1	63.1	65.2	66.8	69.0	70.5	71.6	72.2	72.4	72.1	71.6	70.3	68.1	65.8	64.7	63.0	61.8	61.0	64.7	
JUL	62.2	61.2	60.3	59.4	60.1	62.7	64.1	66.4	68.5	70.2	72.2	74.3	76.0	75.6	75.3	74.5	74.3	72.7	70.8	68.3	66.8	65.7	64.4	63.4	67.8	
AUG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.2	71.4	
OCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.2	
NOV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
AUG																										
TMP	47.0	46.5	45.8	45.2	45.1	46.2	47.3	48.7	50.2	51.8	53.9	55.0	56.0	56.2	56.2	55.6	54.8	53.4	52.0	50.9	50.1	49.3	48.4	47.9	50.6	

STATION - KENNEWICK TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG	TMP
JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL	62.9	61.1	60.4	59.2	59.5	62.6	62.4	65.5	68.8	71.9	75.2	77.3	79.2	80.4	80.3	80.7	79.7	78.3	75.8	72.5	69.8	68.2	66.3	64.2	70.4	70.4
AUG	67.5	66.6	65.9	65.2	65.0	69.1	70.7	71.3	72.6	73.9	76.0	77.6	78.7	79.8	80.2	80.0	79.4	77.9	75.3	73.7	72.3	71.2	70.7	69.2	72.9	72.9
SEP	63.2	62.3	61.4	60.5	59.5	60.0	64.4	64.8	65.8	67.8	69.6	71.2	72.4	73.3	73.4	72.9	72.0	70.3	69.1	68.1	66.7	65.7	64.8	63.8	66.7	66.7
OCT	55.5	55.1	54.5	53.5	52.9	51.9	53.2	55.0	56.1	57.3	58.2	59.5	61.1	61.9	62.2	61.1	60.5	60.0	59.5	58.8	58.7	57.1	56.4	56.1	57.3	57.3
NOV	41.3	41.1	41.0	40.9	41.1	40.8	40.6	41.8	42.4	43.4	44.7	45.7	46.2	45.9	45.7	44.4	44.0	43.6	43.1	42.5	42.0	41.2	41.3	41.1	42.8	42.8
DEC	44.1	44.3	44.4	44.3	43.8	43.8	44.0	43.5	44.5	45.0	45.8	47.1	48.3	48.2	47.8	46.6	45.6	45.4	44.8	44.5	44.3	44.3	44.5	44.4	45.1	45.1
AUG																										
TMP	56.5	56.0	55.3	54.6	54.3	55.2	56.8	57.8	58.8	60.2	61.7	63.3	64.4	65.0	65.1	64.4	63.7	62.7	61.5	60.4	59.5	58.6	58.0	57.3	59.6	59.6

STATION - KENNEWICK TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	29.9	36.6	44.9	53.6	59.9	64.7	67.8	0.0	71.4	66.2	0.0	0.0	4891	50.55	16.11
# OBS	741	669	743	720	744	720	536	0	11	7	0	0			
AVG	29.9	36.6	44.9	53.6	59.9	64.7	67.8	0.0	71.4	66.2	0.0	0.0	4891	50.55	16.11
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - KENNEWICK TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	0.0	0.0	0.0	0.0	0.0	0.0	70.4	72.9	66.7	57.3	42.8	45.1	3319	59.62	13.99
# OBS	0	0	0	0	0	0	205	729	709	744	715	217			
AVG	0.0	0.0	0.0	0.0	0.0	0.0	70.4	72.9	66.7	57.3	42.8	45.1	3319	59.62	13.99
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - KENNEWICK PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	28.1	28.1	28.0	28.1	28.0	28.1	28.0	28.1	28.1	28.2	28.1	27.8	8200	28.07	0.16
# OBS	743	671	743	720	744	720	744	729	710	744	715	217			
AVG	28.1	28.1	28.0	28.1	28.0	28.1	28.0	28.1	28.1	28.2	28.1	27.8	8200	28.07	0.16
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

APPENDIX G

**KITTITAS MICROWAVE
SUMMARY STATISTICS
MARCH 1980 - MAY 1988**

STATION - KITTITAS M/W
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 3/1980 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1980	0.0	0.0	16.3	13.6	14.3	11.5	12.0	14.6	16.1	10.0	10.1	9.7	5987	12.54	8.48
# OBS	0	0	156	719	665	625	394	586	720	709	718	695			
1981	9.9	11.6	14.3	17.1	15.0	17.4	15.1	11.1	11.8	11.9	11.2	12.8	8640	13.27	9.00
# OBS	697	651	741	744	744	656	743	743	719	743	720	739			
1982	16.1	12.9	13.8	16.4	16.3	12.3	14.8	12.8	13.0	10.6	10.6	10.8	8621	13.39	8.64
# OBS	734	658	741	708	738	718	741	744	719	687	715	718			
1983	14.5	11.3	12.8	12.5	15.6	16.8	15.9	0.0	0.0	0.0	0.0	0.0	4692	14.12	8.69
# OBS	721	666	744	714	744	682	421	0	0	0	0	0			
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.00	0.00
# OBS	0	0	0	0	0	0	0	0	0	0	0	0			
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	466	6.50	6.55
# OBS	0	0	0	0	0	0	0	0	0	0	0	466			
1986	12.4	11.9	13.4	16.5	14.8	13.6	14.7	11.4	11.9	8.6	11.3	6.2	8000	12.54	8.48
# OBS	734	671	741	720	734	720	744	744	681	63	720	728			
1987	7.5	10.8	11.2	13.8	13.2	12.2	14.9	12.0	10.3	9.6	9.9	8.3	8356	11.19	8.63
# OBS	744	672	744	719	726	720	744	719	715	389	720	744			
1988	9.1	12.0	13.9	12.9	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3609	12.50	9.51
# OBS	719	696	744	720	730	0	0	0	0	0	0	0			
AVG	11.6	11.7	13.3	14.7	14.8	14.0	14.7	12.3	12.6	10.6	10.6	9.2	48371	12.68	8.78
SD	3.3	0.7	1.6	1.9	1.0	2.5	1.3	1.4	2.2	1.2	0.6	2.5			

STATION - KITTITAS M/W

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 95.4%

MONTH	MEAN POWER (W/M**2)	NORMALIZED	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)					
JAN	683.6	122411	173	546	0	20.4	24.1
FEB	733.6	224290	286	410	0	21.1	41.1
MAR	942.1	325012	345	399	0	23.1	46.4
APR	602.5	204819	329	391	0	20.6	45.7
MAY	662.7	266794	395	335	0	20.7	54.1
JUN	554.6	168611	304	416	0	20.1	42.2
JUL	679.9	288298	424	320	0	21.4	57.0
AUG	595.2	179212	291	428	0	20.5	40.5
SEP	802.5	163679	196	519	0	22.8	27.4
OCT	678.4	128457	99	290	0	21.6	25.4
NOV	535.2	124984	226	494	0	19.6	31.4
DEC	494.1	88443	179	565	0	19.2	24.1
PERIOD							
TOTAL	260.4	2281237	3247	5113	0	21.0	38.8

STATION - KITTITAS M/W
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 3/1980 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	11.7	11.8	11.4	11.2	10.8	10.8	10.9	10.9	11.1	11.4	11.6	11.9	12.1	12.5	12.8	12.8	12.3	11.9	11.8	11.4	11.4	11.1	11.3	11.5	11.6
FEB	11.3	11.7	11.9	11.1	10.9	11.5	11.5	11.5	11.0	11.8	12.3	12.6	12.9	13.2	13.4	13.1	12.2	11.6	11.2	11.0	11.1	11.0	11.0	10.7	11.7
MAR	12.2	12.1	12.2	12.2	11.7	11.7	11.8	12.0	13.0	13.6	13.6	13.8	14.4	14.9	15.5	16.3	16.2	15.0	13.7	13.2	13.0	12.5	12.6	12.5	13.3
APR	12.9	12.7	12.6	12.5	12.0	11.5	11.7	13.2	14.6	15.3	15.5	15.7	16.2	16.4	16.9	17.8	18.2	17.6	16.5	15.5	15.3	14.7	14.2	13.4	14.7
MAY	13.4	12.9	12.8	12.6	12.0	11.8	12.7	14.0	14.4	14.0	14.1	14.5	15.0	15.8	16.7	17.7	18.6	18.7	17.5	16.4	15.6	15.3	15.1	14.1	14.8
JUN	13.6	12.9	12.3	12.1	11.3	10.8	11.6	12.4	12.4	12.1	12.4	12.5	12.9	13.7	15.2	16.5	17.8	18.2	17.8	16.6	15.6	14.9	14.7	14.2	14.0
JUL	14.5	13.8	13.1	12.1	11.5	11.5	12.2	12.9	13.0	12.7	12.7	13.0	13.8	14.3	16.0	17.3	18.6	19.6	19.1	17.7	16.6	16.1	15.5	14.9	14.7
AUG	12.4	11.7	11.4	10.8	10.2	9.6	9.1	9.8	10.3	10.2	10.2	10.4	10.9	12.0	13.3	14.9	16.4	17.0	15.8	14.5	14.0	13.8	13.3	12.9	12.3
SEP	12.2	12.0	11.6	11.3	11.0	10.4	10.0	11.2	12.3	12.5	12.4	12.7	13.4	13.8	14.4	15.0	15.1	14.3	13.1	13.1	13.4	12.7	12.6	12.3	12.6
OCT	9.4	9.7	9.6	9.5	9.3	9.4	9.0	9.3	10.2	10.9	11.3	12.0	12.6	13.1	12.6	12.4	11.4	10.5	10.8	10.9	10.9	10.5	9.8	9.6	10.6
NOV	10.3	10.1	10.1	9.9	10.0	10.0	10.1	9.6	9.2	10.0	10.7	11.3	11.4	12.0	12.1	12.0	11.4	10.6	10.7	10.6	10.9	10.8	10.6	10.6	10.6
DEC	9.8	9.9	9.6	9.1	9.2	9.7	9.5	9.4	9.1	9.0	8.7	9.4	9.4	9.4	9.6	9.4	9.4	8.7	8.2	8.8	8.4	8.7	9.5	9.5	9.2
AUG																									
SPD	12.1	11.9	11.7	11.3	10.9	10.9	11.0	11.6	11.9	12.2	12.3	12.6	13.1	13.6	14.2	14.8	15.0	14.7	14.1	13.5	13.2	12.8	12.7	12.3	12.7

STATION - KITTITAS MW

WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 3/1980 - 5/1988

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 12.7 MPH

NORMALIZED AVAILABLE ENERGY: 2505.8 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 48371

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	785	1.62	48371	100.00	0.0	46	18	0.04	76	0.16	16.0
1	1194	2.47	47586	98.38	0.0	47	11	0.02	58	0.12	10.5
2	1646	3.40	46392	95.91	0.1	48	12	0.02	47	0.10	12.2
3	2012	4.16	44746	92.51	0.5	49	10	0.02	35	0.07	10.8
4	2170	4.49	42734	88.35	1.3	50	5	0.01	25	0.05	5.7
5	2546	5.26	40564	83.86	2.9	51	5	0.01	20	0.04	6.1
6	2773	5.73	38018	78.60	5.5	52	5	0.01	15	0.03	6.4
7	2716	5.61	35245	72.86	8.5	53	1	0.00	10	0.02	1.4
8	2825	5.84	32529	67.25	13.2	54	4	0.01	9	0.02	5.8
9	2654	5.49	29704	61.41	17.7	55	0	0.00	5	0.01	0.0
10	2539	5.25	27050	55.92	23.3	56	2	0.00	5	0.01	3.2
11	2288	4.73	24511	50.67	27.9	57	0	0.00	3	0.01	0.0
12	2164	4.47	22223	45.94	34.3	58	2	0.00	3	0.01	3.6
13	1888	3.90	20059	41.47	38.0	59	1	0.00	1	0.00	1.9
14	1694	3.50	18171	37.57	42.6						
15	1522	3.15	16477	34.06	47.1						
16	1434	2.96	14955	30.92	53.8						
17	1378	2.85	13521	27.95	62.0						
18	1235	2.55	12143	25.10	66.0						
19	1140	2.36	10908	22.55	71.6						
20	1039	2.15	9768	20.19	76.1						
21	921	1.90	8729	18.05	78.1						
22	911	1.88	7808	16.14	88.9						
23	792	1.64	6897	14.26	88.3						
24	718	1.48	6105	12.62	90.9						
25	657	1.36	5387	11.14	94.0						
26	584	1.21	4730	9.78	94.0						
27	519	1.07	4146	8.57	93.6						
28	475	0.98	3627	7.50	95.5						
29	413	0.85	3152	6.52	92.3						
30	396	0.82	2739	5.66	97.9						
31	341	0.70	2343	4.84	93.1						
32	344	0.71	2002	4.14	103.3						
33	280	0.58	1658	3.43	92.2						
34	214	0.44	1378	2.85	77.0						
35	218	0.45	1164	2.41	85.6						
36	206	0.43	946	1.96	88.0						
37	170	0.35	740	1.53	78.9						
38	127	0.26	570	1.18	63.8						
39	87	0.18	443	0.92	47.3						
40	83	0.17	356	0.74	48.7						
41	65	0.13	273	0.56	41.0						
42	46	0.10	208	0.43	31.2						
43	40	0.08	162	0.33	29.1						
44	23	0.05	122	0.25	17.9						
45	23	0.05	99	0.20	19.2						

