Appendix A

SIBLEY COUNTY BOARD OF COMMISSIONERS
RESOLUTION # 2007-44
Community-Based Energy Development Status for a Wind Project
September 25, 2007

Motion by Commissioner Woehler Seconded by Commissioner Pinske

WHEREAS, It is the policy of the State of Minnesota to foster Community-Based Energy Development (C-BED) projects; and

WHEREAS, The State C-BED statute calls for County Board approval of C-BED projects – Minn. Stat. § 216B.1612, subd.2(f)(3); and

WHEREAS, The development of a wind project in Sibley County provides economic opportunity for residents of the County; and

WHEREAS, The Sibley County Wind project which is proposed for development in Cornish Township will be owned by Minnesota limited liability companies organized by Minnesota residents; and

WHEREAS, The Sibley County Wind project will be developing wind turbines; and

WHEREAS, The developers understand and accept responsibility for securing all necessary permits for development of wind turbines and towers; and

WHEREAS, This project calls for the development of up to 20 megawatts of wind energy to be produced by 10 turbines; and

WHEREAS, Sibley County has been assured that the projects are structured to ensure that a majority of the financial benefit of the project accrues to the local owner of the project.

NOW, THEREFORE, BE IT RESOLVED, That the Sibley County Board of Commissioners hereby indicates its support for the development of the Sibley County Wind project as a C-BED project, subject to the authority of said County Board and its agencies to issue permits for said project in accordance with State statute, local ordinances, rules or regulations.

	Yes	No	Abstain	Absent
Anderly	X			
Bauer	X			
Pettis	X			
Pinske	X			
Woehler	X			

STATE OF MINNESOTA

OFFICE OF COUNTY AUDITOR
COUNTY OF SIBLEY

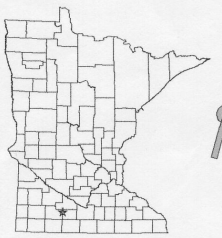
I, Lisa Pfarr, Auditor of the County of Sibley, State of Minnesota, do hereby certify that I have compared the foregoing with the original proceedings filed in my office on the 25th day of September 2007 and that the same is a true and correct copy of part thereof.

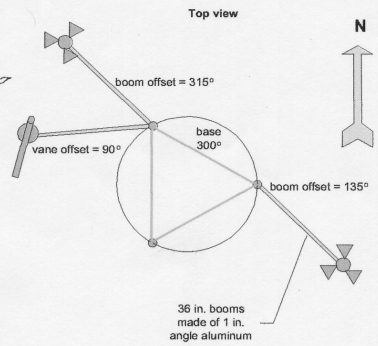
Witness my Hand and Seal of Office at Gaylord, Minnesota the 25th day of September 2007.

