

Project:

Northwest Ohio

Description:

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Licensed user:

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US-GRAND FORKS, ND 58201
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wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR257 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

January		February		March	April	May	June
1	08:04	08:29 (T-34)	07:50	07:14	07:23	06:37	19:45 (T-48) 06:09
2	08:04	08:31 (T-34)	07:47	07:09	07:18	06:34	19:43 (T-48) 06:07
3	08:04	08:32 (T-34)	07:46	07:08	07:16	06:32	19:43 (T-48) 06:07
4	08:04	08:33 (T-34)	07:44	07:04	07:13	06:30	19:42 (T-48) 06:07
5	08:04	08:34 (T-34)	07:43	08:03	07:12	06:29	19:42 (T-48) 06:06
6	08:04	08:35 (T-34)	07:42	08:04	07:11	06:28	19:43 (T-48) 06:06
7	08:04	08:36 (T-34)	07:41	08:05	07:10	06:27	19:44 (T-48) 06:05
8	08:04	08:37 (T-34)	07:40	08:06	07:09	06:26	19:45 (T-48) 06:05
9	08:04	08:38 (T-34)	07:39	08:07	07:08	06:25	19:46 (T-48) 06:04
10	08:04	08:39 (T-34)	07:38	08:08	07:07	06:24	19:47 (T-48) 06:04
11	08:04	08:40 (T-34)	07:37	08:09	07:06	06:23	19:48 (T-48) 06:03
12	08:04	08:41 (T-34)	07:36	08:10	07:05	06:22	19:49 (T-48) 06:03
13	08:04	08:42 (T-34)	07:35	08:11	07:04	06:21	19:50 (T-48) 06:02
14	08:04	08:43 (T-34)	07:34	08:12	07:03	06:20	19:51 (T-48) 06:02
15	08:04	08:44 (T-34)	07:33	08:13	07:02	06:19	19:52 (T-48) 06:01
16	08:04	08:45 (T-34)	07:32	08:14	07:01	06:18	19:53 (T-48) 06:01
17	08:04	08:46 (T-34)	07:31	08:15	07:00	06:17	19:54 (T-48) 06:00
18	08:04	08:47 (T-34)	07:30	08:16	06:59	06:16	19:55 (T-48) 06:00
19	08:04	08:48 (T-34)	07:29	08:17	06:58	06:15	19:56 (T-48) 06:00
20	08:04	08:49 (T-34)	07:28	08:18	06:57	06:14	19:57 (T-48) 06:00
21	08:04	08:50 (T-34)	07:27	08:19	06:56	06:13	19:58 (T-48) 06:00
22	08:04	08:51 (T-34)	07:26	08:20	06:55	06:12	19:59 (T-48) 06:00
23	08:04	08:52 (T-34)	07:25	08:21	06:54	06:11	20:00 (T-48) 06:00
24	08:04	08:53 (T-34)	07:24	08:22	06:53	06:10	20:01 (T-48) 06:00
25	08:04	08:54 (T-34)	07:23	08:23	06:52	06:09	20:02 (T-48) 06:00
26	08:04	08:55 (T-34)	07:22	08:24	06:51	06:08	20:03 (T-48) 06:00
27	08:04	08:56 (T-34)	07:21	08:25	06:50	06:07	20:04 (T-48) 06:00
28	08:04	08:57 (T-34)	07:20	08:26	06:49	06:06	20:05 (T-48) 06:00
29	08:04	08:58 (T-34)	07:19	08:27	06:48	06:05	20:06 (T-48) 06:00
30	08:04	08:59 (T-34)	07:18	08:28	06:47	06:04	20:07 (T-48) 06:00
31	08:04	09:00 (T-34)	07:17	08:29	06:46	06:03	20:08 (T-48) 06:00
Potential sun hours	298	297	370	398	448	452	535
Total, worst case	304			84	743		535
Sun reduction	0.46			0.60	0.68		0.74
Oper. time red.	0.97			0.97	0.97		0.97
Wind dir. red.	0.59			0.59	0.60		0.60
Total reduction	0.26			0.34	0.39		0.43
Total, real	79			29	290		229

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

Northwest Ohio

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Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