STATION - KITTIITAS TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG TMP
JAN	29.3	28.6	28.9	28.9	29.1	28.3	28.2	30.0	31.3	34.0	35.4	36.8	36.8	35.9	34.5	32.2	30.3	29.5	29.7	29.9	29.7	29.9	29.5	29.5	31.1
FEB	35.5	35.1	34.8	34.8	34.7	34.6	35.8	37.6	39.0	40.7	42.7	44.4	44.5	43.5	42.5	40.9	39.1	38.1	37.5	37.0	36.6	36.6	36.4	35.8	38.3
MAR	40.2	40.2	39.6	39.6	39.5	40.7	42.4	44.1	46.1	48.2	49.8	51.2	51.7	51.4	50.4	49.7	48.2	46.0	44.4	43.4	42.5	41.9	41.5	41.2	44.7
APR	47.4	46.4	45.9	45.5	45.0	47.9	50.5	53.7	56.4	58.8	61.2	62.5	63.0	63.0	62.1	60.7	58.6	55.9	53.0	51.5	50.5	49.7	48.9	48.1	53.6
MAY	51.7	50.8	50.1	49.7	51.8	53.4	56.5	59.9	63.1	66.2	68.9	70.2	70.6	70.9	69.7	68.5	66.7	63.6	60.4	57.6	55.6	54.2	53.0	52.0	59.8
JUN	57.6	56.9	56.1	55.8	59.9	61.6	64.6	68.2	71.1	73.6	75.4	76.4	77.6	77.8	77.2	76.6	75.2	73.2	69.9	66.1	63.8	62.0	60.6	59.6	67.3
JUL	59.0	58.4	57.8	57.4	61.2	62.0	64.7	68.2	71.2	73.6	75.0	76.6	78.0	78.4	78.0	76.5	74.4	71.9	68.6	65.1	62.9	61.3	60.1	59.1	67.5
AUG	59.0	58.0	57.2	56.4	58.2	61.6	63.8	67.7	71.8	75.1	77.8	79.8	80.9	81.0	79.9	78.2	76.5	73.5	69.6	66.7	65.1	63.6	62.1	60.9	68.5
SEP	58.2	57.2	56.5	55.8	55.2	59.4	61.2	65.0	68.7	72.4	74.7	76.5	77.6	77.8	77.1	75.4	72.8	68.6	65.5	63.7	62.3	61.0	59.7	58.8	65.9
OCT	55.2	54.4	53.7	53.5	52.4	53.9	58.1	59.4	61.5	65.6	67.6	68.4	69.4	69.4	68.4	66.5	62.9	60.2	58.5	57.7	57.5	56.4	55.6	55.4	60.2
NOV	39.8	39.6	39.4	39.3	39.3	39.4	40.3	42.6	44.1	45.8	47.0	48.2	47.9	47.1	45.8	43.8	42.0	41.4	41.0	40.6	40.3	40.1	39.7	39.5	42.2
DEC	29.5	29.6	29.3	29.3	29.1	29.1	28.8	31.8	32.6	34.0	35.5	36.3	36.3	35.3	33.1	31.4	30.4	30.0	30.2	30.2	30.0	29.8	29.3	29.3	31.3
AUG																									
TMP	46.5	45.9	45.4	45.1	45.9	47.3	49.1	52.0	54.5	57.0	58.9	60.2	60.8	60.6	59.5	58.0	56.1	54.1	52.1	50.5	49.4	48.6	47.7	47.1	52.2

STATION - KITTITAS TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1987	31.1	38.3	44.7	53.6	59.8	67.3	67.5	68.5	65.9	60.2	42.2	31.3	8351	52.20	16.73
# OBS	744	672	744	719	725	716	744	719	715	389	720	744			
AUG	31.1	38.3	44.7	53.6	59.8	67.3	67.5	68.5	65.9	60.2	42.2	31.3	8351	52.20	16.73
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - KITTITAS PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1987	27.6	27.6	27.5	27.5	27.5	27.6	27.5	27.6	27.6	27.7	27.6	27.5	8356	27.56	0.16
# OBS	744	673	744	719	725	720	744	719	715	389	720	744			
AUG	27.6	27.6	27.5	27.5	27.5	27.6	27.5	27.6	27.6	27.7	27.6	27.5	8356	27.56	0.16
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

APPENDIX H

**PEQUOP SUMMIT
SUMMARY STATISTICS
APRIL 1976 - MAY 1988**

STATION - PEQUOP SUMMIT
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 4/1976 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1976	0.0	0.0	0.0	10.1	14.9	18.8	13.3	12.5	11.2	13.5	14.5	13.6	5126	14.09	8.85
# OBS	0	0	0	74	718	710	205	576	718	663	720	742			
1977	17.9	19.0	23.0	15.2	14.6	13.8	13.8	16.4	9.8	0.0	0.0	0.0	5318	16.41	10.08
# OBS	741	631	738	719	743	720	493	182	351	0	0	0			
1978	15.0	15.1	13.2	15.9	17.0	14.6	11.7	13.0	12.6	11.1	12.5	22.0	7690	14.03	8.63
# OBS	561	672	744	717	404	718	741	743	576	730	719	365			
1979	14.3	16.9	12.1	16.6	13.4	14.2	0.0	0.0	0.0	16.7	17.2	15.5	5400	15.14	9.85
# OBS	744	519	560	720	743	478	0	0	0	184	717	735			
1980	19.3	15.4	20.6	14.6	12.4	13.9	13.1	14.6	13.1	13.2	14.9	14.5	8206	15.01	9.42
# OBS	743	694	743	546	738	719	744	734	720	744	715	366			
1981	12.3	17.0	21.9	15.9	16.7	18.3	14.5	12.1	11.8	14.6	14.4	20.4	8330	15.57	10.15
# OBS	700	666	369	720	743	720	744	743	719	743	720	743			
1982	25.2	16.2	0.0	0.0	0.0	16.9	12.6	12.8	13.5	0.0	22.5	22.0	3689	15.98	10.71
# OBS	158	513	0	0	0	157	740	742	607	0	34	738			
1983	28.3	18.5	21.5	24.7	19.8	13.0	18.1	11.1	13.9	11.3	17.6	23.9	6676	17.35	11.43
# OBS	258	636	732	155	710	273	733	742	720	666	720	331			
1984	20.2	20.0	18.0	20.4	18.2	17.4	10.6	13.2	13.8	14.5	15.8	19.6	5714	16.23	11.21
# OBS	149	448	155	529	690	434	640	422	719	552	613	363			
1985	14.6	17.9	18.8	18.0	16.8	14.1	12.1	14.5	14.8	15.1	20.2	16.6	7830	16.27	10.59
# OBS	737	605	718	701	663	505	565	452	709	721	715	739			
1986	13.9	21.3	16.0	18.9	16.2	11.7	12.7	9.7	9.0	0.0	0.0	0.0	5993	14.70	10.41
# OBS	739	653	742	711	739	710	703	719	277	0	0	0			
1987	0.0	0.0	0.0	0.0	0.0	14.0	14.6	13.5	11.6	10.9	0.0	19.5	3623	13.96	10.30
# OBS	0	0	0	0	0	356	693	694	702	576	0	602			
1988	17.3	16.0	20.8	16.6	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3118	17.35	12.90
# OBS	596	672	386	720	744	0	0	0	0	0	0	0			
AVG	16.5	17.5	18.5	17.0	16.1	15.1	13.4	12.7	12.6	13.2	15.9	18.4	76713	15.51	10.31
SD	5.0	2.0	3.7	3.7	2.2	2.2	2.0	1.8	1.8	2.0	3.1	3.5			

STATION - PEQUOP SUMMIT

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 80.3%

MONTH	MEAN POWER (W/M**2)	NORMALIZED			MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12		
JAN	1325.3	567467	343	253	0	57.6
FEB	1122.0	452184	364	308	0	54.2
MAR	1435.7	686295	248	135	3	64.2
APR	960.2	394914	398	320	2	55.3
MAY	937.0	436661	466	276	2	62.6
JUN	650.8	111293	171	182	3	48.0
JUL	556.5	231792	388	305	0	56.0
AUG	541.1	197819	341	353	0	49.1
SEP	461.0	137288	281	421	0	40.0
OCT	515.2	136430	205	371	0	35.6
NOV	0.0	0	0	0	0	0.0
DEC	1149.2	538260	379	217	6	63.0
PERIOD						
TOTAL	477.7	4010964	3584	3141	16	53.2

STATION - PEQUOP SUMMIT
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 4/1976 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	17.1	16.7	16.4	16.8	16.5	16.8	16.3	16.0	15.9	16.6	17.1	17.4	17.5	17.4	17.2	17.0	16.7	16.4	16.8	16.5	16.5	16.6	16.9		16.8
FEB	17.2	17.1	17.0	17.2	17.2	17.0	16.6	16.7	17.3	17.6	18.5	19.6	20.0	19.8	19.2	19.2	18.6	18.2	18.3	17.0	17.0	17.1	17.1	16.9	17.8
MAR	17.6	17.5	17.3	17.2	17.1	17.0	17.4	18.0	18.6	19.3	20.7	20.9	21.1	21.4	21.4	20.8	19.8	18.8	18.3	18.4	18.1	17.7	17.7	17.7	18.7
APR	16.1	15.4	15.0	15.0	14.6	14.2	14.7	16.1	17.2	17.9	18.7	19.5	19.7	20.4	20.6	20.6	19.8	18.4	17.5	17.4	17.0	16.8	16.7	16.2	17.3
MAY	14.7	14.4	14.1	14.2	14.0	13.7	14.5	15.7	16.7	17.7	18.0	18.5	19.3	19.4	19.4	19.3	19.4	18.3	16.6	15.9	15.5	15.2	14.6	14.5	16.4
JUN	14.0	14.1	13.7	12.9	12.3	11.6	11.6	12.6	13.6	14.4	15.4	15.8	16.4	17.1	18.3	19.0	19.2	18.5	17.6	16.2	15.7	15.4	15.1	14.5	15.2
JUL	12.3	11.7	10.9	10.4	9.8	9.5	9.0	10.0	11.4	12.7	13.9	14.8	15.9	17.3	18.2	18.3	18.2	17.5	16.5	15.5	15.0	14.1	13.5	12.8	13.8
AUG	11.4	11.0	10.9	10.5	10.1	9.3	9.4	9.9	11.2	13.0	14.1	15.1	16.1	16.5	17.2	17.4	16.9	15.6	14.4	13.6	12.9	12.5	11.7	11.2	13.0
SEP	11.3	10.9	10.4	10.4	10.5	10.5	10.4	11.1	11.9	12.9	13.9	14.8	15.5	16.1	16.7	16.6	16.2	14.5	13.6	13.1	12.6	12.0	11.6	10.9	12.8
OCT	12.1	12.1	11.9	12.4	12.4	12.0	11.3	11.6	12.6	13.3	14.0	15.1	15.6	15.7	16.3	16.1	14.8	14.1	13.8	13.6	13.0	12.8	12.3	12.0	13.4
NOV	15.1	14.9	14.9	15.1	15.3	15.4	15.6	15.6	16.2	16.5	16.9	17.4	17.5	17.4	17.3	16.5	16.0	15.4	15.0	15.2	15.8	16.1	15.5	15.6	15.9
DEC	18.4	18.3	18.1	18.6	18.5	18.4	17.7	17.5	17.7	17.9	18.5	19.7	19.9	19.8	19.5	19.7	19.2	19.4	19.1	19.7	19.1	18.6	18.3	18.4	18.9
AUG																									
SPD	14.7	14.4	14.1	14.1	13.9	13.7	13.6	14.2	15.0	15.8	16.6	17.3	17.9	18.2	18.5	18.4	18.0	17.2	16.4	16.0	15.6	15.3	15.0	14.7	15.8