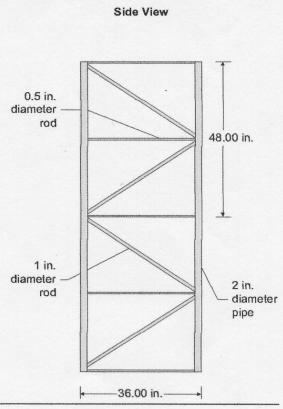
Lisa Pfarr, County Auditor

Appendix B

Mountain Lake







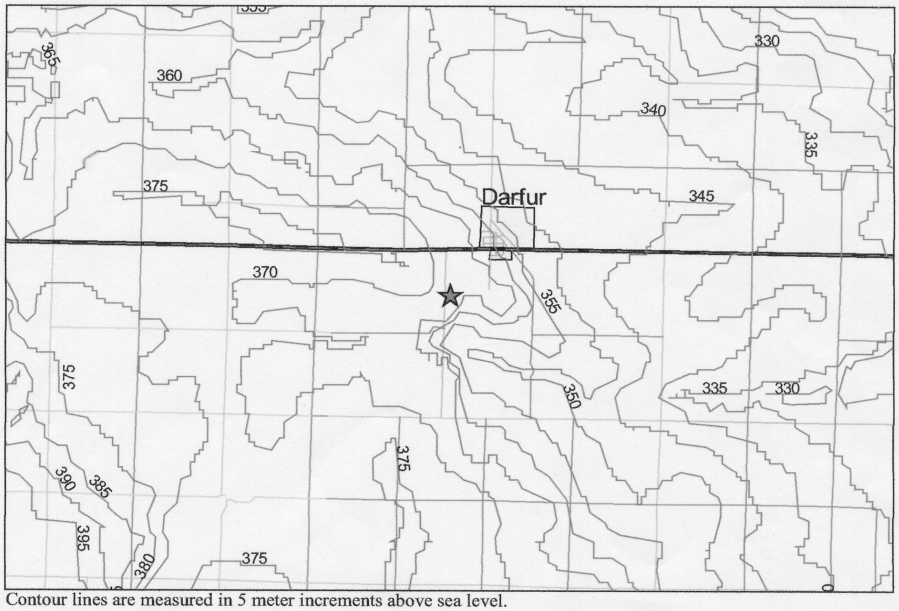
Coordinates

Long/Lat	UTM
N 44.0416	E 351964
W 94.8477	N 4878158

Elevation: 1201 feet

Additional Tower Information:

- Anemometers are located at 30, 50, and 70 meters.
- Vanes are located at 30 and 70 meters.



Contour lines are measured in 5 meter increments above sea level.
County roads are approximately 1 mile apart.

Mountain Lake

Wind Speed (Meters per Second)

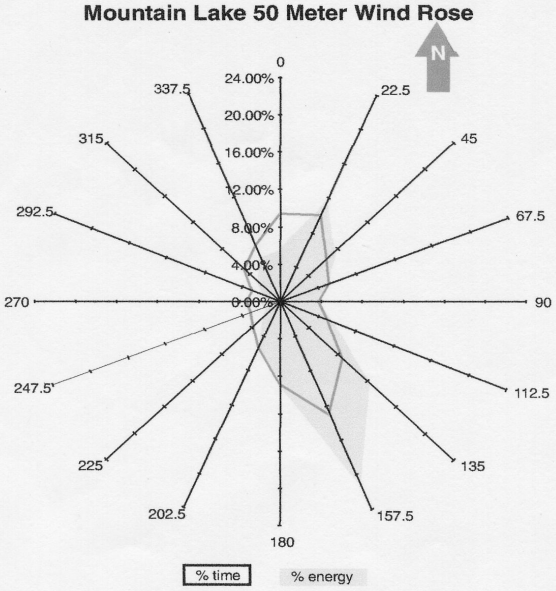
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
	30m						5.1	4.8	4.3	5.0	6.6	6.7	6.0	**5.5**
1995	50m						5.6	5.7	5.1	6.0	7.5	7.5	6.6	**6.3**
	70m						6.0	6.3	5.7	6.7	8.2	8.0	7.1	**6.9**
	30m	6.2	8.0	6.9	6.5	5.8	5.5	4.7	4.2	4.7	6.7	5.8	*	**5.9**
1996	50m	6.9	8.8	7.6	7.2	6.5	6.1	5.3	5.0	5.5	7.8	5.5	*	**6.6**
	70m	7.3	9.5	8.1	7.8	7.0	6.5	5.8	5.6	6.2	8.4	7.0	7.7	**7.2**
	30m	8.0	6.7	7.3	6.2	7.1	5.3	5.0	3.9	5.2	6.8	6.0	6.0	**6.1**
1997	50m	*	7.4	8.0	7.0	7.8	6.0	5.7	4.7	6.0	7.7	6.8	6.5	**6.7**
	70m	9.1	7.5	8.4	7.4	8.3	6.4	6.2	5.1	6.7	8.4	7.3	7.0	**7.3**
	30m	8.0	6.7	7.3	6.2	7.1	5.3	5.0	3.9	5.2	6.8	6.0	6.0	**6.1**
1998	50m	2.4	7.4	8.0	7.0	7.8	6.0	5.7	4.7	6.0	7.7	6.8	6.5	**6.3**
	70m	9.1	7.5	8.4	7.4	8.3	6.4	6.2	5.1	6.7	8.4	7.3	7.0	**7.3**
	30m	7.0	7.8	7.0	7.5	7.7	6.6	5.8	5.6	6.6	7.4	7.5	7.2	**7.0**
1999	50m	7.0	7.8	7.0	7.5	7.7	6.6	5.8	5.6	6.6	7.4	7.5	7.2	**7.0**
	70m	7.2	8.1	7.3	7.8	8.1	7.1	6.3	6.2	7.3	8.1	8.2	7.9	**7.5**
	30m	6.3	6.3	5.9	6.5	6.4	6.3	4.3	4.5	5.4	5.4	6.7	7.0	**5.9**
2000	50m	7.1	7.0	6.6	7.2	6.8	7.0	4.9	5.2	6.3	6.2	7.4	7.6	**6.6**
	70m	7.7	7.7	7.2	7.7	7.4	7.4	5.4	5.9	7.0	7.0	7.9	8.1	**7.2**
	30m	6.2	6.8	5.9	7.0	6.3	6.0	4.3	4.4	4.5	6.7	6.1	6.9	**5.9**
2001	50m	6.6	7.4	6.5	7.7	7.0	6.7	5.0	5.2	5.3	7.6	6.9	7.6	**6.6**
	70m	7.5	7.8	7.0	8.3	7.4	7.2	5.4	5.8	6.0	8.3	7.6	2.2	**6.7**
	30m	7.1	7.1	6.9	6.6	6.8	5.7	4.9	4.4	5.4	6.6	6.4	6.4	**6.2**
Average	50m	5.8	7.7	7.4	7.2	7.3	6.2	5.5	5.0	6.1	7.4	6.9	6.9	**6.6**
(m/s)	70m	8.1	8.0	7.9	7.6	7.8	6.6	6.0	5.6	6.8	8.1	7.6	7.5	**7.3**
	30m	15.9	15.9	15.4	14.7	15.2	12.7	11.0	9.8	12.0	14.8	14.4	14.4	**13.9**
Average	50m	13.1	17.2	16.6	16.1	16.4	13.9	12.3	11.3	13.6	16.5	15.5	15.4	**14.8**
(mph)	70m	18.1	18.0	17.6	17.1	17.5	14.8	13.5	12.5	15.2	18.1	17.0	16.7	**16.3**