July			August			September			October			November			December		
1	06:09		20:28 (T-29)	06:34		19:53 (T-48)	07:04	07:34	07:09			07:43			08:18 (T-34)		
2	12:15	18	20:46 (T-29)	20:57	29	20:22 (T-48)	20:14	19:22	17:35			17:11	19		08:37 (T-34)		
3	06:10		20:27 (T-29)	06:34		19:52 (T-48)	07:05	07:35	07:10			07:44			08:18 (T-34)		
4	12:15	19	20:46 (T-29)	20:56	30	20:22 (T-48)	20:12	19:20	17:34			17:11	19		08:37 (T-34)		
5	06:10		20:28 (T-29)	06:35		19:52 (T-48)	07:06	07:36	07:11			07:46			08:18 (T-34)		
6	12:15	18	20:46 (T-29)	20:54	31	20:23 (T-48)	20:11	19:18	17:33			17:10	20		08:38 (T-34)		
7	06:11		20:27 (T-29)	06:36		19:52 (T-48)	07:07	07:37	07:12			07:47			08:18 (T-34)		
8	12:14	19	20:46 (T-29)	20:53	31	20:23 (T-48)	20:09	19:17	17:31			17:10	21		08:39 (T-34)		
9	06:12		20:28 (T-29)	06:37		19:52 (T-48)	07:08	07:38	07:13			07:47			08:18 (T-34)		
10	12:14	19	20:47 (T-29)	20:52	31	20:23 (T-48)	20:07	19:15	17:30			17:10	22		08:40 (T-34)		
11	06:12		20:28 (T-29)	06:38		19:52 (T-48)	07:09	07:40	07:15			07:48			08:18 (T-34)		
12	12:14	20	20:48 (T-29)	20:51	31	20:23 (T-48)	20:06	19:13	17:29			17:10	22		08:40 (T-34)		
13	06:13		20:27 (T-29)	06:39		19:52 (T-48)	07:10	07:41	07:16			07:49			08:19 (T-34)		
14	12:14	20	20:47 (T-29)	20:50	30	20:22 (T-48)	20:04	19:12	17:28			17:10	22		08:41 (T-34)		
15	06:13		20:28 (T-29)	06:40		19:52 (T-48)	07:11	07:42	07:17			07:50			08:19 (T-34)		
16	12:13	20	20:48 (T-29)	20:49	30	20:22 (T-48)	20:02	19:10	17:27			17:10	23		08:42 (T-34)		
17	06:14		20:28 (T-29)	06:41		19:53 (T-48)	07:12	07:43	07:18			07:51			08:19 (T-34)		
18	12:13	20	20:48 (T-29)	20:47	29	20:22 (T-48)	20:01	19:08	17:26			17:10	23		08:42 (T-34)		
19	06:15		20:28 (T-29)	06:42		19:53 (T-48)	07:13	07:44	07:19			07:52			08:20 (T-34)		
20	12:13	19	20:47 (T-29)	20:46	28	20:21 (T-48)	19:57	19:07	17:25			17:10	23		08:43 (T-34)		
21	06:15		20:28 (T-29)	06:43		19:54 (T-48)	07:14	07:45	07:21			07:53			08:19 (T-34)		
22	12:12	19	20:47 (T-29)	20:45	26	20:20 (T-48)	19:56	19:05	17:24			17:10	23		08:42 (T-34)		
23	06:16		20:29 (T-29)	06:44		19:54 (T-48)	07:15	07:46	07:22			07:54			08:20 (T-34)		
24	12:12	18	20:47 (T-29)	20:43	25	20:19 (T-48)	19:54	19:04	17:23			17:10	23		08:43 (T-34)		
25	06:17		20:28 (T-29)	06:45		19:55 (T-48)	07:16	07:47	07:23			07:55			08:21 (T-34)		
26	12:11	18	20:46 (T-29)	20:42	23	20:18 (T-48)	19:52	19:02	17:22			17:10	23		08:44 (T-34)		
27	06:18		20:28 (T-29)	06:46		19:56 (T-48)	07:17	07:48	07:24			07:55			08:21 (T-34)		
28	12:11	18	20:46 (T-29)	20:41	21	20:17 (T-48)	19:51	19:01	17:21			17:10	24		08:45 (T-34)		
29	06:18		20:29 (T-29)	06:47		19:58 (T-48)	07:18	07:49	07:25			07:56			08:21 (T-34)		
30	12:10	16	20:45 (T-29)	20:39	17	20:15 (T-48)	19:49	18:59	17:20			17:11	23		08:44 (T-34)		
31	06:19		20:29 (T-29)	06:48		20:00 (T-48)	07:19	07:50	07:26			07:57			08:22 (T-34)		
32	12:10	16	20:45 (T-29)	20:38	13	20:13 (T-48)	19:47	18:57	17:19			17:11	23		08:45 (T-34)		
33	06:20		20:29 (T-29)	06:49		20:04 (T-48)	07:20	07:51	07:28			07:57			08:23 (T-34)		
34	12:09	15	20:44 (T-29)	20:37	4	20:08 (T-48)	19:45	18:56	17:19			17:11	23		08:46 (T-34)		
35	06:21		20:30 (T-29)	06:50			07:21	07:53	07:29			07:58			08:22 (T-34)		
36	12:09	13	20:43 (T-29)	20:35			19:44	18:54	17:18			17:12	24		08:46 (T-34)		
37	06:22		20:30 (T-29)	06:51			07:22	07:54	07:30			07:59			08:23 (T-34)		
38	12:08	13	20:43 (T-29)	20:34			19:42	18:53	17:17			17:12	24		08:47 (T-34)		
39	06:23		20:05 (T-48)	06:52			07:23	07:55	07:31			07:59			08:24 (T-34)		
40	12:07	17	20:42 (T-29)	20:32			19:40	18:51	17:16			17:12	24		08:48 (T-34)		
41	06:23		20:03 (T-48)	06:53			07:24	07:56	07:32			08:00			08:24 (T-34)		
42	12:07	21	20:42 (T-29)	20:31			19:39	18:50	17:16			17:13	24		08:48 (T-34)		
43	06:24		20:00 (T-48)	06:54			07:25	07:57	07:34			08:00			08:24 (T-34)		
44	12:06	23	20:40 (T-29)	20:29			19:37	18:49	17:15			17:13	24		08:48 (T-34)		
45	06:25		19:59 (T-48)	06:55			07:26	07:58	07:35			08:01			08:25 (T-34)		
46	12:05	24	20:40 (T-29)	20:28			19:35	18:47	17:14			17:14	24		08:49 (T-34)		
47	06:26		19:58 (T-48)	06:56			07:27	07:59	07:36			08:01			08:25 (T-34)		
48	12:04	23	20:39 (T-29)	20:26			19:33	18:46	17:14			17:14	24		08:49 (T-34)		
49	06:27		19:57 (T-48)	06:57			07:28	08:00	07:37			08:02			08:26 (T-34)		
50	12:03	23	20:38 (T-29)	20:25			19:32	18:44	17:13			17:15	24		08:50 (T-34)		
51	06:28		19:56 (T-48)	06:58			07:29	08:02	07:38			08:02			08:26 (T-34)		
52	12:02	24	20:20 (T-48)	20:23			19:30	18:43	17:13	9	08:30 (T-34)	17:16	24		08:50 (T-34)		
53	06:29		19:56 (T-48)	06:59			07:30	08:03	07:39			08:20 (T-34)	08:02		08:27 (T-34)		
54	12:02	24	20:20 (T-48)	20:22			19:28	18:42	17:12	11	08:31 (T-34)	17:16	23		08:50 (T-34)		
55	06:30		19:55 (T-48)	07:00			07:31	08:04	07:40			08:19 (T-34)	08:03		08:28 (T-34)		
56	12:01	26	20:21 (T-48)	20:20			19:27	18:40	17:12	14	08:33 (T-34)	17:17	23		08:51 (T-34)		
57	06:31		19:55 (T-48)	07:01			07:32	08:05	07:41			08:19 (T-34)	08:03		08:28 (T-34)		
58	12:00	27	20:22 (T-48)	20:19			19:25	18:39	17:12	16	08:35 (T-34)	17:18	24		08:52 (T-34)		
59	06:32		19:54 (T-48)	07:02			07:33	08:06	07:42			08:19 (T-34)	08:03		08:28 (T-34)		
60	12:59	28	20:22 (T-48)	20:17			19:23	18:38	17:11	17	08:36 (T-34)	17:18	24		08:52 (T-34)		
61	06:33		19:53 (T-48)	07:03				08:07				08:03			08:29 (T-34)		
62	12:58	29	20:22 (T-48)	20:15				18:36				17:19	23		08:52 (T-34)		
Potential sun hours	459		428			375	345	298				288					
Total, worst case		627		429				67				709					
Sun reduction		0.75		0.74				0.42				0.38					
Oper. time red.		0.97		0.97				0.97				0.97					
Wind dir. red.		0.60		0.59				0.59				0.59					
Total reduction		0.43		0.42				0.24				0.22					
Total, real		271		182				16				152					