STATION - PEQUOP SUMMIT
WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 4/1976 - 5/1988
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 15.5 MPH
NORMALIZED AVAILABLE ENERGY: 3773.1 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 76713

SPD	HOURS/				NORMALIZED	SPD	HOURS/				NORMALIZED
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	AVAIL. ENERGY KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	AVAIL. ENERGY KWH/M**2/YEAR
0	486	0.63	76713	100.00	0.0	46	146	0.19	986	1.29	70.6
1	969	1.26	76227	99.37	0.0	47	119	0.16	840	1.09	61.4
2	1439	1.88	75258	98.10	0.1	48	97	0.13	721	0.94	53.3
3	1964	2.56	73819	96.23	0.3	49	101	0.13	624	0.81	59.0
4	2617	3.41	71855	93.67	0.8	50	69	0.09	523	0.68	42.8
5	3057	3.98	69238	90.26	1.9	51	71	0.09	454	0.59	46.8
6	3574	4.66	66181	86.27	3.8	52	56	0.07	383	0.50	39.1
7	3805	4.96	62607	81.61	6.5	53	65	0.08	327	0.43	48.1
8	3862	5.03	58802	76.65	9.8	54	34	0.04	262	0.34	26.6
9	3994	5.21	54940	71.62	14.5	55	41	0.05	228	0.30	33.9
10	3766	4.91	50946	66.41	18.7	56	21	0.03	187	0.24	18.3
11	3455	4.50	47180	61.50	22.8	57	34	0.04	166	0.22	31.3
12	3293	4.29	43725	57.00	28.3	58	24	0.03	132	0.17	23.3
13	3144	4.10	40432	52.71	34.3	59	18	0.02	108	0.14	18.4
14	2881	3.76	37288	48.61	39.3	60	24	0.03	90	0.12	25.7
15	2868	3.74	34407	44.85	48.1	61	17	0.02	66	0.09	19.2
16	2641	3.44	31539	41.11	53.7	62	11	0.01	49	0.06	13.0
17	2394	3.12	28898	37.67	58.4	63	8	0.01	38	0.05	9.9
18	2360	3.08	26504	34.55	68.4	64	6	0.01	30	0.04	7.8
19	2178	2.84	24144	31.47	74.2	65	3	0.00	24	0.03	4.1
20	1898	2.47	21966	28.63	75.4	66	3	0.00	21	0.03	4.3
21	1793	2.34	20068	26.16	82.5	67	4	0.01	18	0.02	6.0
22	1654	2.16	18275	23.82	87.5	68	3	0.00	14	0.02	4.7
23	1525	1.99	16621	21.67	92.1	69	2	0.00	11	0.01	3.3
24	1383	1.80	15096	19.68	94.9	70	0	0.00	9	0.01	0.0
25	1318	1.72	13713	17.88	102.3	71	2	0.00	9	0.01	3.6
26	1189	1.55	12395	16.16	103.8	72	1	0.00	7	0.01	1.9
27	1068	1.39	11206	14.61	104.4	73	2	0.00	6	0.01	3.9
28	1015	1.32	10138	13.22	110.7	74	0	0.00	4	0.01	0.0
29	944	1.23	9123	11.89	114.3	75	1	0.00	4	0.01	2.1
30	853	1.11	8179	10.66	114.4	76	1	0.00	3	0.00	2.2
31	848	1.11	7326	9.55	125.5	77	2	0.00	2	0.00	4.5
32	759	0.99	6478	8.44	123.5						
33	656	0.86	5719	7.46	117.1						
34	593	0.77	5063	6.60	115.7						
35	543	0.71	4470	5.83	115.6						
36	447	0.58	3927	5.12	103.6						
37	418	0.54	3480	4.54	105.1						
38	391	0.51	3062	3.99	106.6						
39	341	0.44	2671	3.48	100.5						
40	291	0.38	2330	3.04	92.5						
41	256	0.33	2039	2.66	87.6						
42	217	0.28	1783	2.32	79.8						
43	199	0.26	1566	2.04	78.6						
44	195	0.25	1367	1.78	82.5						
45	186	0.24	1172	1.53	84.2						

DATA PERIOD OF RECORD - 1/1987 - 12/1987

[illegible]

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987 # OBS	23.5 744	23.5 672	23.6 370	23.7 395	23.7 320	23.7 358	23.7 704	23.8 689	23.8 701	23.9 577	0.0 0	23.5 601	6131	23.68	1.14
AVG SD	23.5 0.0	23.5 0.0	23.6 0.0	23.7 0.0	23.7 0.0	23.7 0.0	23.7 0.0	23.8 0.0	23.8 0.0	23.9 0.0	0.0 0.0	23.5 0.0	6131	23.68	1.14

STATION - PEQUOP SUMMIT TEMPERATURE (deg f)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG TMP
JAN	22.0	22.8	22.2	22.2	21.2	21.1	20.1	22.0	22.8	25.4	26.6	29.3	29.8	28.9	28.9	28.3	24.3	24.0	24.8	24.4	22.8	23.2	22.5	22.4	24.2
FEB	23.8	24.1	22.9	22.9	23.5	23.5	23.6	24.9	27.6	29.5	31.2	33.6	34.7	35.5	34.5	34.3	30.6	26.9	25.1	25.4	24.9	24.2	24.8	24.1	27.3
MAR	32.8	32.4	31.6	31.1	30.6	30.5	31.5	33.1	34.9	36.2	38.5	40.0	40.0	40.0	41.2	42.0	40.3	34.2	33.3	34.1	32.7	32.2	33.5	33.5	34.9
APR	44.4	43.8	43.4	43.3	43.4	47.0	48.8	52.0	56.1	57.9	59.3	60.9	59.4	61.6	62.9	61.3	60.1	55.9	49.4	47.8	47.0	45.6	44.8	44.4	51.7
MAY	46.8	46.1	44.8	44.9	46.0	48.1	50.9	55.4	57.2	59.6	62.3	62.8	63.5	61.3	62.3	63.6	62.6	58.4	52.6	50.8	49.6	47.9	48.9	48.4	53.4
JUN	51.7	50.4	50.4	48.0	50.8	51.9	52.2	58.1	60.6	66.6	68.7	70.9	71.9	73.7	69.1	70.9	67.4	63.1	60.8	56.9	51.7	53.2	51.8	53.2	59.1
JUL	55.0	54.0	53.5	53.2	54.2	55.5	57.6	61.3	64.4	68.0	69.5	71.4	71.4	71.7	72.4	74.2	72.4	64.2	58.5	53.9	57.8	55.1	53.7	55.5	62.1
AUG	52.8	55.4	54.6	54.1	52.6	53.2	59.3	59.2	65.0	66.6	69.4	70.0	72.1	73.3	73.4	74.0	72.9	66.5	56.5	52.6	54.5	54.0	54.6	54.2	61.5
SEP	52.1	51.5	51.7	50.9	50.0	51.9	51.6	57.0	60.9	63.5	66.7	67.9	70.4	71.9	74.1	74.4	70.0	61.4	54.9	55.2	51.7	54.1	53.1	52.8	59.1
OCT	46.5	46.8	44.9	45.3	44.4	43.3	47.1	48.0	50.3	51.5	55.2	55.4	59.8	62.4	63.2	61.9	49.9	48.6	47.2	47.4	45.8	45.9	47.1	45.1	50.1
NOV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEC	19.8	18.8	20.3	19.1	18.6	16.7	16.5	18.6	18.8	19.8	22.8	23.6	24.9	24.6	25.0	23.2	19.5	18.6	20.4	18.9	18.6	18.7	18.1	20.2	20.2
AUG																									
TMP	40.0	40.0	39.5	38.8	38.7	39.3	40.8	43.7	46.4	48.7	50.8	52.3	53.9	54.3	54.3	54.6	50.9	46.6	43.1	41.4	40.7	40.5	40.3	40.5	45.0

STATION - PEQUOP SUMMIT TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	24.2	27.3	34.9	51.7	53.4	59.1	62.1	61.5	59.1	50.1	0.0	20.2	5903	45.02	19.77
# OBS	687	656	366	381	284	342	638	679	697	571	0	602			
AVG	24.2	27.3	34.9	51.7	53.4	59.1	62.1	61.5	59.1	50.1	0.0	20.2	5903	45.02	19.77
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - PEQUOP SUMMIT PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	23.5	23.5	23.6	23.7	23.7	23.7	23.7	23.8	23.8	23.9	0.0	23.5	6131	23.68	1.14
# OBS	744	672	370	395	320	358	704	689	701	577	0	601			
AVG	23.5	23.5	23.6	23.7	23.7	23.7	23.7	23.8	23.8	23.9	0.0	23.5	6131	23.68	1.14
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

APPENDIX I

**PEQUOP TOWER 50 AND 150 FT LEVEL
SUMMARY STATISTICS
JUNE 1982 - MAY 1988**

STATION - PEDUOP TOWER 50'
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 6/1982 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1982	0.0	0.0	0.0	0.0	0.0	13.0	12.5	12.8	11.8	0.0	0.0	0.0	951	12.48	5.85
# OBS	0	0	0	0	0	152	470	141	188	0	0	0			
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5	16.5	12.5	17.0	0.0	1385	15.20	8.26
# OBS	0	0	0	0	0	0	0	11	516	497	361	0			
1984	0.0	0.0	0.0	0.0	16.9	15.4	11.7	13.1	15.6	15.8	22.0	0.0	4119	14.88	8.31
# OBS	0	0	0	0	469	691	743	707	661	670	178	0			
1985	0.0	0.0	0.0	0.0	15.8	14.1	11.9	16.4	15.2	15.8	21.0	15.1	4105	15.87	9.37
# OBS	0	0	0	0	139	140	517	738	635	602	598	736			
1986	15.5	23.0	16.1	16.6	11.5	15.3	15.5	13.1	10.7	13.5	20.1	10.1	7280	15.51	9.98
# OBS	719	668	609	518	274	701	744	742	174	668	720	743			
1987	16.6	11.0	16.7	15.6	10.9	13.2	15.6	14.2	12.3	12.0	14.6	23.8	7634	14.71	9.05
# OBS	623	298	612	720	576	658	735	744	715	738	691	524			
1988	25.1	11.7	30.0	21.8	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2713	23.72	13.34
# OBS	333	197	735	717	731	0	0	0	0	0	0	0			
AVG	17.8	18.0	21.5	18.1	16.3	14.5	13.6	14.1	14.3	13.9	18.5	15.5	28187	15.92	9.96
SD	5.2	6.8	7.8	3.3	4.5	1.1	1.9	2.0	2.4	1.8	3.1	6.9			

STATION - PEQUOD TOWER 150'
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 6/1982 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1982	0.0	0.0	0.0	0.0	0.0	14.1	13.7	14.2	13.0	0.0	0.0	0.0	951	13.71	6.46
# OBS	0	0	0	0	0	152	470	141	188	0	0	0			
1983	0.0	14.2	16.0	10.0	0.0	0.0	0.0	19.3	17.5	13.5	20.1	23.3	2634	17.74	9.55
# OBS	0	73	527	23	0	0	0	8	516	497	602	388			
1984	18.1	20.9	21.3	25.2	19.0	16.6	12.7	14.4	16.9	16.5	23.7	0.0	5627	17.52	10.05
# OBS	389	11	458	440	713	685	742	705	655	651	178	0			
1985	0.0	0.0	0.0	0.0	17.4	17.0	13.3	16.0	14.7	13.3	18.8	15.0	4303	15.45	8.94
# OBS	0	0	0	0	310	142	559	730	633	597	595	737			
1986	0.0	0.0	0.0	0.0	11.9	15.7	15.8	13.5	11.0	15.4	22.1	12.2	4754	15.37	8.85
# OBS	0	0	0	0	265	699	744	742	173	668	720	743			
1987	19.0	12.9	18.2	17.2	12.3	14.2	16.2	14.8	12.6	12.6	14.8	26.0	7331	15.41	8.98
# OBS	623	298	612	720	576	659	735	744	714	733	691	226			
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.00	0.00
# OBS	0	0	0	0	0	0	0	0	0	0	0	0			
AUG	18.7	13.4	18.4	20.0	15.7	15.5	14.5	14.6	14.9	14.3	19.2	16.8	25600	16.05	9.24
SD	0.6	4.3	2.6	7.6	3.6	1.3	1.6	2.1	2.5	1.6	3.4	6.5			