Wind Shear Exponent (Alpha)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
	30m-50m						0.21	0.33	0.36	0.35	0.29	0.22	0.18	**0.28**
1995	50m-70m						0.23	0.26	0.28	0.31	0.26	0.21	0.21	**0.25**
	30m-50m	0.19	0.22	0.20	0.22	0.21	0.21	0.26	0.35	0.32	0.31	0.25	*	**0.25**
1996	50m-70m	0.19	0.24	0.20	0.22	0.25	0.22	0.24	0.32	0.34	0.27	0.25	*	**0.25**
	30m-50m	*	0.19	0.18	0.22	0.21	0.26	0.29	0.34	0.31	0.26	0.21	0.16	**0.24**
1997	50m-70m	*	0.03	0.15	0.21	0.18	0.23	0.26	0.27	0.30	0.26	0.19	0.18	**0.21**
	30m-50m	0.18	0.18	0.14	0.20	0.20	0.22	0.27	0.29	0.32	0.23	0.25	0.24	**0.23**
1998	50m-70m	0.20	0.26	0.21	0.20	0.23	0.26	0.31	0.37	0.34	0.31	0.28	0.27	**0.27**
	30m-50m	0.21	0.23	0.24	0.20	0.18	0.21	0.29	0.31	0.34	0.28	0.29	0.26	**0.25**
1999	50m-70m	0.29	0.26	0.23	0.20	0.20	0.22	0.29	0.32	0.31	0.30	0.32	0.29	**0.27**
	30m-50m	0.25	0.23	0.26	0.25	0.26	0.24	0.27	0.31	0.30	0.30	0.22	0.18	**0.26**
2000	50m-70m	0.28	0.28	0.29	0.25	0.39	0.27	0.30	0.36	0.33	0.36	0.25	0.23	**0.30**
	30m-50m	0.24	0.19	0.20	0.22	0.20	0.22	0.29	0.32	0.34	0.28	0.27	0.20	**0.25**
2001	50m-70m	0.25	0.19	0.19	0.23	0.22	0.19	0.26	0.31	0.35	0.29	0.27	*	**0.25**
	30m-50m	0.21	0.21	0.20	0.22	0.21	0.23	0.28	0.32	0.32	0.28	0.25	0.21	**0.24**
Average	50m-70m	0.24	0.21	0.21	0.22	0.24	0.23	0.28	0.32	0.33	0.30	0.26	0.24	**0.26**