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

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2	08:04 17:21	07:49 17:56	07:12 18:30	07:21 20:03	06:36 20:35	06:08 21:04	20:23 (Alt-05) 06:10 20:40 (Alt-05) 21:15	20:27 (Alt-05) 06:35 20:50 (Alt-05) 20:55	07:05 20:12	07:35 19:20	07:10 17:34	07:44 17:11
3	08:04 17:22	07:48 17:57	07:11 18:31	07:20 20:04	06:35 20:36	06:08 21:05	20:23 (Alt-05) 06:11 20:41 (Alt-05) 21:15	20:27 (Alt-05) 06:36 20:49 (Alt-05) 20:54	07:06 20:11	07:36 19:18	07:11 17:33	07:45 17:11
4	08:04 17:23	07:47 17:58	07:09 18:32	07:18 20:05	06:34 20:37	06:08 21:05	20:22 (Alt-05) 06:11 20:41 (Alt-05) 21:14	20:28 (Alt-05) 06:36 20:49 (Alt-05) 20:53	07:07 20:09	07:37 19:17	07:12 17:32	07:46 17:10
5	08:04 17:24	07:46 18:00	07:08 18:33	07:16 20:06	06:32 20:38	06:07 21:06	20:22 (Alt-05) 06:12 20:42 (Alt-05) 21:14	20:28 (Alt-05) 06:37 20:49 (Alt-05) 20:52	07:08 20:07	07:38 19:15	07:13 17:30	07:47 17:10
6	08:04 17:25	07:45 18:01	07:06 18:34	07:15 20:07	06:31 20:39	06:07 21:07	20:22 (Alt-05) 06:12 20:42 (Alt-05) 21:14	20:28 (Alt-05) 06:38 20:49 (Alt-05) 20:51	07:09 20:06	07:40 19:13	07:14 17:29	07:48 17:10
7	08:04 17:26	07:44 18:02	07:04 18:36	07:13 20:08	06:30 20:40	06:07 21:07	20:22 (Alt-05) 06:13 20:42 (Alt-05) 21:14	20:28 (Alt-05) 06:39 20:48 (Alt-05) 20:50	07:10 20:04	07:41 19:12	07:16 17:28	07:49 17:10
8	08:04 17:27	07:43 18:03	08:03 19:37	07:12 20:09	06:29 20:41	06:06 21:08	20:22 (Alt-05) 06:14 20:43 (Alt-05) 21:13	20:29 (Alt-05) 06:40 20:48 (Alt-05) 20:49	07:11 20:02	07:42 19:10	07:17 17:27	07:50 17:10
9	08:04 17:28	07:41 18:05	08:01 19:38	07:10 20:10	06:28 20:42	06:06 21:09	20:22 (Alt-05) 06:14 20:44 (Alt-05) 21:13	20:30 (Alt-05) 06:41 20:48 (Alt-05) 20:47	07:12 20:01	07:43 19:08	07:18 17:26	07:51 17:10
10	08:04 17:29	07:40 18:06	08:00 19:39	07:08 20:11	06:27 20:43	06:06 21:09	20:22 (Alt-05) 06:15 20:44 (Alt-05) 21:13	20:30 (Alt-05) 06:42 20:47 (Alt-05) 20:46	07:13 19:57	07:44 19:07	07:19 17:25	07:52 17:10
11	08:04 17:30	07:39 18:07	07:58 19:40	07:07 20:12	06:25 20:44	06:06 21:10	20:22 (Alt-05) 06:16 20:45 (Alt-05) 21:12	20:31 (Alt-05) 06:43 20:47 (Alt-05) 20:45	07:14 19:56	07:45 19:05	07:20 17:24	07:53 17:10
12	08:03 17:31	07:38 18:08	07:56 19:41	07:05 20:13	06:24 20:45	06:06 21:10	20:22 (Alt-05) 06:16 20:46 (Alt-05) 21:12	20:32 (Alt-05) 06:44 20:47 (Alt-05) 20:43	07:15 19:54	07:46 19:04	07:22 17:23	07:54 17:10
13	08:02 17:32	07:36 18:10	07:55 19:42	07:04 20:14	06:23 20:46	06:06 21:11	20:23 (Alt-05) 06:17 20:46 (Alt-05) 21:11	20:32 (Alt-05) 06:45 20:46 (Alt-05) 20:42	07:16 19:52	07:47 19:02	07:23 17:22	07:54 17:10
14	08:02 17:33	07:35 18:11	07:53 19:43	07:02 20:15	06:22 20:47	06:06 21:11	20:23 (Alt-05) 06:18 20:47 (Alt-05) 21:11	20:32 (Alt-07) 06:46 20:46 (Alt-05) 20:41	07:17 19:51	07:48 19:01	07:24 17:21	07:55 17:11
15	08:02 17:34	07:34 18:12	07:51 19:44	07:00 20:17	06:21 20:48	06:06 21:12	20:23 (Alt-05) 06:19 20:47 (Alt-05) 21:10	20:33 (Alt-07) 06:47 20:45 (Alt-05) 20:39	07:18 19:49	07:49 18:59	07:25 17:20	07:56 17:11
16	08:01 17:35	07:33 18:13	07:50 19:46	06:59 20:18	06:20 20:49	06:06 21:12	20:23 (Alt-05) 06:19 20:47 (Alt-05) 21:10	20:33 (Alt-07) 06:48 20:45 (Alt-05) 20:38	07:19 19:47	07:50 18:57	07:26 17:20	07:57 17:11
17	08:01 17:37	07:31 18:15	07:48 19:47	06:57 20:19	06:19 20:50	06:06 21:13	20:23 (Alt-05) 06:20 20:47 (Alt-05) 21:09	20:32 (Alt-07) 06:49 20:44 (Alt-05) 20:37	07:20 19:45	07:51 18:56	07:28 17:19	07:57 17:11
18	08:00 17:38	07:30 18:16	07:46 19:48	06:56 20:20	06:18 20:51	06:06 21:13	20:23 (Alt-05) 06:21 20:47 (Alt-05) 21:09	20:33 (Alt-07) 06:50 20:43 (Alt-07) 20:35	07:21 19:44	07:52 18:54	07:29 17:18	07:58 17:12
19	08:00 17:39	07:29 18:17	07:45 19:49	06:54 20:21	06:18 20:52	06:06 21:13	20:23 (Alt-05) 06:22 20:48 (Alt-05) 21:08	20:33 (Alt-07) 06:51 20:43 (Alt-07) 20:34	07:22 19:42	07:54 18:53	07:30 17:17	07:59 17:12
20	07:59 17:40	07:27 18:18	07:43 19:50	06:53 20:22	06:17 20:53	06:06 21:14	20:26 (Alt-07) 06:06 20:30 (Alt-07) 21:14	20:34 (Alt-07) 06:52 20:48 (Alt-05) 21:07	07:23 19:40	07:55 18:51	07:31 17:16	07:59 17:12
21	07:59 17:41	07:26 18:19	07:41 19:51	06:51 20:23	06:16 20:54	06:06 21:14	20:25 (Alt-07) 06:06 20:30 (Alt-07) 21:14	20:48 (Alt-05) 06:23 20:49 (Alt-05) 21:06	8 7	07:24 19:39	07:32 18:50	08:00 17:16
22	07:58 17:42	07:24 18:21	07:40 19:52	06:50 20:24	06:15 20:55	06:06 21:14	20:24 (Alt-07) 06:06 20:31 (Alt-07) 21:14	20:24 (Alt-05) 06:24 20:49 (Alt-05) 21:06	7 6	07:25 19:37	07:33 18:49	08:00 17:15
23	07:57 17:44	07:23 18:22	07:38 19:53	06:48 20:25	06:14 20:56	06:07 21:14	20:24 (Alt-07) 06:07 20:32 (Alt-07) 21:14	20:24 (Alt-05) 06:25 20:49 (Alt-05) 21:05	6 5	07:26 19:35	07:58 18:47	07:35 17:15
24	07:57 17:45	07:21 18:23	07:36 19:54	06:47 20:26	06:14 20:56	06:07 21:14	20:24 (Alt-07) 06:07 20:33 (Alt-07) 21:14	20:24 (Alt-05) 06:26 20:49 (Alt-05) 21:04	5 2	07:27 19:33	07:59 18:46	07:36 17:14
25	07:56 17:46	07:20 18:24	07:35 19:55	06:46 20:27	06:13 20:57	06:07 21:15	20:24 (Alt-07) 06:07 20:33 (Alt-07) 21:15	20:25 (Alt-05) 06:27 20:50 (Alt-05) 21:03	06:57 20:25	07:28 19:32	07:37 18:44	07:37 17:15
26	07:55 17:47	07:18 18:25	07:33 19:56	06:44 20:28	06:12 20:58	06:07 21:15	20:23 (Alt-07) 06:07 20:34 (Alt-07) 21:15	20:25 (Alt-05) 06:28 20:49 (Alt-05) 21:02	06:58 20:23	07:29 19:30	07:38 18:43	07:38 17:16
27	07:54 17:48	07:17 18:26	07:31 19:57	06:43 20:29	06:12 20:59	06:08 21:15	20:24 (Alt-07) 06:08 20:35 (Alt-05) 21:15	20:25 (Alt-05) 06:29 20:49 (Alt-05) 21:01	06:59 20:22	07:30 19:28	07:39 18:42	07:39 17:16
28	07:54 17:50	07:15 18:28	07:30 19:58	06:41 20:30	06:11 21:00	06:08 21:15	20:23 (Alt-07) 06:08 20:36 (Alt-05) 21:15	20:26 (Alt-05) 06:30 20:50 (Alt-05) 21:01	07:00 20:20	07:31 19:27	07:40 18:40	07:40 17:17
29	07:53 17:51	07:28 20:00	07:28 20:31	06:40 21:01	06:10 21:01	06:09 21:15	20:24 (Alt-07) 06:09 20:37 (Alt-05) 21:15	20:26 (Alt-05) 06:31 20:49 (Alt-05) 21:00	07:01 20:19	07:32 19:25	07:41 18:39	07:41 17:18
30	07:52 17:52	07:26 20:00	07:26 20:32	06:39 21:02	06:10 21:02	06:09 21:15	20:24 (Alt-05) 06:09 20:37 (Alt-05) 21:15	20:27 (Alt-05) 06:32 20:50 (Alt-05) 20:59	07:02 20:17	07:33 19:23	07:42 18:38	07:42 17:19
31	07:51 17:53	07:25 20:01	07:25 20:01	06:09 21:02	06:09 21:02	06:09 21:02	20:24 (Alt-05) 06:09 20:38 (Alt-05) 20:58	20:33 (Alt-05) 06:33 20:58 (Alt-05) 20:58	07:03 20:15	08:07 18:36	07:35 17:19	08:03 17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case					118	678	348					
Sun reduction					0.68	0.74	0.75					
Oper. time red.					0.97	0.97	0.97					
Wind dir. red.					0.60	0.60	0.60					
Total reduction					0.39	0.43	0.44					
Total, real					47	291	151					