STATION - PEQUOP TOWER 50*

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 86.4%

MONTH	MEAN POWER (W/M**2)	NORMALIZED TOTAL ENERGY (KWH/M**2)	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
JAN	1386.5	823390	266	58	9	27.5	79.9
FEB	431.7	154890	95	102	0	20.2	48.2
MAR	1819.6	1217487	661	52	22	30.6	89.9
APR	966.3	584594	583	127	7	24.1	81.3
MAY	1066.0	642313	592	138	1	25.0	81.0
JUN	527.2	167116	317	341	0	19.3	48.2
JUL	431.0	205504	471	264	0	19.9	64.1
AUG	370.0	160937	435	309	0	18.7	58.5
SEP	300.3	102197	327	388	0	17.5	45.7
OCT	364.5	112814	307	431	0	17.9	41.6
NOV	502.8	214942	397	294	0	19.6	57.5
DEC	1124.3	700774	439	76	7	25.9	83.8
PERIOD							
TOTAL	564.2	4907138	4890	2582	46	23.0	65.0

STATION - PEGUOP TOWER
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 6/1982 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG SPD
JAN	18.0	18.0	18.0	17.4	17.4	16.9	17.3	17.4	18.0	17.7	18.3	18.7	18.9	19.1	19.1	18.4	18.8	16.4	16.5	15.9	17.2	17.3	18.8	18.2	17.8
FEB	18.8	18.7	19.0	17.9	18.0	18.6	17.9	18.0	18.4	18.8	18.7	18.8	19.2	18.5	17.9	18.2	17.1	16.8	17.0	16.7	17.1	17.5	17.5	17.9	18.0
MAR	20.1	21.2	21.3	21.8	21.8	21.1	21.0	21.3	21.3	21.7	22.4	23.2	23.0	23.6	23.7	22.6	22.1	21.1	19.8	20.2	20.4	19.9	20.5	20.4	21.5
APR	16.8	15.8	15.7	15.9	15.4	14.3	14.6	16.7	17.7	18.5	19.8	21.0	20.5	20.7	21.8	22.3	21.3	19.0	18.5	19.0	17.6	17.4	17.7	17.1	18.1
MAY	14.3	14.0	13.9	13.4	13.4	12.9	13.8	15.7	16.5	16.4	17.3	18.0	19.1	19.4	20.4	19.8	20.0	18.5	16.9	16.4	15.8	15.3	14.7	14.7	16.3
JUN	13.9	13.4	13.5	12.6	11.9	11.1	11.4	11.8	12.1	12.7	14.7	16.1	16.9	17.3	16.7	16.6	17.4	16.4	15.8	15.5	15.7	15.5	15.2	14.1	14.5
JUL	12.0	11.5	11.2	10.3	9.8	9.0	9.0	10.1	11.5	13.1	13.6	14.8	15.5	16.7	18.1	18.0	17.7	17.7	16.8	15.6	14.7	13.9	13.4	12.4	13.6
AUG	12.7	11.9	11.9	11.3	10.8	10.3	10.2	11.0	12.2	13.3	14.6	15.8	17.2	17.7	18.1	18.2	17.3	17.3	16.3	15.6	14.8	14.5	13.5	12.8	14.1
SEP	13.4	13.1	12.4	12.1	12.4	11.9	11.4	12.1	12.8	13.4	14.5	15.7	16.8	16.9	17.6	18.1	17.3	15.6	15.2	15.1	14.7	14.6	13.8	13.2	14.3
OCT	12.8	12.9	13.2	12.9	13.1	13.1	12.1	12.1	13.5	14.3	14.9	15.2	16.1	16.2	16.0	15.7	14.3	13.8	13.8	13.6	13.7	13.4	13.7	13.3	13.9
NOV	17.9	18.3	18.4	18.3	18.4	18.9	18.9	18.4	18.4	18.5	19.8	20.0	20.1	19.2	18.9	19.2	17.7	16.7	17.0	18.0	18.3	18.1	18.1	17.9	18.5
DEC	15.6	16.5	15.7	16.0	15.6	14.8	14.9	14.7	15.1	14.6	15.0	15.6	15.8	15.1	14.7	14.7	15.3	15.8	16.4	16.6	15.7	15.5	16.3	16.3	15.5
AVG																									
SPD	15.0	14.8	14.7	14.4	14.2	13.8	13.7	14.3	15.1	15.6	16.5	17.4	18.0	18.1	18.4	18.3	17.8	17.0	16.5	16.3	16.0	15.7	15.6	15.1	15.9

STATION - PEDUOP TOWER 50'
WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 6/1982 - 5/1988
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 15.9 MPH
NORMALIZED AVAILABLE ENERGY: 3852.2 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 28187

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUM HRS	CUM REL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUM HRS	CUM REL FREQ	KWH/M**2/YEAR
0	199	0.71	28187	100.00	0.0	46	60	0.21	419	1.49	79.2
1	351	1.25	27988	99.29	0.0	47	39	0.14	359	1.27	54.9
2	358	1.27	27637	98.05	0.0	48	45	0.16	320	1.14	67.5
3	479	1.70	27279	96.78	0.2	49	35	0.12	275	0.98	55.8
4	607	2.15	26800	95.08	0.5	50	34	0.12	240	0.85	57.6
5	807	2.86	26193	92.93	1.4	51	27	0.10	206	0.73	48.6
6	1034	3.67	25386	90.06	3.0	52	23	0.08	179	0.64	43.8
7	1158	4.11	24352	86.39	5.4	53	18	0.06	156	0.55	36.3
8	1327	4.71	23194	82.29	9.2	54	20	0.07	138	0.49	42.7
9	1421	5.04	21867	77.58	14.0	55	15	0.05	118	0.42	33.8
10	1453	5.15	20446	72.54	19.7	56	12	0.04	103	0.37	28.6
11	1528	5.42	18993	67.38	27.6	57	16	0.06	91	0.32	40.2
12	1481	5.25	17465	61.96	34.7	58	7	0.02	75	0.27	18.5
13	1376	4.88	15984	56.71	41.0	59	8	0.03	68	0.24	22.3
14	1350	4.79	14608	51.83	50.2	60	7	0.02	60	0.21	20.5
15	1272	4.51	13258	47.04	58.2	61	9	0.03	53	0.19	27.7
16	1157	4.10	11986	42.52	64.2	62	4	0.01	44	0.16	12.9
17	1076	3.82	10829	38.42	71.7	63	9	0.03	40	0.14	30.5
18	987	3.50	9753	34.60	78.0	64	4	0.01	31	0.11	14.2
19	862	3.06	8766	31.10	80.2	65	2	0.01	27	0.10	7.4
20	823	2.92	7904	28.04	89.3	66	4	0.01	25	0.09	15.6
21	700	2.48	7081	25.12	87.9	67	3	0.01	21	0.07	12.2
22	598	2.12	6381	22.64	86.3	68	2	0.01	18	0.06	8.5
23	568	2.02	5783	20.52	93.7	69	2	0.01	16	0.06	8.9
24	517	1.83	5215	18.50	96.9	70	1	0.00	14	0.05	4.7
25	493	1.75	4698	16.67	104.4	71	3	0.01	13	0.05	14.6
26	466	1.65	4205	14.92	111.0	72	2	0.01	10	0.04	10.1
27	377	1.34	3739	13.26	100.6	73	0	0.00	8	0.03	0.0
28	333	1.18	3362	11.93	99.1	74	1	0.00	8	0.03	5.5
29	338	1.20	3029	10.75	111.8	75	1	0.00	7	0.02	5.7
30	301	1.07	2691	9.55	110.2	76	1	0.00	6	0.02	6.0
31	252	0.89	2390	8.48	101.8	77	0	0.00	5	0.02	0.0
32	214	0.76	2138	7.59	95.1	78	2	0.01	5	0.02	12.9
33	188	0.67	1924	6.83	91.6	79	1	0.00	3	0.01	6.7
34	161	0.57	1736	6.16	85.8	80	0	0.00	2	0.01	0.0
35	154	0.55	1575	5.59	89.5	81	0	0.00	2	0.01	0.0
36	134	0.48	1421	5.04	84.8	82	0	0.00	2	0.01	0.0
37	137	0.49	1287	4.57	94.1	83	0	0.00	2	0.01	0.0
38	125	0.44	1150	4.08	93.0	84	0	0.00	2	0.01	0.0
39	110	0.39	1025	3.64	88.5	85	2	0.01	2	0.01	16.7
40	110	0.39	915	3.25	95.4						
41	93	0.33	805	2.86	86.9						
42	89	0.32	712	2.53	89.4						
43	75	0.27	623	2.21	80.8						
44	64	0.23	548	1.94	73.9						
45	65	0.23	484	1.72	80.3						

STATION - PEQUOP TOWER 150'

WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY

DATA PERIOD OF RECORD - 6/1982 - 5/1988

NORMALIZATION PERIOD - ONE YEAR

AVERAGE WIND SPEED FOR PERIOD: 16.1 MPH

NORMALIZED AVAILABLE ENERGY: 3452.6 KWH/M**2/YEAR

TOTAL HOURS OBSERVED: 25600

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUM HRS	CUM REL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUM HRS	CUM REL FREQ	KWH/M**2/YEAR
0	62	0.24	25600	100.00	0.0	46	33	0.13	200	0.78	47.9
1	334	1.30	25538	99.76	0.0	47	43	0.17	167	0.65	66.6
2	386	1.51	25204	98.45	0.0	48	17	0.07	124	0.48	28.1
3	417	1.63	24818	96.95	0.2	49	20	0.08	107	0.42	35.1
4	551	2.15	24401	95.32	0.5	50	17	0.07	87	0.34	31.7
5	655	2.56	23850	93.16	1.2	51	14	0.05	70	0.27	27.7
6	861	3.36	23195	90.61	2.8	52	12	0.05	56	0.22	25.2
7	931	3.64	22334	87.24	4.8	53	7	0.03	44	0.17	15.6
8	1096	4.28	21403	83.61	8.4	54	5	0.02	37	0.14	11.8
9	1114	4.35	20307	79.32	12.1	55	9	0.04	32	0.13	22.4
10	1256	4.91	19193	74.97	18.7	56	7	0.03	23	0.09	18.3
11	1281	5.00	17937	70.07	25.5	57	3	0.01	16	0.06	8.3
12	1305	5.10	16656	65.06	33.7	58	4	0.02	13	0.05	11.6
13	1253	4.89	15351	59.96	41.1	59	2	0.01	9	0.04	6.1
14	1289	5.04	14098	55.07	52.8	60	0	0.00	7	0.03	0.0
15	1239	4.84	12809	50.04	62.4	61	0	0.00	7	0.03	0.0
16	1111	4.34	11570	45.20	67.9	62	1	0.00	7	0.03	3.6
17	1087	4.25	10459	40.86	79.7	63	1	0.00	6	0.02	3.7
18	976	3.81	9372	36.61	85.0	64	0	0.00	5	0.02	0.0
19	828	3.23	8396	32.80	84.8	65	0	0.00	5	0.02	0.0
20	859	3.36	7568	29.56	102.6	66	0	0.00	5	0.02	0.0
21	719	2.81	6709	26.21	99.4	67	2	0.01	5	0.02	9.0
22	638	2.49	5990	23.40	101.4	68	0	0.00	3	0.01	0.0
23	586	2.29	5352	20.91	106.4	69	1	0.00	3	0.01	4.9
24	520	2.03	4766	18.62	107.3	70	0	0.00	2	0.01	0.0
25	512	2.00	4246	16.59	119.4	71	0	0.00	2	0.01	0.0
26	442	1.73	3734	14.59	116.0	72	0	0.00	2	0.01	0.0
27	371	1.45	3292	12.86	109.0	73	1	0.00	2	0.01	5.8
28	364	1.42	2921	11.41	119.3	74	0	0.00	1	0.00	0.0
29	297	1.16	2557	9.99	108.1	75	0	0.00	1	0.00	0.0
30	291	1.14	2260	8.83	117.3	76	1	0.00	1	0.00	6.6
31	227	0.89	1969	7.69	100.9						
32	231	0.90	1742	6.80	113.0						
33	190	0.74	1511	5.90	101.9						
34	147	0.57	1321	5.16	86.2						
35	143	0.56	1174	4.59	91.5						
36	126	0.49	1031	4.03	87.8						
37	112	0.44	905	3.54	84.7						
38	113	0.44	793	3.10	92.6						
39	86	0.34	680	2.66	76.1						
40	89	0.35	594	2.32	85.0						
41	88	0.34	505	1.97	90.5						
42	65	0.25	417	1.63	71.9						
43	55	0.21	352	1.38	65.3						
44	52	0.20	297	1.16	66.1						
45	45	0.18	245	0.96	61.2						