*Equipment was damaged during this period

Mountain Lake 50 Meter Wind Rose



Wind Power (Watts per Square Meter)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
	30m						101	122	77	152	298	346	306	200
1995	50m						135	188	126	233	413	455	398	278
	70m						164	248	171	310	512	546	469	346
	30m	249	538	304	292	182	163	91	71	96	348	203	*	231
1996	50m	328	692	391	383	249	218	132	113	147	477	267	*	309
	70m	396	826	466	466	313	269	171	159	205	579	354	577	398
	30m	653	303	360	278	401	139	141	60	144	308	308	222	276
1997	50m	*	397	467	357	507	193	197	97	217	421	401	293	322
	70m	856	443	546	422	590	245	247	130	288	534	482	372	430
	30m	158	167	306	234	270	147	62	64	128	308	352	307	209
1998	50m	201	218	365	310	355	197	93	98	194	421	483	424	280
	70m	245	281	427	382	432	248	129	142	271	534	607	537	353
	30m	308	401	341	340	322	204	140	106	152	257	277	287	261
1999	50m	375	517	452	427	406	265	203	157	231	355	392	386	347
	70m	420	555	495	466	467	318	263	213	305	456	511	486	413
	30m	262	278	266	315	256	242	75	79	157	132	290	390	229
2000	50m	344	372	346	395	294	320	111	122	238	193	369	476	298
	70m	432	470	421	468	374	375	148	172	321	272	450	576	373
	30m	280	310	192	361	223	188	70	67	76	285	234	292	215
2001	50m	364	386	251	467	282	252	101	105	119	379	329	377	284
	70m	485	452	313	566	341	308	133	149	172	467	433	43	322
	30m	318	333	295	303	276	181	96	74	125	273	277	299	238
Average	50m	322	430	379	390	349	241	140	115	191	374	373	391	308
	70m	472	505	445	462	420	294	182	161	260	474	473	432	382

Appendix C-1

Park Power Curve Analysis

WindPRO version 2.5.0.60 Dec 2005

Project:
25Sibley

David Norgaard
290th Ave
Tyler, MN 56178

Description:
WAsP calculation using 10 years of 50m Montain Lake correlated to on-site Lang farm data.
Wind turbine layout based on map from David Norgaard.
This report includes array losses only, it does not include other losses such as: grid, availability, icing or blade losses.
Verify WTG power curve with manufacturer.

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Licensed user:
EAPC Architects Engineers
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 5507

Calculated:
02/15/2006 9:35 AM/2.5.0.60

PARK - Power Curve Analysis

Calculation: Derated 10-S88 80m hh Using ML data correlated to on-site data **WTG:** 1 - Suzlon S88/80Hz 2000 88.0 (0) Provided Document from Suzlon, Hub height: 80.0 m

Name: Provided Document from Suzlon
Source: Provided Document from Suzlon

Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type
USER	04/05/2005	12/27/2005	25.0	Pitch	Standard pitch

Derated per e-mail from Suzlon/Jay Gislason

Power curve

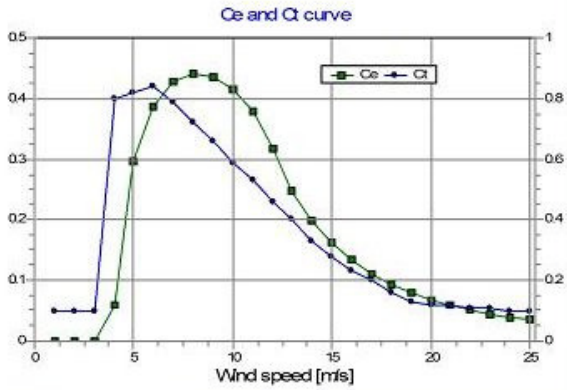
Original data from Windcat, Air density: 1.225 kg/m3