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)

Project:

Northwest Ohio

Description:

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR259 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	[January	[February	[March	[April	[May		[June	[July		[August		[September	[October	[November	[December
1	08:04	07:50	07:14	07:23	06:37		06:09	06:10		06:34	20:12 (Alt-05)	07:04	07:34	07:09	07:43
	17:20	17:55	18:29	20:02	20:33		21:03	21:15		20:57	20	20:32 (Alt-05)	20:14	19:22	17:35
2	08:04	07:49	07:12	07:21	06:36		06:08	06:10		06:35	20:12 (Alt-05)	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:35		21:04	21:15		20:55	19	20:31 (Alt-05)	20:12	19:20	17:34
3	08:04	07:48	07:11	07:20	06:35		06:08	06:11		06:36	20:13 (Alt-05)	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36		21:05	21:15		20:54	17	20:30 (Alt-05)	20:11	19:18	17:33
4	08:04	07:47	07:09	07:18	06:34	20:11 (Alt-05)	06:08	06:11		06:36	20:13 (Alt-05)	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	3	20:14 (Alt-05)	21:05	21:14	20:53	16	20:29 (Alt-05)	20:09	19:17	17:32
5	08:04	07:46	07:08	07:16	06:32	20:08 (Alt-05)	06:07	06:12		06:37	20:14 (Alt-05)	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	7	20:15 (Alt-05)	21:06	21:14	20:52	14	20:28 (Alt-05)	20:07	19:15	17:30
6	08:04	07:45	07:06	07:15	06:31	20:06 (Alt-05)	06:07	06:12		06:38	20:15 (Alt-05)	07:09	07:40	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	10	20:16 (Alt-05)	21:07	21:14	20:51	12	20:27 (Alt-05)	20:06	19:13	17:29
7	08:04	07:44	07:04	07:13	06:30	20:05 (Alt-05)	06:07	06:13		06:39	20:16 (Alt-05)	07:10	07:41	07:16	07:49
	17:26	18:02	18:36	20:08	20:40	12	20:17 (Alt-05)	21:07	21:14	20:50	10	20:26 (Alt-05)	20:04	19:12	17:28
8	08:04	07:43	08:03	07:12	06:29	20:04 (Alt-05)	06:06	06:14		06:40	20:18 (Alt-05)	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	14	20:18 (Alt-05)	21:08	21:13	20:48	6	20:24 (Alt-05)	20:02	19:10	17:27
9	08:03	07:41	08:01	07:10	06:28	20:03 (Alt-05)	06:06	06:14		06:41		07:12	07:43	07:18	07:51
	17:28	18:05	19:38	20:10	20:42	16	20:19 (Alt-05)	21:09	21:13	20:47		20:01	19:08	17:26	17:10
10	08:03	07:40	08:00	07:08	06:27	20:03 (Alt-05)	06:06	06:15		06:42		07:13	07:44	07:19	07:52
	17:29	18:06	19:39	20:11	20:43	17	20:20 (Alt-05)	21:09	21:13	20:46		19:57	19:07	17:25	17:10
11	08:03	07:39	07:58	07:07	06:25	20:03 (Alt-05)	06:06	06:16		06:43		07:14	07:45	07:20	07:53
	17:30	18:07	19:40	20:12	20:44	18	20:21 (Alt-05)	21:10	21:12	20:45		19:56	19:05	17:24	17:10
12	08:03	07:38	07:56	07:05	06:24	20:02 (Alt-05)	06:06	06:16		06:44		07:15	07:46	07:22	07:54
	17:31	18:08	19:41	20:13	20:45	20	20:22 (Alt-05)	21:10	21:12	20:43		19:54	19:04	17:23	17:10
13	08:02	07:36	07:55	07:04	06:23	20:02 (Alt-05)	06:06	06:17		06:45		07:16	07:47	07:23	07:54
	17:32	18:10	19:42	20:14	20:46	21	20:23 (Alt-05)	21:11	21:11	20:42		19:52	19:02	17:22	17:10
14	08:02	07:35	07:53	07:02	06:22	20:02 (Alt-05)	06:06	06:18		06:46		07:17	07:48	07:24	07:55
	17:33	18:11	19:43	20:15	20:47	22	20:24 (Alt-05)	21:11	21:11	20:41		19:51	19:01	17:21	17:11
15	08:02	07:34	07:51	07:00	06:21	20:02 (Alt-05)	06:06	06:19		06:47		07:18	07:49	07:25	07:56
	17:34	18:12	19:44	20:17	20:48	22	20:24 (Alt-05)	21:12	21:10	20:39		19:49	18:59	17:20	17:11
16	08:01	07:33	07:50	06:59	06:20	20:02 (Alt-05)	06:06	06:19		06:48		07:19	07:50	07:26	07:57
	17:35	18:13	19:46	20:18	20:49	22	20:24 (Alt-05)	21:12	21:10	20:38		19:47	18:57	17:20	17:11
17	08:01	07:31	07:48	06:57	06:19	20:02 (Alt-05)	06:06	06:20	20:21 (Alt-05)	06:49		07:20	07:51	07:28	07:57
	17:37	18:15	19:47	20:19	20:50	22	20:24 (Alt-05)	21:13	21:09	3	20:24 (Alt-05)	20:37	19:45	18:56	17:19
18	08:00	07:30	07:46	06:56	06:18	20:02 (Alt-05)	06:06	06:21	20:19 (Alt-05)	06:50		07:21	07:52	07:29	07:58
	17:38	18:16	19:48	20:20	20:51	21	20:23 (Alt-05)	21:13	21:09	8	20:27 (Alt-05)	20:35	19:44	18:54	17:18
19	08:00	07:29	07:45	06:54	06:18	20:03 (Alt-05)	06:06	06:22	20:17 (Alt-05)	06:51		07:22	07:54	07:30	07:59
	17:39	18:17	19:49	20:21	20:52	20	20:23 (Alt-05)	21:13	21:08	12	20:29 (Alt-05)	20:34	19:42	18:53	17:17
20	07:59	07:27	07:43	06:53	06:17	20:04 (Alt-05)	06:06	06:23	20:17 (Alt-05)	06:52		07:23	07:55	07:31	07:59
	17:40	18:18	19:50	20:22	20:53	19	20:23 (Alt-05)	21:14	21:07	13	20:30 (Alt-05)	20:32	19:40	18:51	17:16
21	07:59	07:26	07:41	06:51	06:16	20:05 (Alt-05)	06:06	06:23	20:16 (Alt-05)	06:53		07:24	07:56	07:32	08:00
	17:41	18:19	19:51	20:23	20:54	17	20:22 (Alt-05)	21:14	21:06	15	20:31 (Alt-05)	20:31	19:39	18:50	17:16
22	07:58	07:24	07:40	06:50	06:15	20:05 (Alt-05)	06:06	06:24	20:14 (Alt-05)	06:54		07:25	07:57	07:33	08:00
	17:42	18:21	19:52	20:24	20:55	16	20:21 (Alt-05)	21:14	21:06	17	20:31 (Alt-05)	20:29	19:37	18:49	17:15
23	07:57	07:23	07:38	06:48	06:14	20:06 (Alt-05)	06:07	06:25	20:14 (Alt-05)	06:55		07:26	07:58	07:35	08:01
	17:44	18:22	19:53	20:25	20:56	14	20:20 (Alt-05)	21:14	21:05	18	20:32 (Alt-05)	20:28	19:35	18:47	17:15
24	07:57	07:21	07:36	06:47	06:14	20:07 (Alt-05)	06:07	06:26	20:13 (Alt-05)	06:56		07:27	07:59	07:36	08:01
	17:45	18:23	19:54	20:26	20:56	13	20:20 (Alt-05)	21:14	21:04	20	20:33 (Alt-05)	20:26	19:33	18:46	17:14
25	07:56	07:20	07:35	06:46	06:13	20:09 (Alt-05)	06:07	06:27	20:13 (Alt-05)	06:57		07:28	08:00	07:37	08:02
	17:46	18:24	19:55	20:27	20:57	9	20:18 (Alt-05)	21:15	21:03	21	20:34 (Alt-05)	20:25	19:32	18:44	17:13
26	07:55	07:18	07:33	06:44	06:12	20:10 (Alt-05)	06:07	06:28	20:13 (Alt-05)	06:58		07:29	08:02	07:38	08:02
	17:47	18:25	19:56	20:28	20:58	6	20:16 (Alt-05)	21:15	21:02	21	20:34 (Alt-05)	20:23	19:30	18:43	17:13
27	07:54	07:17	07:31	06:43	06:12		06:08	06:29	20:13 (Alt-05)	06:59		07:30	08:03	07:39	08:02
	17:48	18:26	19:57	20:29	20:59		21:15	21:01	21	20:34 (Alt-05)	20:22	19:28	18:42	17:12	17:16
28	07:54	07:15	07:30	06:41	06:11		06:08	06:30	20:13 (Alt-05)	07:00		07:31	08:04	07:40	08:03
	17:50	18:28	19:58	20:30	21:00		21:15	21:01	22	20:35 (Alt-05)	20:20	19:27	18:40	17:12	17:17
29	07:53		07:28	06:40	06:10		06:09	06:31	20:13 (Alt-05)	07:01		07:32	08:05	07:41	08:03
	17:51		20:00	20:31	21:01		21:15	21:00	22	20:35 (Alt-05)	20:19	19:25	18:39	17:12	17:18
30	07:52		07:26	06:39	06:10		06:09	06:32	20:13 (Alt-05)	07:02		07:33	08:06	07:42	08:03
	17:52		20:00	20:32	21:02		21:15	20:59	21	20:34 (Alt-05)	20:17	19:23	18:38	17:11	17:19
31	07:51		07:25		06:09			06:33	20:12 (Alt-05)	07:03			08:07		08:03
	17:53		20:01		21:02			20:58	21	20:33 (Alt-05)	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448		452	459		428		375	345	298	288
Total, worst case					361			255		114					
Sun reduction					0.68			0.75		0.74					
Oper. time red.					0.97			0.97		0.97					
Wind dir. red.					0.60			0.60		0.60					
Total reduction					0.39			0.43		0.43					
Total, real					142			111		49					