APPENDIX J

**SEVEN MILE HILL 50 AND 150 FT LEVEL
SUMMARY STATISTICS
OCTOBER 1978 - MAY 1988**

STATION - SEVEN MILE HILL 50 FT
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 10/1978 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AUG	SD
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	9.9	14.8	1749	12.26	9.38
# OBS	0	0	0	0	0	0	0	0	0	295	713	741			
1979	8.7	11.6	13.2	18.2	21.4	21.8	23.0	21.6	15.7	13.1	10.8	13.0	7840	15.85	10.42
# OBS	642	519	739	695	719	201	743	742	717	737	717	669			
1980	0.0	0.0	19.2	15.2	22.9	21.4	21.8	22.6	17.0	12.1	9.0	7.3	7209	16.85	10.22
# OBS	0	0	634	719	744	720	742	744	717	737	712	740			
1981	11.2	9.5	14.5	15.8	20.0	19.8	20.8	19.8	14.3	11.9	8.6	11.3	8578	14.91	9.61
# OBS	741	526	739	719	744	719	743	736	714	742	718	737			
1982	15.2	11.3	13.2	14.1	21.5	20.0	20.6	19.5	14.2	10.0	9.0	11.7	8363	15.15	9.58
# OBS	697	661	516	713	743	716	732	744	718	743	679	701			
1983	10.7	8.5	11.2	15.1	21.9	20.9	20.6	22.2	0.0	0.0	0.0	0.0	5501	16.17	10.26
# OBS	735	664	742	718	739	720	743	440	0	0	0	0			
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.00	0.00
# OBS	0	0	0	0	0	0	0	0	0	0	0	0			
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	3.0	763	4.47	3.89
# OBS	0	0	0	0	0	0	0	0	0	0	545	218			
1986	0.0	0.0	0.0	16.7	17.9	19.8	21.1	18.2	13.6	8.1	10.5	6.4	5586	14.69	10.06
# OBS	0	0	0	476	744	720	369	715	720	744	720	378			
1987	8.4	8.9	12.1	15.3	17.5	17.6	21.3	16.8	15.3	10.8	8.8	8.7	8296	13.76	10.40
# OBS	306	672	744	720	744	720	734	744	721	744	709	738			
1988	8.0	11.4	13.9	16.3	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3589	12.99	10.56
# OBS	743	667	729	718	732	0	0	0	0	0	0	0			
AUG	10.6	10.2	13.8	15.8	19.8	20.0	21.3	20.0	15.0	11.0	9.1	10.4	57474	14.91	10.16
SD	2.7	1.1	2.6	1.3	2.6	1.4	0.9	2.1	1.2	1.7	1.8	3.9			

STATION - SEVEN MILE HILL 150FT
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 10/1978 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	11.7	16.7	2109	14.59	10.13
# OBS	0	0	0	0	0	0	0	0	0	654	714	741			
1979	10.3	9.6	14.5	23.7	22.5	24.2	24.8	23.2	17.3	14.6	14.3	14.5	6027	16.50	11.34
# OBS	646	652	728	266	468	200	658	107	715	650	251	686			
1980	11.1	10.3	20.8	17.5	26.6	24.8	24.9	26.2	19.9	13.7	10.2	8.3	8732	17.93	11.95
# OBS	721	693	743	720	742	720	742	740	717	741	714	739			
1981	13.2	10.7	17.2	18.4	23.4	22.5	24.0	22.7	16.5	13.6	10.1	13.1	8717	17.17	11.29
# OBS	740	666	742	720	743	718	741	735	718	735	719	740			
1982	17.7	12.9	14.9	16.7	24.7	23.0	24.1	22.6	16.5	12.2	10.6	12.3	8660	17.39	11.14
# OBS	712	661	741	701	742	717	730	740	716	737	720	743			
1983	11.2	9.0	11.3	14.7	23.5	24.8	24.2	24.3	20.4	14.4	13.2	10.4	8670	16.89	11.70
# OBS	741	655	710	715	741	720	743	744	717	743	720	721			
1984	13.7	11.7	13.7	19.8	18.9	22.1	23.0	26.2	18.4	14.8	12.7	14.0	8709	17.46	11.20
# OBS	740	692	741	718	730	719	744	743	715	743	699	725			
1985	9.6	15.2	15.1	20.1	23.7	24.0	24.1	22.9	16.8	16.7	13.3	7.8	8014	18.21	11.23
# OBS	603	666	744	686	741	711	742	742	720	741	699	219			
1986	0.0	0.0	0.0	0.0	18.1	21.1	22.4	19.7	14.5	8.7	11.3	6.7	4504	14.75	10.96
# OBS	0	0	0	0	28	718	370	721	720	744	720	483			
1987	7.8	9.0	12.7	15.9	18.2	18.4	22.1	17.4	16.0	12.8	11.3	11.2	8505	14.59	10.84
# OBS	517	672	744	720	744	718	734	744	721	744	709	738			
1988	10.2	13.6	15.6	18.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3589	14.88	10.67
# OBS	743	667	729	718	732	0	0	0	0	0	0	0			
AVG	11.8	11.3	15.1	17.9	22.0	22.6	23.8	22.8	17.4	13.6	11.7	12.0	76236	16.73	11.33
SD	2.9	2.2	2.7	2.6	3.3	2.1	1.0	2.9	1.9	2.2	1.4	3.2			

STATION - SEVEN MILE 50*

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 99.3%

MONTH	MEAN POWER (W/M**2)	NORMALIZED	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)					
JAN	729.1	127760	175	568	0	21.4	23.6
FEB	687.0	206127	269	398	0	21.4	40.3
MAR	764.6	296529	380	349	0	22.4	52.1
APR	886.5	389469	424	294	0	23.7	59.1
MAY	813.2	354583	429	303	0	22.7	58.6
JUN	730.1	372372	510	210	0	22.3	70.8
JUL	991.2	596767	594	140	0	24.8	80.9
AUG	970.4	421144	434	310	0	24.5	58.3
SEP	1044.3	406242	377	344	0	24.7	52.3
OCT	727.4	181113	249	495	0	22.5	33.5
NOV	696.9	130168	178	531	0	21.3	25.1
DEC	453.8	97897	214	524	0	18.9	29.0
PERIOD							
TOTAL	403.0	3530449	4233	4466	0	23.0	48.7

STATION - SEVENMILE HILL 150 FT
WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 5/1979 - 5/1988
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 16.9 MPH
NORMALIZED AVAILABLE ENERGY: 5482.5 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 71835

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR	MPH	PERIOD	REL FREQ	CUMHRS	CUMREL FREQ	KWH/M**2/YEAR
0	1472	2.05	71835	100.00	0.0	46	119	0.17	485	0.68	73.1
1	2147	2.99	70363	97.95	0.0	47	95	0.13	366	0.51	62.3
2	2370	3.30	68216	94.96	0.1	48	77	0.11	271	0.38	53.8
3	2470	3.44	65846	91.66	0.4	49	62	0.09	194	0.27	46.1
4	2571	3.58	63376	88.22	1.0	50	46	0.06	132	0.18	36.3
5	2597	3.62	60805	84.65	2.0	51	33	0.05	86	0.12	27.6
6	2641	3.68	58208	81.03	3.6	52	17	0.02	53	0.07	15.1
7	2556	3.56	55567	77.35	5.5	53	13	0.02	36	0.05	12.2
8	2454	3.42	53011	73.80	7.9	54	11	0.02	23	0.03	10.9
9	2520	3.51	50557	70.38	11.6	55	5	0.01	12	0.02	5.3
10	2424	3.37	48037	66.87	15.3	56	3	0.00	7	0.01	3.3
11	2200	3.06	45613	63.50	18.5	57	1	0.00	4	0.01	1.2
12	2128	2.96	43413	60.43	23.2	58	0	0.00	3	0.00	0.0
13	1963	2.73	41285	57.47	27.2	59	1	0.00	3	0.00	1.3
14	1953	2.72	39322	54.74	33.8	60	0	0.00	2	0.00	0.0
15	1777	2.47	37369	52.02	37.9	61	0	0.00	2	0.00	0.0
16	1807	2.52	35592	49.55	46.7	62	2	0.00	2	0.00	3.0
17	1761	2.45	33785	47.03	54.6						
18	1784	2.48	32024	44.58	65.7						
19	1773	2.47	30240	42.10	76.8						
20	1716	2.39	28467	39.63	86.7						
21	1753	2.44	26751	37.24	102.5						
22	1749	2.43	24998	34.80	117.6						
23	1679	2.34	23249	32.36	129.0						
24	1768	2.46	21570	30.03	154.3						
25	1659	2.31	19802	27.57	163.7						
26	1637	2.28	18143	25.26	181.6						
27	1628	2.27	16506	22.98	202.3						
28	1582	2.20	14878	20.71	219.3						
29	1575	2.19	13296	18.51	242.5						
30	1447	2.01	11721	16.32	246.7						
31	1357	1.89	10274	14.30	255.2						
32	1176	1.64	8917	12.41	243.3						
33	1131	1.57	7741	10.78	256.6						
34	1012	1.41	6610	9.20	251.1						
35	894	1.24	5598	7.79	242.0						
36	825	1.15	4704	6.55	243.0						
37	684	0.95	3879	5.40	218.7						
38	597	0.83	3195	4.45	206.8						
39	495	0.69	2598	3.62	185.4						
40	465	0.65	2103	2.93	187.9						
41	351	0.49	1638	2.28	152.7						
42	274	0.38	1287	1.79	128.2						
43	207	0.29	1013	1.41	103.9						
44	177	0.25	806	1.12	95.2						
45	144	0.20	629	0.88	82.8						