Wind speed [m/s]	Power [kW]	Ce	Wind speed [m/s]	Ct curve
4.0	14.0	0.06	1.0	0.10
5.0	138.0	0.30	2.0	0.10
6.0	312.0	0.39	3.0	0.10
7.0	546.0	0.43	4.0	0.80
8.0	840.0	0.44	5.0	0.82
9.0	1,180.0	0.43	6.0	0.84
10.0	1,535.0	0.41	7.0	0.79
11.0	1,856.0	0.38	8.0	0.72
12.0	2,000.0	0.32	9.0	0.66
13.0	2,000.0	0.25	10.0	0.59
14.0	2,000.0	0.20	11.0	0.53
15.0	2,000.0	0.16	12.0	0.46
16.0	2,000.0	0.13	13.0	0.40
17.0	2,000.0	0.11	14.0	0.33
18.0	2,000.0	0.09	15.0	0.28
19.0	2,000.0	0.08	16.0	0.23
20.0	2,000.0	0.07	17.0	0.20
21.0	2,000.0	0.06	18.0	0.16
22.0	2,000.0	0.05	19.0	0.13
23.0	2,000.0	0.04	20.0	0.12
24.0	2,000.0	0.04	21.0	0.12
25.0	2,000.0	0.03	22.0	0.11
			23.0	0.11
			24.0	0.10

Power, Efficiency and energy vs. wind speed

Data used in calculation, Air density: 1.204 kg/m3

Wind speed [m/s]	Power [kW]	Ce	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1.0	0.0	0.00	0.50- 1.50	0.0	0.0	0.0
2.0	0.0	0.00	1.50- 2.50	0.0	0.0	0.0
3.0	0.0	0.00	2.50- 3.50	0.0	0.0	0.0
4.0	13.8	0.06	3.50- 4.50	29.1	29.1	0.4
5.0	135.6	0.30	4.50- 5.50	129.3	158.4	2.3
6.0	306.7	0.39	5.50- 6.50	305.1	463.5	6.8
7.0	536.6	0.43	6.50- 7.50	534.4	997.9	14.5
8.0	825.6	0.44	7.50- 8.50	775.4	1,773.3	25.9
9.0	1,159.8	0.43	8.50- 9.50	964.5	2,737.7	39.9
10.0	1,514.8	0.41	9.50-10.50	1,043.7	3,781.5	55.1
11.0	1,843.8	0.38	10.50-11.50	975.0	4,756.5	69.3
12.0	2,000.0	0.32	11.50-12.50	775.7	5,532.2	80.7
13.0	2,000.0	0.25	12.50-13.50	537.1	6,069.3	88.5
14.0	2,000.0	0.20	13.50-14.50	339.9	6,409.2	93.4
15.0	2,000.0	0.16	14.50-15.50	202.6	6,611.8	96.4
16.0	2,000.0	0.13	15.50-16.50	115.1	6,726.9	98.1
17.0	2,000.0	0.11	16.50-17.50	63.1	6,790.0	99.0
18.0	2,000.0	0.09	17.50-18.50	33.7	6,823.7	99.5
19.0	2,000.0	0.08	18.50-19.50	17.7	6,841.4	99.7
20.0	2,000.0	0.07	19.50-20.50	9.2	6,850.6	99.9
21.0	2,000.0	0.06	20.50-21.50	4.6	6,855.2	99.9
22.0	2,000.0	0.05	21.50-22.50	2.3	6,857.5	100.0
23.0	2,000.0	0.04	22.50-23.50	1.1	6,858.6	100.0
24.0	2,000.0	0.04	23.50-24.50	0.5	6,859.2	100.0
25.0	2,000.0	0.03	24.50-25.50	0.2	6,859.3	100.0



WindPRO is developed by EMD International A/S, Niels Jernesvej10, DK-9220 Aalborg Ø, Tlf. +45 96 35 4444, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Appendix C-2

Park Production Analysis

WindPRO version 2.5.0.60 Dec 2005

Project:
25Sibley

David Norgaard
290th Ave
Tyler, MN 56178

Description:
WAsP calculation using 10 years of 50m Montain Lake correlated to on-site Lang farm data.
Wind turbine layout based on map from David Norgaard.
This report includes array losses only, it does not include other losses such as: grid, availability, icing or blade losses.
Verify WTG power curve with manufacturer.