Project:

Northwest Ohio

Description:

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US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR260 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

January		February		March		April		May		June	
1	08:04	07:50	16:59 (T-49)	07:14	07:23	06:37	19:52 (T-48)	06:09			
	17:20	17:55	28 17:27 (T-49)	18:29	20:02	20:34	16 20:08 (T-48)	21:03			
2	08:04	07:49	16:59 (T-49)	07:12	07:21	06:36	19:53 (T-48)	06:08			
	17:21	17:56	29 17:28 (T-49)	18:30	20:03	20:35	14 20:07 (T-48)	21:04			
3	08:04	07:48	16:59 (T-49)	07:11	07:20	06:35	19:54 (T-48)	06:08			
	17:22	17:57	30 17:29 (T-49)	18:31	20:04	20:36	12 20:06 (T-48)	21:05			
4	08:04	07:47	16:59 (T-49)	07:09	07:18	06:34	19:55 (T-48)	06:07			
	17:23	17:58	30 17:29 (T-49)	18:32	20:05	20:37	8 20:03 (T-48)	21:05			
5	08:04	07:46	16:59 (T-49)	07:08	07:16	06:32		06:07			
	17:24	18:00	31 17:30 (T-49)	18:33	20:06	20:38		21:06			
6	08:04	07:45	16:59 (T-49)	07:06	07:15	06:31		06:07			
	17:25	18:01	31 17:30 (T-49)	18:34	20:07	20:39		21:07			
7	08:04	07:44	16:59 (T-49)	07:04	07:13	06:30		06:07			
	17:26	18:02	31 17:30 (T-49)	18:36	20:08	20:40		21:08			
8	08:04	07:43	17:00 (T-49)	08:03	07:12	06:29		06:06			
	17:27	18:03	31 17:31 (T-49)	19:37	20:09	20:41		21:08			
9	08:03	07:41	16:59 (T-49)	08:01	07:10	06:28		06:06			
	17:28	18:05	31 17:30 (T-49)	19:38	20:10	20:42		21:09			
10	08:03	07:40	17:00 (T-49)	08:00	07:08	06:26		06:06			
	17:29	18:06	30 17:30 (T-49)	19:39	20:11	20:43		21:09			
11	08:03	07:39	17:01 (T-49)	07:58	07:07	06:25		06:06			
	17:30	18:07	28 17:29 (T-49)	19:40	20:12	20:44		21:10			
12	08:03	07:38	17:02 (T-49)	07:56	07:05	06:24		06:06			
	17:31	18:08	27 17:29 (T-49)	19:41	20:13	20:45		21:10			
13	08:02	07:37	17:02 (T-49)	07:55	07:04	06:23		06:06			
	17:32	18:10	26 17:28 (T-49)	19:42	20:14	20:46		21:11			
14	08:02	07:35	17:03 (T-49)	07:53	07:02	06:22		06:05			
	17:33	18:11	24 17:27 (T-49)	19:43	20:15	20:47		21:11			
15	08:02	07:34	17:05 (T-49)	07:51	07:00	06:21		06:05			
	17:34	18:12	21 17:26 (T-49)	19:44	20:17	20:48		21:12			
16	08:01	07:33	17:06 (T-49)	07:50	06:59	06:20		06:05			
	17:35	18:13	17 17:23 (T-49)	19:46	20:18	20:49		21:12			
17	08:01	07:31	17:09 (T-49)	07:48	06:57	06:19		06:06			
	17:36	18:14	12 17:21 (T-49)	19:47	20:19	20:50		21:13			
18	08:00	07:30		07:46	06:56	06:18		06:06			
	17:38	18:16		19:48	20:20	20:51		21:13			
19	08:00	07:29		07:45	06:54	06:17		06:06			
	17:39	18:17		19:49	20:21	20:52		21:13			
20	07:59	07:27		07:43	06:53	06:17		06:06			
	17:40	18:18		19:50	20:22	20:53		21:14			
21	07:59	07:26		07:41	06:51	19:57 (T-48)	06:16	06:06			
	17:41	18:19		19:51	20:23	5 20:02 (T-48)	20:54	21:14			
22	07:58	07:24		07:40	06:50	19:55 (T-48)	06:15	06:06			
	17:42	18:20		19:52	20:24	7 20:02 (T-48)	20:55	21:14			
23	07:57	07:23		07:38	06:48	19:54 (T-48)	06:14	06:06			
	17:44	18:22		19:53	20:25	10 20:04 (T-48)	20:56	21:14			
24	07:57	07:21		07:36	06:47	19:52 (T-48)	06:13	06:07			
	17:45	18:23		19:54	20:26	12 20:04 (T-48)	20:57	21:15			
25	07:56	17:07 (T-49)	07:20	07:35	06:46	19:52 (T-48)	06:13	06:07			
	17:46	11 17:18 (T-49)	18:24	19:55	20:27	14 20:06 (T-48)	20:57	21:15			
26	07:55	17:05 (T-49)	07:18	07:33	06:44	19:52 (T-48)	06:12	06:07			
	17:47	15 17:20 (T-49)	18:25	19:56	20:28	15 20:07 (T-48)	20:58	21:15			
27	07:54	17:04 (T-49)	07:17	07:31	06:43	19:51 (T-48)	06:11	06:08			
	17:48	18 17:22 (T-49)	18:26	19:57	20:29	16 20:07 (T-48)	20:59	21:15			
28	07:54	17:02 (T-49)	07:15	07:30	06:41	19:51 (T-48)	06:11	06:08			
	17:50	21 17:23 (T-49)	18:28	19:58	20:30	18 20:09 (T-48)	21:00	21:15			
29	07:53	17:01 (T-49)		07:28	06:40	19:51 (T-48)	06:10	06:09			
	17:51	24 17:25 (T-49)		20:00	20:31	19 20:10 (T-48)	21:01	21:15			
30	07:52	17:01 (T-49)		07:26	06:39	19:51 (T-48)	06:10	06:09			
	17:52	25 17:26 (T-49)		20:00	20:32	18 20:09 (T-48)	21:02	21:15			
31	07:51	17:00 (T-49)		07:25			06:09				
	17:53	27 17:27 (T-49)		20:01			21:02				
Potential sun hours	298		297		370	398	448		452		
Total, worst case	141		457			134		50			
Sun reduction	0.46		0.51			0.60		0.68			
Oper. time red.	0.97		0.97			0.97		0.97			
Wind dir. red.	0.69		0.69			0.60		0.60			
Total reduction	0.31		0.34			0.35		0.40			
Total, real	44		157			47		20			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
--------------	------------------	-----------------	----------------------	---------------------------------	--------------------------------	----------------------------------	---------------------------------