STATION - SEVEN MILE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG TMP
JAN	36.2	33.9	33.7	33.7	33.5	33.5	33.3	33.4	33.5	34.0	34.6	35.1	35.3	35.7	35.6	35.1	34.9	34.5	34.5	34.1	34.4	34.4	34.4	34.7	34.4
FEB	36.7	36.6	36.4	36.1	36.0	35.8	35.6	35.7	36.1	37.3	37.9	39.0	39.8	40.2	40.3	40.5	39.5	38.4	38.1	37.8	37.8	37.4	37.2	37.1	37.6
MAR	39.7	39.2	38.9	38.7	38.6	38.4	38.6	39.6	41.1	42.5	43.5	44.5	45.2	46.2	46.5	46.2	45.4	44.0	42.8	42.3	41.6	41.3	40.8	40.3	41.9
APR	45.5	44.6	43.9	43.5	43.1	43.0	44.0	45.6	47.3	49.1	50.9	52.3	53.3	54.1	54.7	54.6	53.9	52.8	50.8	49.8	48.6	47.7	46.9	46.1	48.6
MAY	50.2	48.8	48.2	47.7	47.6	48.3	49.7	51.5	53.7	55.5	57.2	59.0	60.9	61.5	61.8	61.3	60.4	59.6	57.4	55.3	54.0	53.2	52.1	51.3	54.4
JUN	56.5	55.3	54.2	53.5	53.0	53.7	55.2	57.2	59.5	62.2	64.4	66.5	68.9	70.5	71.8	72.5	72.0	70.6	68.1	64.9	62.1	61.5	59.8	58.6	62.2
JUL	57.6	56.6	55.6	55.1	54.5	54.8	56.1	58.0	59.9	62.0	63.7	65.3	67.0	68.4	68.7	69.1	68.5	66.9	65.0	62.7	61.1	60.1	59.1	57.9	61.3
AUG	60.8	59.4	58.5	57.4	56.8	57.0	58.1	60.4	63.3	66.2	69.4	71.6	73.8	75.4	76.8	77.0	76.5	74.8	71.9	69.1	67.3	65.7	64.3	62.8	66.4
SEP	57.9	56.8	56.0	55.3	54.6	54.2	55.0	57.1	59.9	62.6	65.3	67.9	70.1	71.3	72.3	73.0	71.0	68.1	65.2	63.3	62.0	60.7	59.5	58.7	62.4
OCT	51.6	50.9	50.3	49.5	48.7	48.1	48.5	50.0	52.7	55.6	58.2	60.4	62.6	64.1	64.4	63.6	61.1	58.4	56.6	55.3	54.4	53.5	52.9	52.2	55.2
NOV	40.7	40.5	40.3	40.1	40.0	39.7	39.6	40.0	40.8	41.9	43.3	44.0	44.8	45.3	45.2	44.4	42.8	42.1	41.5	41.1	40.8	40.6	40.4	40.3	41.7
DEC	32.2	32.1	32.1	32.1	32.1	31.9	31.7	31.7	32.0	32.6	33.4	33.9	34.1	33.9	34.0	33.8	33.3	33.1	32.8	32.7	32.4	32.3	32.1	32.1	32.7
AUG	47.5	46.6	46.0	45.6	45.2	45.2	45.8	47.1	48.8	50.6	52.4	53.8	55.2	56.2	56.6	56.6	55.7	54.2	52.7	51.2	50.2	49.5	48.7	48.1	50.4

STATION - SEVEN MILE HILL 150 FT

DIURNAL WIND SPEEDS (MPH)

DATA PERIOD OF RECORD - 10/1978 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	11.6	11.7	11.8	11.6	11.2	11.1	11.0	10.7	11.0	11.1	11.3	11.5	11.6	12.3	13.2	13.3	12.9	12.5	12.2	12.3	12.1	12.3	11.9	11.9	11.8
FEB	11.3	11.2	11.0	10.8	10.9	10.8	10.8	10.3	10.2	10.3	10.8	11.2	11.6	12.0	12.2	12.6	12.8	12.5	12.3	11.8	11.3	11.2	10.9	11.1	11.3
MAR	14.6	14.3	13.8	13.9	13.7	13.6	13.2	12.9	12.6	12.9	13.8	14.5	15.7	16.5	17.2	17.5	17.4	17.3	17.0	16.4	16.3	16.1	15.6	15.5	15.1
APR	17.9	18.1	17.7	17.2	16.9	16.2	15.3	14.5	14.8	15.4	16.3	17.3	18.4	19.1	20.3	20.8	20.6	20.1	20.0	19.0	18.5	18.4	18.4	18.0	17.9
MAY	23.1	22.6	22.1	21.5	20.7	19.6	18.7	18.1	18.4	18.6	18.9	19.8	21.2	22.2	23.3	24.5	25.3	25.2	24.9	24.9	24.2	23.9	23.5	23.6	22.0
JUN	24.0	23.6	23.0	22.6	21.8	20.3	19.0	17.9	17.7	18.3	18.8	20.0	21.3	22.8	24.4	25.4	26.2	26.4	26.3	25.7	25.0	24.6	24.3	24.0	22.6
JUL	25.6	25.2	24.5	23.9	23.3	22.2	20.4	19.1	18.7	18.9	19.3	19.9	21.1	22.5	24.5	25.8	27.1	28.1	27.9	28.0	27.0	26.3	26.1	25.7	23.8
AUG	24.0	23.7	23.6	23.3	23.0	22.0	20.5	18.8	18.2	18.1	18.5	19.3	20.3	21.7	23.1	24.7	25.6	26.4	27.0	26.2	25.4	24.6	24.4	23.8	22.8
SEP	17.2	16.8	16.5	16.3	15.9	15.3	14.7	13.9	13.4	13.8	15.0	16.2	17.4	18.7	19.5	20.2	21.0	21.3	21.0	20.2	19.4	18.3	17.8	17.1	17.4
OCT	13.7	13.5	13.2	13.2	12.7	12.3	11.6	10.9	10.5	10.7	11.6	12.5	13.2	14.1	14.9	15.5	16.1	16.4	16.2	15.6	15.3	15.3	14.7	14.0	13.6
NOV	11.5	11.5	11.2	11.1	11.0	10.8	10.8	10.5	10.6	11.2	11.5	11.8	12.5	12.8	13.0	12.9	12.8	12.6	12.3	12.0	11.7	11.6	11.5	11.5	11.7
DEC	11.3	11.3	11.2	11.4	11.5	12.0	11.8	12.1	11.9	11.7	11.9	12.2	12.6	12.7	12.9	12.5	12.3	12.2	12.2	12.4	12.1	11.9	11.4	11.2	12.0
AUG	17.0	16.8	16.5	16.3	15.9	15.4	14.7	14.1	13.9	14.2	14.7	15.4	16.3	17.2	18.1	18.7	19.1	19.1	19.0	18.6	18.1	17.8	17.4	17.1	16.7

STATION - SEVEN MILE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	34.4	37.6	41.9	48.6	54.4	62.2	61.3	66.4	62.4	55.2	41.7	32.7	8509	50.38	13.71
# OBS	520	672	744	720	744	720	734	744	720	744	709	738			
AVG	34.4	37.6	41.9	48.6	54.4	62.2	61.3	66.4	62.4	55.2	41.7	32.7	8509	50.38	13.71
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

STATION - SEVEN MILE HILL PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987	28.3	28.3	28.2	28.3	28.3	28.3	28.2	28.3	28.3	28.4	28.4	28.3	8516	28.30	0.35
# OBS	527	672	744	720	744	720	734	744	720	744	709	738			
AVG	28.3	28.3	28.2	28.3	28.3	28.3	28.2	28.3	28.3	28.4	28.4	28.3	8516	28.30	0.35
SD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

APPENDIX K
SPRING CREEK FISH HATCHERY
SUMMARY STATISTICS
MARCH 1981 - MAY 1988

STATION - SPRING CREEK FISH HATCHERY
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 3/1981 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1981	0.0	0.0	15.2	11.8	15.7	14.3	17.8	16.0	0.0	5.7	5.7	0.0	3905	14.15	9.44
# OBS	0	0	12	720	743	720	744	571	0	139	256	0			
1982	0.0	4.5	8.3	9.8	16.2	0.0	16.6	14.3	10.3	7.9	6.7	10.7	5778	10.39	7.56
# OBS	0	399	744	720	375	0	735	566	710	744	720	65			
1983	0.0	5.8	13.2	11.2	14.9	15.0	14.3	16.4	14.0	8.1	8.4	8.0	5580	11.86	8.01
# OBS	0	487	18	719	744	720	200	744	372	468	564	544			
1984	8.6	7.2	7.3	12.4	11.2	16.6	18.2	16.4	10.4	8.3	6.6	8.2	8110	11.01	7.78
# OBS	744	696	685	659	685	660	707	720	720	435	717	682			
1985	0.0	0.0	10.5	11.7	15.4	14.3	16.8	14.3	10.3	9.2	9.4	8.1	6799	12.11	8.34
# OBS	0	0	404	710	738	655	742	737	720	742	676	675			
1986	5.9	4.9	6.7	11.4	13.3	17.4	17.6	14.8	13.2	9.4	5.2	5.9	6043	9.58	8.24
# OBS	733	672	744	662	743	170	561	268	260	196	291	743			
1987	5.4	6.0	6.7	10.0	12.1	12.8	14.2	9.5	12.0	8.5	6.4	6.7	7079	9.21	7.78
# OBS	739	636	728	719	729	586	621	106	700	477	707	331			
1988	4.8	0.0	0.0	0.0	12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	662	9.97	7.00
# OBS	219	0	0	0	443	0	0	0	0	0	0	0			
AVG	6.4	5.8	7.7	11.2	13.9	14.8	16.8	15.3	11.3	8.3	7.2	7.5	43956	10.98	8.21
SD	1.7	1.0	3.4	1.0	1.9	1.7	1.6	2.4	1.6	1.2	1.5	1.7			

STATION - SPRING CREEK

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 48.6%

MONTH	MEAN POWER (W/M**2)	NORMALIZED	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)					
JAN	202.4	18565	27	192	0	15.2	12.3
FEB	0.0	0	0	0	0	0.0	0.0
MAR	0.0	0	0	0	0	0.0	0.0
APR	0.0	0	0	0	0	0.0	0.0
MAY	317.1	131547	247	196	0	17.2	55.8
JUN	414.4	137588	332	254	0	18.7	56.7
JUL	437.7	220782	421	200	0	18.9	67.8
AUG	499.0	140090	40	66	0	19.7	37.7
SEP	635.4	214752	318	382	0	20.9	45.4
OCT	375.4	68509	117	360	0	18.1	24.5
NOV	345.2	36330	100	607	0	17.6	14.1
DEC	272.6	45348	74	257	0	16.4	22.4
PERIOD							
TOTAL	173.3	1495229	1676	2514	0	18.7	40.0

STATION - SPRING CREEK HATCHERY
WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 1/1987 - 12/1987
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 9.2 MPH
NORMALIZED AVAILABLE ENERGY: 1333.5 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 7079

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	RELFREQ	CUMHRS	CUMRELFREQ	KWH/M**2/YEAR	MPH	PERIOD	RELFREQ	CUMHRS	CUMRELFREQ	KWH/M**2/YEAR
0	729	10.30	7079	100.00	0.0						
1	634	8.96	6350	89.70	0.0						
2	472	6.67	5716	80.75	0.3						
3	412	5.82	5244	74.08	0.8						
4	376	5.31	4832	68.26	1.6						
5	358	5.06	4456	62.95	3.0						
6	332	4.69	4098	57.89	4.8						
7	260	3.67	3766	53.20	6.0						
8	286	4.04	3506	49.53	9.9						
9	252	3.56	3220	45.49	12.4						
10	244	3.45	2968	41.93	16.5						
11	197	2.78	2724	38.48	17.7						
12	216	3.05	2527	35.70	25.2						
13	208	2.94	2311	32.65	30.9						
14	214	3.02	2103	29.71	39.7						
15	200	2.83	1889	26.68	45.6						
16	194	2.74	1689	23.86	53.7						
17	235	3.32	1495	21.12	78.0						
18	209	2.95	1260	17.80	82.3						
19	203	2.87	1051	14.85	94.0						
20	154	2.18	848	11.98	83.2						
21	129	1.82	694	9.80	80.7						
22	120	1.70	565	7.98	86.3						
23	92	1.30	445	6.29	75.6						
24	81	1.14	353	4.99	75.6						
25	78	1.10	272	3.84	82.3						
26	51	0.72	194	2.74	60.5						
27	35	0.49	143	2.02	46.5						
28	21	0.30	108	1.53	31.1						
29	14	0.20	87	1.23	23.1						
30	26	0.37	73	1.03	47.4						
31	17	0.24	47	0.66	34.2						
32	8	0.11	30	0.42	17.7						
33	4	0.06	22	0.31	9.7						
34	4	0.06	18	0.25	10.6						
35	4	0.06	14	0.20	11.6						
36	4	0.06	10	0.14	12.6						
37	2	0.03	6	0.08	6.8						
38	2	0.03	4	0.06	7.4						
39	1	0.01	2	0.03	4.0						
40	1	0.01	1	0.01	4.3						