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3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 5507

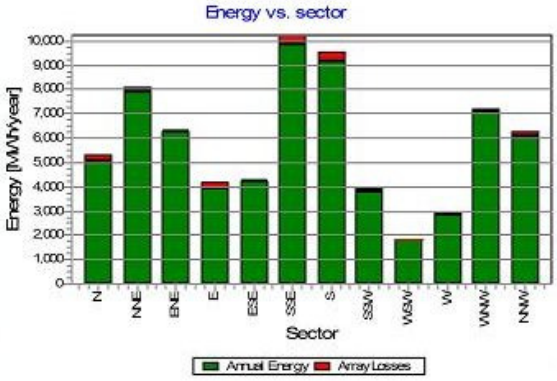
Calculated:
02/15/2006 9:35 AM/2.5.0.60

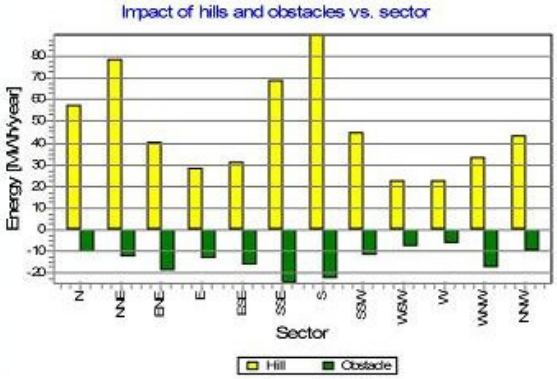
PARK - Production Analysis

Calculation: Derated 10-S88 80m hh Using ML data correlated to on-site data **WTG:** All new WTG's, Air density: 1.204 kg/m3

Directional Analysis

Sector		0 N	1 NNE	2 ENE	3 E	4 ESE	5 SSE	6 S	7 SSW	8 WSW	9 W	10 WNW	11 NNW	Total
Roughness based energy	[MWh]	5,230.6	8,014.2	6,325.4	4,125.8	4,301.8	10,191.8	9,503.7	3,854.9	1,847.3	2,944.9	7,164.4	6,221.4	69,726.2
-Decrease due to obstacles	[MWh]	10.7	12.5	19.3	13.4	16.3	24.6	22.6	12.0	7.6	6.3	17.6	9.8	172.7
+Increase due to hills	[MWh]	57.4	78.9	40.6	28.1	31.3	68.5	89.8	44.4	22.7	22.9	33.5	43.3	561.4
-Decrease due to array losses	[MWh]	240.0	194.8	76.5	195.1	83.0	357.8	390.4	112.3	33.3	146.9	99.9	213.5	2,143.5
Resulting energy	**[MWh]**	**5,037.4**	**7,885.8**	**6,270.2**	**3,945.5**	**4,233.8**	**9,877.9**	**9,180.5**	**3,775.0**	**1,829.1**	**2,814.6**	**7,080.4**	**6,041.4**	**67,971.4**
Specific energy	[kWh/m2]													1,118
Specific energy	[kWh/kW]													3,399
Decrease due to obstacles	[%]	0.2	0.2	0.3	0.3	0.4	0.2	0.2	0.3	0.4	0.2	0.2	0.2	0.2
Increase due to hills	[%]	1.1	1.0	0.6	0.7	0.7	0.7	0.9	1.2	1.2	0.8	0.5	0.7	0.8
Decrease due to array losses	[%]	4.5	2.4	1.2	4.7	1.9	3.5	4.1	2.9	1.8	5.0	1.4	3.4	3.1
Utilization	[%]	33.5	34.2	27.3	29.8	34.7	31.7	31.9	32.9	34.2	30.1	26.7	29.4	30.9
Operational	[Hours/year]	625	753	632	558	636	1,037	1,022	522	376	434	763	704	8,061
Full Load Equivalent	[Hours/year]	252	394	314	197	212	494	459	189	91	141	354	302	3,399





WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tlf. +45 96 35 4444, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Appendix C-3

Park-Main Result

WindPRO version 2.5.0.60 Dec 2005

Project:
25Sibley

David Norgaard
290th Ave
Tyler, MN 56178

Description:
WAsP calculation using 10 years of 50m Montain Lake correlated to on-site Lang farm data.
Wind turbine layout based on map from David Norgaard.
This report includes array losses only, it does not include other losses such as: grid, availability, icing or blade losses.
Verify WTG power curve with manufacturer.

Printed/Page
02/15/2006 10:22 AM / 1

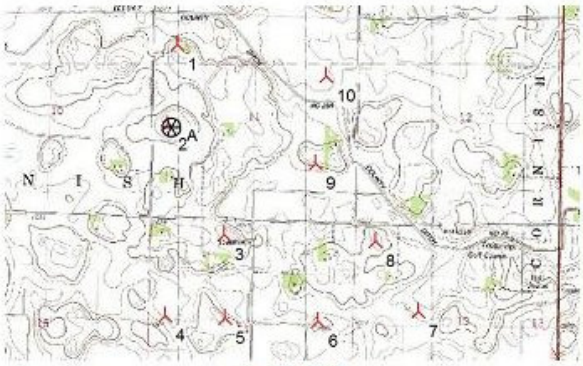
Licensed user:
EAPC Architects Engineers
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 5507

Calculated:
02/15/2006 9:35 AM/2.5.0.60

PARK - Main Result

Calculation: Derated 10-S88 80m hh Using ML data correlated to on-site data

Wake Model	N.O. Jensen (RISØ/EMD)
Calculation Settings	
Air density calculation mode	Fixed for all WTGs (User defined)
Result for WTG at hub altitude	1.204 kg/m3
Wake Model Parameters	
Wake Decay Constant	0.075
Wind statistics	US 40.00 m matrix method.wws



Key results for height 80.0 m above ground level

Terrain UTM WGS84 Zone: 15

	East	North	Name of wind distribution	Type	Wind energy [kWh/m2]	Mean wind speed [m/s]	Equivalent roughness
A	387,932	4,930,709	LTA Matrix MCP ML 50m data	WAsP (RVEA0011 1, 0, 0, 11)	3,706	7.6	1.1

Calculated Annual Energy for Wind Farm

WTG combination	Annual Energy Result [MWh]	Annual Energy Result-10.0% [MWh]	Park Efficiency [%]	Mean WTG energy [MWh]	Capacity Factor for Result [%]	Capacity Factor for Result-10.0% [%]
Wind farm	67,971.4	61,174.3	96.9	6,797.1	38.8	34.9

Calculated Annual Energy for each of 10 new WTG's with total 20.0 MW rated power

	Terrain	WTG type Valid	Manufact.	Type	Power [kW]	Diam. [m]	Height [m]	Circle radius [m]	Power curve Creator	Name	Annual Energy Result [MWh]	Annual Energy Result-10.0% [MWh]	Park Efficiency [%]	Mean wind speed [m/s]
1	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,859.3	6,173	97.2	7.5
2	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,894.6	6,205	96.7	7.6
3	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,798.4	6,119	95.9	7.5
4	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,705.6	6,035	97.3	7.4
5	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,804.3	6,124	96.9	7.5
6	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,819.1	6,137	97.1	7.5
7	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,799.1	6,119	98.1	7.5
8	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,823.4	6,141	96.6	7.5
9	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,770.9	6,094	96.5	7.5
10	A	No	Suzlon	S88	2,000	88.0	80.0	264.0	USER	Provided Document from Suzlon	6,696.7	6,027	97.3	7.4

WTG siting

UTM WGS84 Zone: 15

		East	North	Z [m]	Row data/Description
1	New	387,977	4,931,366	316	1
2	New	387,903	4,930,732	317	2
3	New	388,351	4,929,868	315	3
4	New	387,881	4,929,231	309	4
5	New	388,357	4,929,213	313	5
6	New	389,085	4,929,189	312	6

UTM WGS84 Zone: 15

		East	North	Z [m]	Row data/Description
7	New	389,877	4,929,263	309	7
8	New	389,541	4,929,814	314	8
9	New	389,067	4,930,430	314	9
10	New	389,151	4,931,116	309	10