STATION - SPRING CREEK TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG TMP
JAN	32.2	31.9	31.7	31.7	31.6	31.3	31.0	30.8	31.1	32.0	33.7	35.6	37.5	38.9	39.6	39.2	37.7	36.2	35.2	34.2	33.6	33.1	32.8	32.5	34.0
FEB	37.5	37.4	37.4	37.9	36.8	36.3	36.5	36.5	37.3	39.0	41.4	43.5	46.3	47.9	49.3	48.7	47.1	45.8	43.8	42.1	40.8	40.1	38.9	38.0	41.1
MAR	41.9	41.1	40.1	39.6	39.1	38.6	38.7	39.8	42.2	45.4	48.6	51.4	53.4	54.9	55.3	55.7	54.2	52.3	49.8	47.6	46.1	45.2	43.7	42.8	46.1
APR	49.7	48.7	47.6	46.8	45.8	45.3	45.7	48.0	51.6	56.2	61.1	65.0	67.6	69.2	68.9	68.4	67.7	65.1	61.4	58.2	55.8	53.9	52.2	50.8	56.3
MAY	55.6	54.3	53.1	51.8	51.2	51.3	52.7	55.4	59.8	64.3	68.3	71.6	73.5	73.9	74.2	73.3	73.1	71.2	67.2	64.9	62.0	60.1	58.2	56.7	62.3
JUN	60.0	58.6	57.0	56.1	55.0	54.9	56.1	58.7	63.9	69.2	73.5	76.6	78.3	80.2	80.7	80.5	80.6	78.1	75.4	71.4	68.5	66.1	63.9	62.0	67.3
JUL	63.8	63.4	61.9	60.9	60.1	59.9	60.6	63.0	68.2	72.8	76.7	79.1	80.5	81.5	80.1	81.1	78.9	76.4	75.3	72.0	69.9	68.2	64.6	65.5	70.0
AUG	63.8	61.2	59.4	58.0	56.2	55.3	57.1	61.4	68.8	75.8	85.6	88.5	91.7	91.8	92.4	91.2	90.2	87.7	85.2	81.1	76.6	73.6	70.0	67.8	72.2
SEP	60.3	59.1	57.8	56.8	55.8	54.8	54.9	57.8	63.8	71.0	76.8	80.7	82.4	81.5	81.5	81.5	80.3	79.1	73.1	69.7	67.2	65.1	63.3	61.7	67.6
OCT	53.8	51.9	51.3	51.0	49.3	49.1	48.3	50.0	55.5	63.0	69.6	74.5	79.3	78.8	79.7	79.4	74.1	69.7	65.4	62.3	60.3	57.9	56.2	55.3	61.4
NOV	42.8	42.3	42.0	41.7	41.2	41.0	40.8	41.2	42.5	44.8	47.9	50.9	53.2	54.8	55.0	53.4	50.9	48.3	46.7	45.3	44.2	43.4	42.8	42.2	45.9
DEC	39.5	38.8	38.6	38.5	38.0	37.9	37.7	38.0	38.8	39.6	41.3	43.0	43.7	44.4	43.8	43.5	42.8	41.5	41.3	40.7	40.0	39.8	39.5	39.7	40.3
AUG																									
MP	49.1	48.1	47.3	46.8	45.8	45.5	45.9	47.4	50.8	54.6	58.6	61.3	63.1	63.8	63.7	63.4	62.4	60.7	58.1	55.9	53.9	52.6	51.0	50.2	54.0

STATION - SPRING CREEK HATCHERY

DATA PERIOD OF RECORD - 3/1981 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	6.2	6.3	6.3	6.0	6.5	6.4	6.0	6.2	6.6	7.1	7.4	7.6	7.7	7.8	7.7	6.5	6.0	5.8	5.9	5.5	5.4	5.5	6.2	6.2	6.4
FEB	5.1	4.9	5.2	5.1	5.5	5.4	5.2	5.5	6.0	6.3	6.8	7.1	7.2	7.5	7.4	7.0	6.4	5.8	4.9	5.1	4.8	4.9	5.3	4.8	5.8
MAR	5.9	5.9	5.5	5.5	5.6	5.4	5.6	6.6	7.4	8.4	9.8	10.6	11.1	11.5	11.2	11.0	9.5	8.4	7.7	7.0	7.0	6.4	6.2	5.9	7.7
APR	8.9	8.7	8.3	8.4	8.2	8.6	10.0	11.3	12.2	13.0	14.0	14.5	15.0	15.2	15.5	14.7	13.5	11.3	10.4	9.9	9.6	9.3	9.1	8.8	11.2
MAY	11.4	10.8	10.6	10.2	10.2	11.1	12.2	13.5	14.8	15.5	16.8	17.7	18.5	18.9	18.7	18.1	16.8	14.9	12.8	12.1	11.7	11.8	11.9	11.8	13.9
JUN	12.7	12.6	12.5	11.9	11.6	12.2	13.3	14.3	14.7	15.8	17.2	18.5	19.1	19.5	19.8	19.1	18.0	16.4	14.5	13.1	11.7	12.0	11.9	12.7	14.8
JUL	14.6	13.9	13.7	13.5	13.7	14.2	15.5	16.8	18.2	19.1	20.1	20.5	20.8	20.8	21.0	21.0	19.8	18.0	16.1	14.4	13.8	14.1	14.4	14.6	16.8
AUG	13.6	13.3	13.2	13.3	13.3	13.2	13.6	14.1	14.8	15.7	16.4	17.2	18.2	19.0	19.5	19.2	18.5	16.9	15.2	13.9	13.7	13.7	13.6	13.4	15.3
SEP	9.5	9.6	9.7	9.4	9.4	9.3	10.2	10.8	11.3	12.1	13.0	13.7	14.6	14.9	14.9	14.7	13.6	11.8	10.3	9.5	9.4	9.5	9.6	9.9	11.3
OCT	7.7	7.6	8.0	8.0	7.3	7.2	7.5	8.0	8.6	8.8	9.8	10.0	10.4	10.9	11.0	10.0	8.3	7.4	7.2	7.5	6.8	7.0	7.2	8.2	8.3
NOV	6.1	6.1	6.5	6.7	6.8	6.7	6.8	7.1	7.4	8.0	8.5	9.2	9.0	8.9	8.5	8.0	7.0	6.7	6.2	6.4	6.4	6.4	6.1	6.1	7.2
DEC	6.5	6.4	6.4	6.6	7.1	6.7	6.6	6.6	7.0	7.9	8.5	8.8	8.9	9.0	9.4	8.9	7.9	7.9	7.7	7.5	6.9	6.7	6.7	6.8	7.5
AUG																									
SPD	9.4	9.1	9.1	9.0	9.0	9.2	9.8	10.6	11.3	12.1	13.0	13.6	14.1	14.3	14.4	13.8	12.8	11.5	10.4	9.7	9.3	9.3	9.4	9.4	11.0

STATION - SPRING CREEK TEMPERATURE (deg F)
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	Avg	SD
1987 # OBS	34.0 740	41.1 635	46.1 727	56.3 717	62.3 717	67.3 571	70.0 609	72.2 99	67.6 675	61.4 471	45.9 707	40.3 333	7001	54.04	15.60
Avg SD	34.0 0.0	41.1 0.0	46.1 0.0	56.3 0.0	62.3 0.0	67.3 0.0	70.0 0.0	72.2 0.0	67.6 0.0	61.4 0.0	45.9 0.0	40.3 0.0	7001	54.04	15.60

STATION - SPRING CREEK PRESSURE
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 1/1987 - 12/1987

[illegible]

APPENDIX L

**UPPER PYLE CANYON
SUMMARY STATISTICS
MARCH 1984 - MAY 1988**

STATION - UPPER PYLE CANYON
MONTHLY WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 3/1984 - 5/1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1984	0.0	0.0	11.4	15.2	14.1	11.8	10.9	13.4	11.1	11.9	16.9	12.6	4925	13.01	7.50
# OBS	0	0	339	227	232	347	143	732	708	740	720	737			
1985	11.1	13.3	0.0	0.0	0.0	0.0	13.4	12.3	11.0	12.2	0.0	9.9	3691	11.82	7.03
# OBS	744	538	0	0	0	0	217	718	697	492	0	285			
1986	19.0	13.5	12.5	16.9	15.8	8.3	15.2	13.6	12.1	11.7	14.0	12.8	6946	13.96	9.25
# OBS	744	672	698	337	209	69	545	744	720	744	720	744			
1987	16.7	13.1	15.9	14.3	9.6	14.9	0.0	0.0	11.0	11.3	15.5	19.0	5706	14.78	9.78
# OBS	744	672	744	720	110	165	0	0	351	744	718	738			
1988	15.3	11.5	14.9	14.6	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2677	14.36	8.53
# OBS	715	302	651	720	289	0	0	0	0	0	0	0			
AVG	15.6	13.1	14.1	14.9	13.6	12.3	14.1	13.1	11.3	11.7	15.4	14.2	23945	13.68	8.71
SD	3.3	0.9	2.1	1.2	2.6	3.3	2.1	0.7	0.6	0.4	1.5	3.8			

STATION - UPPER PYLE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG	TMP
JAN	23.0	22.6	22.5	22.5	22.2	22.1	22.1	22.6	23.6	24.4	25.4	26.0	26.4	26.5	26.2	25.6	25.0	24.7	24.5	24.1	23.8	23.5	23.3	23.3	24.0	
FEB	30.3	30.0	30.1	30.2	30.0	29.9	30.0	30.6	31.0	31.6	32.2	32.9	33.7	34.2	34.1	33.5	32.8	31.8	31.7	31.3	31.0	30.8	30.7	30.5	31.5	
MAR	34.1	33.5	33.2	33.1	32.7	32.7	33.7	34.8	36.4	38.1	39.4	40.4	40.8	41.0	40.9	40.7	39.3	37.9	36.8	36.0	35.7	35.1	34.9	34.9	36.5	
APR	42.1	41.4	40.8	40.1	39.9	41.4	45.5	49.3	51.6	53.8	55.4	56.5	56.9	57.4	57.2	56.4	53.6	50.3	48.3	46.5	45.1	44.2	43.5	42.8	48.3	
MAY	43.3	42.3	41.2	40.7	41.7	44.8	52.4	61.2	61.0	59.3	60.1	61.3	60.0	60.2	56.3	55.5	53.9	51.9	49.0	47.3	46.1	45.8	44.9	44.0	51.2	
JUN	51.8	51.5	46.8	50.1	50.3	51.9	55.8	62.2	67.8	72.6	71.8	69.5	68.0	70.9	69.4	67.0	64.4	59.6	59.2	57.0	55.1	53.3	52.8	48.5	59.6	
JUL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
AUG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SEP	52.1	50.4	49.0	47.8	47.0	46.6	50.6	56.0	60.7	65.3	70.0	73.4	74.7	75.9	76.2	75.2	70.6	64.4	61.6	60.0	58.2	56.5	55.2	53.6	60.6	
OCT	44.3	43.1	42.1	41.2	40.0	39.0	41.5	46.9	52.2	57.0	61.0	64.7	66.8	67.1	66.0	63.1	58.3	54.7	52.6	50.5	49.2	47.7	46.4	45.2	51.7	
NOV	33.6	33.4	33.3	33.0	33.0	32.7	32.8	34.0	36.2	38.2	39.5	40.6	40.9	40.7	39.9	38.1	36.7	35.9	35.2	34.6	34.3	33.9	33.8	33.3	35.7	
DEC	26.8	26.3	26.3	26.3	26.0	25.9	25.7	25.8	26.6	27.8	29.1	29.6	30.0	29.9	29.4	28.5	27.9	27.7	27.3	27.2	27.0	26.9	26.9	26.8	27.4	
AUG																										
TMP	35.3	34.7	34.2	34.0	33.5	33.6	35.0	37.3	39.5	41.7	43.5	44.8	45.5	45.7	45.2	44.1	42.1	40.2	39.1	38.1	37.4	36.7	36.3	35.8	38.9	

STATION - UPPER PYLE
WIND SPEED FREQUENCY DISTRIBUTION WITH NORMALIZED AVAILABLE ENERGY
DATA PERIOD OF RECORD - 3/1984 - 5/1988
NORMALIZATION PERIOD - ONE YEAR
AVERAGE WIND SPEED FOR PERIOD: 13.7 MPH
NORMALIZED AVAILABLE ENERGY: 2701.0 KWH/M**2/YEAR
TOTAL HOURS OBSERVED: 23945