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Appendix D

DIURNAL WIND SPEED GRAPH

SITE 0101

May 2004

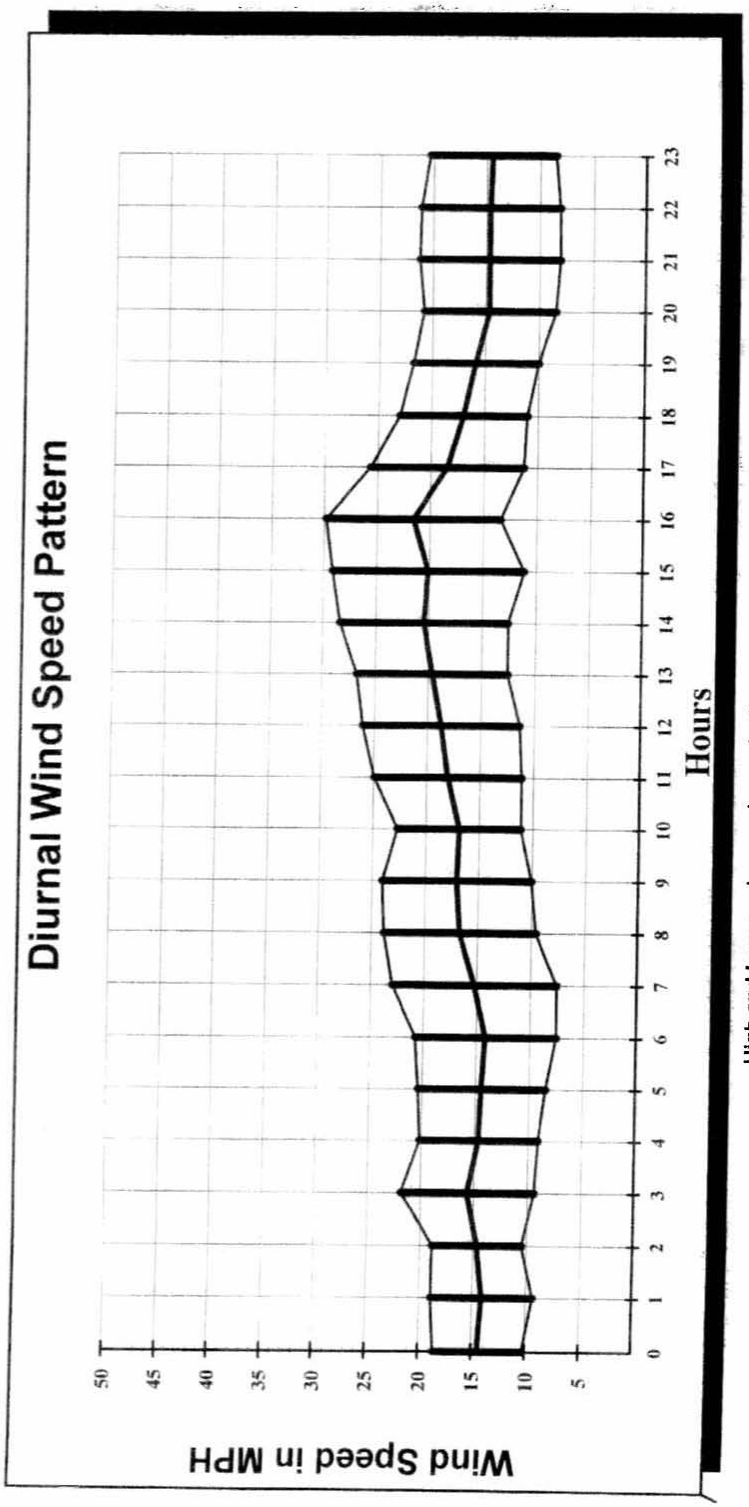
May 2004
Date Range
2004-05-01 TO 2004-05-31

Site Information

Project: 0101
Location: Winthrop, MN
Site Elevation: 0FT
Averaging Time: 10 min

Sensor Information

Channel: 1
Type: Anemometer
Scale: 1.711000000
Offset: 0.7800
Description: Anemometer
Height: 131FT



High and Low marks are plus and minus one standard deviation points.

Total hours = 744 Total hours used in Calculations = 393 Percent Data used = 52.8

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NRG Systems MicroSite Version 2.07