NORMALIZED						NORMALIZED					
SPD	HOURS/				AVAIL. ENERGY	SPD	HOURS/				AVAIL. ENERGY
MPH	PERIOD	RELFREQ	CUMHRS	CUMRELFREQ	KWH/M**2/YEAR	MPH	PERIOD	RELFREQ	CUMHRS	CUMRELFREQ	KWH/M**2/YEAR
0	479	2.00	23945	100.00	0.0	46	12	0.05	63	0.26	21.0
1	553	2.31	23466	98.00	0.0	47	11	0.05	51	0.21	20.5
2	625	2.61	22913	95.69	0.1	48	11	0.05	40	0.17	21.8
3	760	3.17	22288	93.08	0.4	49	10	0.04	29	0.12	21.1
4	840	3.51	21528	89.91	1.0	50	5	0.02	19	0.08	11.2
5	978	4.08	20688	86.40	2.2	51	4	0.02	14	0.06	9.5
6	919	3.84	19710	82.31	3.6	52	0	0.00	10	0.04	0.0
7	977	4.08	18791	78.48	6.0	53	4	0.02	10	0.04	10.7
8	1096	4.58	17814	74.40	10.1	54	0	0.00	6	0.03	0.0
9	1194	4.99	16718	69.82	15.6	55	0	0.00	6	0.03	0.0
10	1200	5.01	15524	64.83	21.6	56	2	0.01	6	0.03	6.3
11	1157	4.83	14324	59.82	27.7	57	0	0.00	4	0.02	0.0
12	1232	5.15	13167	54.99	38.2	58	1	0.00	4	0.02	3.5
13	1181	4.93	11935	49.84	46.6	59	0	0.00	3	0.01	0.0
14	1126	4.70	10754	44.91	55.5	60	0	0.00	3	0.01	0.0
15	1097	4.58	9628	40.21	66.5	61	1	0.00	3	0.01	4.1
16	1008	4.21	8531	35.63	74.1	62	1	0.00	2	0.01	4.3
17	873	3.65	7523	31.42	77.0	63	0	0.00	1	0.00	0.0
18	839	3.50	6650	27.77	87.9	64	0	0.00	1	0.00	0.0
19	699	2.92	5811	24.27	86.1	65	0	0.00	1	0.00	0.0
20	613	2.56	5112	21.35	88.1	66	0	0.00	1	0.00	0.0
21	502	2.10	4499	18.79	83.5	67	0	0.00	1	0.00	0.0
22	490	2.05	3997	16.69	93.7	68	0	0.00	1	0.00	0.0
23	419	1.75	3507	14.65	91.6	69	0	0.00	1	0.00	0.0
24	361	1.51	3088	12.90	89.6	70	0	0.00	1	0.00	0.0
25	310	1.29	2727	11.39	87.0	71	0	0.00	1	0.00	0.0
26	304	1.27	2417	10.09	96.0	72	0	0.00	1	0.00	0.0
27	244	1.02	2113	8.82	86.2	73	1	0.00	1	0.00	7.0
28	221	0.92	1869	7.81	87.1						
29	224	0.94	1648	6.88	98.1						
30	204	0.85	1424	5.95	98.9						
31	167	0.70	1220	5.10	89.3						
32	167	0.70	1053	4.40	98.3						
33	130	0.54	886	3.70	83.9						
34	113	0.47	756	3.16	79.8						
35	98	0.41	643	2.69	75.5						
36	100	0.42	545	2.28	83.8						
37	78	0.33	445	1.86	71.0						
38	73	0.30	367	1.53	71.9						
39	61	0.25	294	1.23	65.0						
40	48	0.20	233	0.97	55.2						
41	45	0.19	185	0.77	55.7						
42	25	0.10	140	0.58	33.3						
43	27	0.11	115	0.48	38.6						
44	18	0.08	88	0.37	27.5						
45	7	0.03	70	0.29	11.5						

STATION - UPPER PYLE
 DIURNAL WIND SPEEDS (MPH)
 DATA PERIOD OF RECORD - 3/1984 - 5/1988

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG SPD
JAN	14.8	15.0	14.6	14.7	14.8	14.7	14.7	15.2	15.7	16.3	17.0	17.3	17.8	17.3	16.9	16.4	15.5	15.6	15.0	14.7	14.4	14.9	15.3	14.8	15.6
FEB	11.8	12.1	12.3	12.3	12.5	12.9	12.6	12.7	13.3	14.2	15.0	15.7	15.9	15.6	15.2	13.9	13.2	12.4	12.3	12.0	11.8	11.6	11.1	10.9	13.1
MAR	11.5	11.5	11.1	11.6	11.4	11.1	11.0	12.3	14.1	16.2	18.1	18.1	18.3	18.0	17.6	17.1	16.9	15.3	14.0	13.5	12.7	12.0	12.0	11.7	14.1
APR	12.1	11.5	11.3	11.3	10.9	11.1	11.9	14.0	15.7	17.7	18.2	18.8	18.5	18.4	18.5	18.8	18.3	17.1	16.1	14.9	14.0	13.6	12.8	12.4	14.9
MAY	10.4	9.5	8.6	9.0	10.1	10.2	11.6	12.7	13.8	16.5	16.1	16.2	17.0	17.4	17.8	17.7	17.7	17.3	15.0	12.6	11.9	12.0	12.3	11.6	13.6
JUN	10.1	9.8	10.2	11.0	12.3	12.7	13.1	14.0	14.1	13.9	13.2	13.5	14.4	12.8	12.8	14.2	15.1	12.8	11.2	11.3	11.3	10.2	10.3	9.9	12.3
JUL	12.9	13.0	12.0	12.3	13.2	13.3	14.3	15.0	14.4	14.1	13.4	12.4	12.2	13.1	14.6	16.3	18.4	18.0	16.1	14.7	13.7	13.1	13.3	13.0	14.1
AUG	12.9	12.5	12.5	11.7	10.7	9.9	11.0	12.0	12.6	13.2	13.3	12.3	12.7	13.5	14.5	15.3	15.8	15.6	14.7	14.3	13.5	13.8	13.3	12.9	13.1
SEP	10.0	9.9	9.8	9.6	9.1	8.7	8.3	9.7	10.8	12.2	13.2	14.4	13.5	13.8	13.4	13.1	13.1	12.3	12.2	12.0	11.8	10.8	10.1	10.1	11.3
OCT	9.9	9.6	9.2	9.3	9.3	9.3	9.2	9.9	11.2	13.1	14.9	15.9	16.2	16.4	16.3	15.2	13.3	11.9	11.0	10.3	10.0	10.4	10.3	9.9	11.7
NOV	13.8	14.3	14.3	15.2	15.3	14.9	14.4	15.1	15.5	16.7	17.9	18.8	18.9	18.1	17.2	15.5	14.5	14.0	14.3	14.5	14.5	14.5	14.2	14.4	15.4
DEC	14.2	14.8	13.7	14.2	14.1	14.2	14.1	14.6	14.3	15.1	15.2	16.0	16.1	15.6	15.0	14.2	13.1	12.6	12.9	12.8	12.6	13.3	13.8	14.0	14.2
AUG																									
SPD	12.2	12.2	11.9	12.1	12.0	11.9	12.0	12.9	13.7	14.9	15.7	16.1	16.2	16.1	16.0	15.6	15.0	14.3	13.6	13.2	12.7	12.6	12.5	12.3	13.7

STATION - UPPER PYLE

MONTHLY POWER DENSITIES AND NORMALIZED TOTAL ENERGY WITH SPEED RANGE OF 12 TO 60 MPH

DATA PERIOD OF RECORD - 6/1987 - 5/1988

DATA RECOVERY - 69.6%

MONTH	MEAN POWER (W/M**2)	NORMALIZED	NO. DATA PTS. WITHIN RANGE	NO. DATA PTS. BELOW 12	NO. DATA PTS. ABOVE 60	MEAN SPD(MPH) WITHIN RANGE	PERCENT TIME WITHIN RANGE
		TOTAL ENERGY (KWH/M**2)					
JAN	793.8	335364	406	309	0	21.9	56.8
FEB	287.6	79356	112	190	0	16.6	37.1
MAR	539.7	237469	385	266	0	20.0	59.1
APR	513.1	220563	416	304	0	20.2	57.8
MAY	377.3	59616	158	131	0	18.1	54.7
JUN	409.0	43760	107	58	0	19.1	64.8
JUL	0.0	0	0	0	0	0.0	0.0
AUG	0.0	0	0	0	0	0.0	0.0
SEP	292.9	93115	150	200	1	17.1	42.7
OCT	305.0	103074	338	406	0	17.7	45.4
NOV	615.1	283011	444	274	0	21.1	61.8
DEC	1213.6	598272	489	249	0	25.2	66.3
PERIOD							
TOTAL	351.0	2719878	3005	2387	1	20.6	55.7

STATION - UPPER PYLE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AUG	TMP
JAN	23.0	22.6	22.5	22.5	22.2	22.1	22.1	22.6	23.6	24.4	25.4	26.0	26.4	26.5	26.2	25.6	25.0	24.7	24.5	24.1	23.8	23.5	23.3	23.3	24.0	
FEB	30.3	30.0	30.1	30.2	30.0	29.9	30.0	30.6	31.0	31.6	32.2	32.9	33.7	34.2	34.1	33.5	32.8	31.8	31.7	31.3	31.0	30.8	30.7	30.5	31.5	
MAR	34.1	33.5	33.2	33.1	32.7	32.7	33.7	34.8	36.4	38.1	39.4	40.4	40.8	41.0	40.9	40.7	39.3	37.9	36.8	36.0	35.7	35.1	34.9	34.9	36.5	
APR	42.1	41.4	40.8	40.1	39.9	41.4	45.5	49.3	51.6	53.8	55.4	56.5	56.9	57.4	57.2	56.4	53.6	50.3	48.3	46.5	45.1	44.2	43.5	42.8	48.3	
MAY	43.3	42.3	41.2	40.7	41.7	44.8	52.4	61.2	61.0	59.3	60.1	61.3	60.0	60.2	56.3	55.5	53.9	51.9	49.0	47.3	46.1	45.8	44.9	44.0	51.2	
JUN	51.8	51.5	46.8	50.1	50.3	51.9	55.8	62.2	67.8	72.6	71.8	69.5	68.0	70.9	69.4	67.0	64.4	59.6	59.2	57.0	55.1	53.3	52.8	48.5	59.6	
JUL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
AUG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SEP	52.1	50.4	49.0	47.8	47.0	46.6	50.6	56.0	60.7	65.3	70.0	73.4	74.7	75.9	76.2	75.2	70.6	64.4	61.6	60.0	58.2	56.5	55.2	53.6	60.6	
OCT	44.3	43.1	42.1	41.2	40.0	39.0	41.5	46.9	52.2	57.0	61.0	64.7	66.8	67.1	66.0	63.1	58.3	54.7	52.6	50.5	49.2	47.7	46.4	45.2	51.7	
NOV	33.6	33.4	33.3	33.0	33.0	32.7	32.8	34.0	36.2	38.2	39.5	40.6	40.9	40.7	39.9	38.1	36.7	35.9	35.2	34.6	34.3	33.9	33.8	33.3	35.7	
DEC	26.8	26.3	26.3	26.3	26.0	25.9	25.7	25.8	26.6	27.8	29.1	29.6	30.0	29.9	29.4	28.5	27.9	27.7	27.3	27.2	27.0	26.9	26.9	26.8	27.4	
AUG																										
TMP	35.3	34.7	34.2	34.0	33.5	33.6	35.0	37.3	39.5	41.7	43.5	44.8	45.5	45.7	45.2	44.1	42.1	40.2	39.1	38.1	37.4	36.7	36.3	35.8	38.9	

STATION - UPPER PYLE TEMPERATURE (deg F)

DATA PERIOD OF RECORD - 1/1987 - 12/1987

[illegible]

STATION - UPPER PYLE PRESSURE

DATA PERIOD OF RECORD - 1/1987 - 12/1987

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	# OBS	AVG	SD
1987 # OBS	26.7 744	26.7 672	26.6 744	26.7 720	26.7 110	26.6 166	0.0 0	0.0 0	26.9 349	26.9 744	26.8 718	26.7 738	5705	26.73	0.24
AVG SD	26.7 0.0	26.7 0.0	26.6 0.0	26.7 0.0	26.7 0.0	26.6 0.0	0.0 0.0	0.0 0.0	26.9 0.0	26.9 0.0	26.8 0.0	26.7 0.0	5705	26.73	0.24