Project:

Northwest Ohio

Description:

EAPC does not warrant, guarantee, or make any such representations regarding the contents of this report. EAPC cannot be held liable for erroneous results caused by errors or omissions in the delivered data, or inaccuracy, limitations, or malfunctioning of models or software used. For any claim whatsoever related to the subject matter of this report, the liability of EAPC for actual damages, regardless of the form of action, shall be limited to the total amount paid to EAPC for the services provided as part of this consultancy service.

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Licensed user:

EAPC Wind Energy
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wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR260 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

July		August		September		October		November		December	
1	06:09	06:33			07:04	07:34		07:09	16:30 (T-49)	07:43	
	21:15	20:57			20:14	19:22		17:35	29	16:59 (T-49)	17:11
2	06:10	06:34			07:05	07:35		07:10		16:29 (T-49)	07:44
	21:15	20:55			20:12	19:20		17:34	30	16:59 (T-49)	17:11
3	06:10	06:35			07:06	07:36		07:11		16:28 (T-49)	07:45
	21:15	20:54			20:11	19:18		17:33	31	16:59 (T-49)	17:10
4	06:11	06:36			07:07	07:37		07:12		16:29 (T-49)	07:46
	21:14	20:53			20:09	19:17		17:31	31	17:00 (T-49)	17:10
5	06:12	06:37			07:08	07:38		07:13		16:29 (T-49)	07:47
	21:14	20:52			20:07	19:15		17:30	31	17:00 (T-49)	17:10
6	06:12	06:38			07:09	07:40		07:15		16:29 (T-49)	07:48
	21:14	20:51			20:06	19:13		17:29	31	17:00 (T-49)	17:10
7	06:13	06:39			07:10	07:41		07:16		16:29 (T-49)	07:49
	21:14	20:50			20:04	19:12		17:28	30	16:59 (T-49)	17:10
8	06:13	06:40		20:07 (T-48)	07:11	07:42		07:17		16:30 (T-49)	07:50
	21:13	20:49	4	20:11 (T-48)	20:02	19:10		17:27	30	17:00 (T-49)	17:10
9	06:14	06:41		20:04 (T-48)	07:12	07:43		07:18		16:30 (T-49)	07:51
	21:13	20:47	10	20:14 (T-48)	20:01	19:08		17:26	29	16:59 (T-49)	17:10
10	06:15	06:42		20:02 (T-48)	07:13	07:44		07:19		16:30 (T-49)	07:52
	21:13	20:46	13	20:15 (T-48)	19:57	19:07		17:25	28	16:58 (T-49)	17:10
11	06:15	06:43		20:01 (T-48)	07:14	07:45		07:21		16:32 (T-49)	07:53
	21:12	20:45	15	20:16 (T-48)	19:56	19:05		17:24	27	16:59 (T-49)	17:10
12	06:16	06:44		20:00 (T-48)	07:15	07:46		07:22		16:33 (T-49)	07:54
	21:12	20:43	17	20:17 (T-48)	19:54	19:04		17:23	25	16:58 (T-49)	17:10
13	06:17	06:45		19:59 (T-48)	07:16	07:47		07:23		16:33 (T-49)	07:54
	21:11	20:42	18	20:17 (T-48)	19:52	19:02		17:22	24	16:57 (T-49)	17:10
14	06:18	06:46		19:59 (T-48)	07:17	07:48		07:24		16:34 (T-49)	07:55
	21:11	20:41	18	20:17 (T-48)	19:51	19:01		17:21	21	16:55 (T-49)	17:10
15	06:18	06:47		19:59 (T-48)	07:18	07:49		07:25		16:37 (T-49)	07:56
	21:10	20:39	17	20:16 (T-48)	19:49	18:59		17:20	18	16:55 (T-49)	17:11
16	06:19	06:48		19:58 (T-48)	07:19	07:50		07:26		16:38 (T-49)	07:57
	21:10	20:38	17	20:15 (T-48)	19:47	18:57		17:19	15	16:53 (T-49)	17:11
17	06:20	06:49		19:58 (T-48)	07:20	07:51		07:28		16:40 (T-49)	07:57
	21:09	20:37	15	20:13 (T-48)	19:45	18:56		17:19	11	16:51 (T-49)	17:11
18	06:21	06:50		19:58 (T-48)	07:21	07:52		07:29			07:58
	21:09	20:35	13	20:11 (T-48)	19:44	18:54		17:18			17:12
19	06:22	06:51		19:58 (T-48)	07:22	07:54		07:30			07:59
	21:08	20:34	12	20:10 (T-48)	19:42	18:53		17:17			17:12
20	06:23	06:52		19:59 (T-48)	07:23	07:55		07:31			07:59
	21:07	20:32	9	20:08 (T-48)	19:40	18:51		17:16			17:12
21	06:23	06:53		20:00 (T-48)	07:24	07:56		07:32			08:00
	21:07	20:31	7	20:07 (T-48)	19:39	18:50		17:16			17:13
22	06:24	06:54		20:01 (T-48)	07:25	07:57		07:33			08:00
	21:06	20:29	5	20:06 (T-48)	19:37	18:48		17:15			17:13
23	06:25	06:55			07:26	07:58		07:35			08:01
	21:05	20:28			19:35	18:47		17:14			17:14
24	06:26	06:56			07:27	07:59	17:42 (T-49)	07:36			08:01
	21:04	20:26			19:33	18:46	6	17:48 (T-49)	17:14		17:14
25	06:27	06:57			07:28	08:00		17:38 (T-49)	07:37		08:02
	21:03	20:25			19:32	18:44	14	17:52 (T-49)	17:13		17:15
26	06:28	06:58			07:29	08:02		17:35 (T-49)	07:38		08:02
	21:02	20:23			19:30	18:43	19	17:54 (T-49)	17:13		17:16
27	06:29	06:59			07:30	08:03		17:34 (T-49)	07:39		08:02
	21:02	20:22			19:28	18:42	22	17:56 (T-49)	17:12		17:16
28	06:30	07:00			07:31	08:04		17:33 (T-49)	07:40		08:03
	21:01	20:20			19:27	18:40	24	17:57 (T-49)	17:12		17:17
29	06:31	07:01			07:32	08:05		17:31 (T-49)	07:41		08:03
	21:00	20:19			19:25	18:39	26	17:57 (T-49)	17:12		17:18
30	06:32	07:02			07:33	08:06		17:30 (T-49)	07:42		08:03
	20:59	20:17			19:23	18:38	28	17:58 (T-49)	17:11		17:18
31	06:33	07:03				08:07		17:30 (T-49)			08:03
	20:58	20:15				18:36	29	17:59 (T-49)			17:19
Potential sun hours	459	428			375	345		298			288
Total, worst case			190			168		441			
Sun reduction			0.74			0.62		0.42			
Oper. time red.			0.97			0.97		0.97			
Wind dir. red.			0.60			0.69		0.69			
Total reduction			0.44			0.42		0.28			
Total, real			83			70		124			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:

Northwest Ohio

Description:

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5/21/2013 8:45 AM / 357

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US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR261 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:04	07:50	07:14	07:23	06:37	06:09	06:09	06:34	07:04	07:34	07:09	07:43
	17:20	17:55	18:29	20:02	20:33	21:03	21:15	20:56	20:14	19:22	17:35	17:11
2	08:04	07:49	07:12	07:21	06:36	06:08	06:10	06:34	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:35	21:04	21:15	20:55	20:12	19:20	17:34	17:11
3	08:04	07:48	07:11	07:20	06:35	06:08	06:10	06:35	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36	21:05	21:15	20:54	20:11	19:18	17:33	17:10
4	08:04	07:47	07:09	07:18	06:34	06:07	06:11	06:36	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	21:05	21:14	20:53	20:09	19:17	17:31	17:10
5	08:04	07:46	07:08	07:16	06:32	06:07	06:12	06:37	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	21:06	21:14	20:52	20:07	19:15	17:30	17:10
6	08:04	07:45	07:06	07:15	06:31	06:07	06:12	06:38	07:09	07:39	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	21:07	21:14	20:51	20:06	19:13	17:29	17:10
7	08:04	07:44	07:04	07:13	06:30	06:07	06:13	06:39	07:10	07:41	07:16	07:49
	17:26	18:02	18:36	20:08	20:40	21:07	21:14	20:50	20:04	19:12	17:28	17:10
8	08:04	07:43	08:03	07:12	06:29	06:06	06:13	06:40	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	21:08	21:13	20:48	20:02	19:10	17:27	17:10
9	08:03	07:41	08:01	07:10	06:28	06:06	06:14	06:41	07:12	07:43	07:18	07:51
	17:28	18:05	19:38	20:10	20:42	21:09	21:13	20:47	20:01	19:08	17:26	17:10
10	08:03	07:40	08:00	07:08	06:26	06:06	06:15	06:42	07:13	07:44	07:19	07:52
	17:29	18:06	19:39	20:11	20:43	21:09	21:13	20:46	19:57	19:07	17:25	17:10
11	08:03	07:39	07:58	07:07	06:25	06:06	06:15	06:43	07:14	07:45	07:20	07:53
	17:30	18:07	19:40	20:12	20:44	21:10	21:12	20:45	19:56	19:05	17:24	17:10
12	08:03	07:38	07:56	07:05	06:24	06:06	06:16	06:44	07:15	07:46	07:22	07:54
	17:31	18:08	19:41	20:13	20:45	21:10	21:12	20:43	19:54	19:04	17:23	17:10
13	08:02	07:36	07:55	07:04	06:23	06:06	06:17	06:45	07:16	07:47	07:23	07:54
	17:32	18:10	19:42	20:14	20:46	21:11	21:11	20:42	19:52	19:02	17:22	17:10
14	08:02	07:35	07:53	07:02	06:22	06:05	06:18	06:46	07:17	07:48	07:24	07:55
	17:33	18:11	19:43	20:15	20:47	21:11	21:11	20:41	19:51	19:00	17:21	17:10
15	08:02	07:34	07:51	07:00	06:21	06:05	06:18	06:47	07:18	07:49	07:25	07:56
	17:34	18:12	19:44	20:17	20:48	21:12	21:10	20:39	19:49	18:59	17:20	17:11
16	08:01	07:33	07:50	06:59	06:20	06:05	06:19	06:48	07:19	07:50	07:26	07:57
	17:35	18:13	19:46	20:18	20:49	21:12	21:10	20:38	19:47	18:57	17:19	17:11
17	08:01	07:31	07:48	06:57	06:19	06:06	06:20	06:49	07:20	07:51	07:28	07:57
	17:36	18:14	19:47	20:19	20:50	21:13	21:09	20:37	19:45	18:56	17:19	17:11
18	08:00	07:30	07:46	06:56	06:18	06:06	06:21	06:50	07:21	07:52	07:29	07:58
	17:38	18:16	19:48	20:20	20:51	21:13	21:09	20:35	19:44	18:54	17:18	17:12
19	08:00	07:28	07:45	06:54	06:17	06:06	06:22	06:51	07:22	07:54	07:30	07:59
	17:39	18:17	19:49	20:21	20:52	21:13	21:08	20:34	19:42	18:53	17:17	17:12
20	07:59	07:27	07:43	06:53	06:17	06:06	06:23	06:52	07:23	07:55	07:31	07:59
	17:40	18:18	19:50	20:22	20:53	21:14	21:07	20:32	19:40	18:51	17:16	17:12
21	07:59	07:26	07:41	06:51	06:16	06:06	06:23	06:53	07:24	07:56	07:32	08:00
	17:41	18:19	19:51	20:23	20:54	21:14	21:06	20:31	19:39	18:50	17:16	17:13
22	07:58	07:24	07:40	06:50	06:15	06:06	06:24	06:54	07:25	07:57	07:33	08:00
	17:42	18:20	19:52	20:24	20:55	21:14	21:06	20:29	19:37	18:48	17:15	17:13
23	07:57	07:23	07:38	06:48	06:14	06:06	06:25	06:55	07:26	07:58	07:35	08:01
	17:44	18:22	19:53	20:25	20:56	21:14	21:05	20:28	19:35	18:47	17:14	17:14
24	07:57	07:21	07:36	06:47	06:14	06:07	06:26	06:56	07:27	07:59	07:36	08:01
	17:45	18:23	19:54	20:26	20:56	21:14	21:04	20:26	19:33	18:46	17:14	17:14
25	07:56	07:20	07:35	06:46	06:13	06:07	06:27	06:57	07:28	08:00	07:37	08:02
	17:46	18:24	19:55	20:27	20:57	21:15	21:03	20:25	19:32	18:44	17:13	17:15
26	07:55	07:18	07:33	06:44	06:12	06:07	06:28	06:58	07:29	08:02	07:38	08:02
	17:47	18:25	19:56	20:28	20:58	21:15	21:02	20:23	19:30	18:43	17:13	17:16
27	07:54	07:17	07:31	06:43	06:11	06:08	06:29	06:59	07:30	08:03	07:39	08:02
	17:48	18:26	19:57	20:29	20:59	21:15	21:01	20:22	19:28	18:42	17:12	17:16
28	07:54	07:15	07:30	06:41	06:11	06:08	06:30	07:00	07:31	08:04	07:40	08:03
	17:50	18:28	19:58	20:30	21:00	21:15	21:01	20:20	19:27	18:40	17:12	17:17
29	07:53		07:28	06:40	06:10	06:09	06:31	07:01	07:32	08:05	07:41	08:03
	17:51		20:00	20:31	21:01	21:15	21:00	20:19	19:25	18:39	17:12	17:18
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31	07:51		07:25		06:09		06:33	07:03		08:07		08:03
	17:53		20:01		21:02		20:58	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)

Project:

Northwest Ohio

Description:

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3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR262 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:04	07:50	07:14	07:23	06:37	06:09	06:09	06:33	07:04	07:34	07:09	07:43
	17:20	17:55	18:29	20:02	20:33	21:03	21:15	20:57	20:14	19:22	17:35	17:11
2	08:04	07:49	07:12	07:21	06:36	06:08	06:10	06:34	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:35	21:04	21:15	20:55	20:12	19:20	17:34	17:11
3	08:04	07:48	07:11	07:20	06:35	06:08	06:10	06:35	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36	21:05	21:15	20:54	20:11	19:18	17:33	17:10
4	08:04	07:47	07:09	07:18	06:34	06:07	06:11	06:36	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	21:05	21:14	20:53	20:09	19:17	17:31	17:10
5	08:04	07:46	07:08	07:16	06:32	06:07	06:12	06:37	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	21:06	21:14	20:52	20:07	19:15	17:30	17:10
6	08:04	07:45	07:06	07:15	06:31	06:07	06:12	06:38	07:09	07:39	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	21:07	21:14	20:51	20:06	19:13	17:29	17:10
7	08:04	07:44	07:04	07:13	06:30	06:07	06:13	06:39	07:10	07:41	07:16	07:49
	17:26	18:02	18:36	20:08	20:40	21:07	21:14	20:50	20:04	19:12	17:28	17:10
8	08:04	07:43	08:03	07:12	06:29	06:06	06:13	06:40	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	21:08	21:13	20:48	20:02	19:10	17:27	17:10
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	17:29	18:06	19:39	20:11	20:43	21:09	21:13	20:46	19:57	19:07	17:25	17:10
11	08:03	07:39	07:58	07:07	06:25	06:06	06:15	06:43	07:14	07:45	07:20	07:53
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16	08:01	07:33	07:50	06:59	06:20	06:05	06:19	06:48	07:19	07:50	07:26	07:57
	17:35	18:13	19:46	20:18	20:49	21:12	21:10	20:38	19:47	18:57	17:19	17:11
17	08:01	07:31	07:48	06:57	06:19	06:06	06:20	06:49	07:20	07:51	07:28	07:57
	17:36	18:14	19:47	20:19	20:50	21:13	21:09	20:37	19:45	18:56	17:19	17:11
18	08:00	07:30	07:46	06:56	06:18	06:06	06:21	06:50	07:21	07:52	07:29	07:58
	17:38	18:16	19:48	20:20	20:51	21:13	21:09	20:35	19:44	18:54	17:18	17:12
19	08:00	07:28	07:45	06:54	06:17	06:06	06:22	06:51	07:22	07:54	07:30	07:59
	17:39	18:17	19:49	20:21	20:52	21:13	21:08	20:34	19:42	18:53	17:17	17:12
20	07:59	07:27	07:43	06:53	06:17	06:06	06:23	06:52	07:23	07:55	07:31	07:59
	17:40	18:18	19:50	20:22	20:53	21:14	21:07	20:32	19:40	18:51	17:16	17:12
21	07:59	07:26	07:41	06:51	06:16	06:06	06:23	06:53	07:24	07:56	07:32	08:00
	17:41	18:19	19:51	20:23	20:54	21:14	21:06	20:31	19:39	18:50	17:16	17:13
22	07:58	07:24	07:40	06:50	06:15	06:06	06:24	06:54	07:25	07:57	07:33	08:00
	17:42	18:20	19:52	20:24	20:55	21:14	21:06	20:29	19:37	18:48	17:15	17:13
23	07:57	07:23	07:38	06:48	06:14	06:06	06:25	06:55	07:26	07:58	07:35	08:01
	17:44	18:22	19:53	20:25	20:56	21:14	21:05	20:28	19:35	18:47	17:14	17:14
24	07:57	07:21	07:36	06:47	06:13	06:07	06:26	06:56	07:27	07:59	07:36	08:01
	17:45	18:23	19:54	20:26	20:56	21:14	21:04	20:26	19:33	18:46	17:14	17:14
25	07:56	07:20	07:35	06:46	06:13	06:07	06:27	06:57	07:28	08:00	07:37	08:02
	17:46	18:24	19:55	20:27	20:57	21:15	21:03	20:25	19:32	18:44	17:13	17:15
26	07:55	07:18	07:33	06:44	06:12	06:07	06:28	06:58	07:29	08:02	07:38	08:02
	17:47	18:25	19:56	20:28	20:58	21:15	21:02	20:23	19:30	18:43	17:13	17:16
27	07:54	07:17	07:31	06:43	06:11	06:08	06:29	06:59	07:30	08:03	07:39	08:02
	17:48	18:26	19:57	20:29	20:59	21:15	21:01	20:22	19:28	18:42	17:12	17:16
28	07:54	07:15	07:30	06:41	06:11	06:08	06:30	07:00	07:31	08:04	07:40	08:03
	17:50	18:28	19:58	20:30	21:00	21:15	21:01	20:20	19:27	18:40	17:12	17:17
29	07:53		07:28	06:40	06:10	06:09	06:31	07:01	07:32	08:05	07:41	08:03
	17:51		20:00	20:31	21:01	21:15	21:00	20:19	19:25	18:39	17:12	17:18
30	07:52		07:26	06:39	06:10	06:09	06:32	07:02	07:33	08:06	07:42	08:03
	17:52		20:00	20:32	21:02	21:15	20:59	20:17	19:23	18:38	17:11	17:18
31	07:51		07:25		06:09		06:33	07:03		08:07		08:03
	17:53		20:01		21:02		20:58	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
--------------	------------------	-----------------	----------------------	---------------------------------	--------------------------------	----------------------------------	---------------------------------

Project:

Northwest Ohio

Description:

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 3100 DeMers Avenue
 US-GRAND FORKS, ND 58201
 +1 701 775 3000
 wind@eapc.net
 Calculated:
 5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR263 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:04	07:50	07:14	07:23	06:37	06:09	06:09	06:33	07:04	07:34	07:09	07:43
	17:20	17:55	18:29	20:02	20:33	21:03	21:15	20:56	20:14	19:22	17:35	17:11
2	08:04	07:49	07:12	07:21	06:36	06:08	06:10	06:34	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:35	21:04	21:15	20:55	20:12	19:20	17:34	17:11
3	08:04	07:48	07:11	07:20	06:35	06:08	06:10	06:35	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36	21:05	21:15	20:54	20:11	19:18	17:33	17:10
4	08:04	07:47	07:09	07:18	06:34	06:07	06:11	06:36	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	21:05	21:14	20:53	20:09	19:17	17:31	17:10
5	08:04	07:46	07:08	07:16	06:32	06:07	06:12	06:37	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	21:06	21:14	20:52	20:07	19:15	17:30	17:10
6	08:04	07:45	07:06	07:15	06:31	06:07	06:12	06:38	07:09	07:39	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	21:07	21:14	20:51	20:06	19:13	17:29	17:10
7	08:04	07:44	07:04	07:13	06:30	06:07	06:13	06:39	07:10	07:41	07:16	07:49
	17:26	18:02	18:36	20:08	20:40	21:07	21:14	20:50	20:04	19:12	17:28	17:10
8	08:04	07:42	08:03	07:12	06:29	06:06	06:13	06:40	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	21:08	21:13	20:48	20:02	19:10	17:27	17:10
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	17:38	18:16	19:48	20:20	20:51	21:13	21:09	20:35	19:44	18:54	17:18	17:12
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25	07:56	07:20	07:35	06:46	06:13	06:07	06:27	06:57	07:28	08:00	07:37	08:02
	17:46	18:24	19:55	20:27	20:57	21:15	21:03	20:25	19:32	18:44	17:13	17:15
26	07:55	07:18	07:33	06:44	06:12	06:07	06:28	06:58	07:29	08:02	07:38	08:02
	17:47	18:25	19:56	20:28	20:58	21:15	21:02	20:23	19:30	18:43	17:13	17:16
27	07:54	07:17	07:31	06:43	06:11	06:08	06:29	06:59	07:30	08:03	07:39	08:02
	17:48	18:26	19:57	20:29	20:59	21:15	21:01	20:22	19:28	18:42	17:12	17:16
28	07:54	07:15	07:30	06:41	06:11	06:08	06:30	07:00	07:31	08:04	07:40	08:03
	17:50	18:27	19:58	20:30	21:00	21:15	21:01	20:20	19:27	18:40	17:12	17:17
29	07:53		07:28	06:40	06:10	06:09	06:31	07:01	07:32	08:05	07:41	08:03
	17:51		19:59	20:31	21:01	21:15	21:00	20:19	19:25	18:39	17:12	17:18
30	07:52		07:26	06:39	06:10	06:09	06:32	07:02	07:33	08:06	07:42	08:03
	17:52		20:01	20:32	21:02	21:15	20:59	20:17	19:23	18:38	17:11	17:18
31	07:51		07:25		06:09		06:33	07:03		08:07		08:03
	17:53		20:01		21:02		20:58	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)

Project:

Northwest Ohio

Description:

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5/21/2013 8:45 AM / 360

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EAPC Wind Energy
3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR264 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:04	07:50	07:14	07:23	06:37	06:09	06:09	06:33	07:04	07:34	07:09	07:43
	17:20	17:55	18:29	20:02	20:33	21:03	21:15	20:56	20:14	19:22	17:35	17:11
2	08:04	07:49	07:12	07:21	06:36	06:08	06:10	06:34	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:35	21:04	21:15	20:55	20:12	19:20	17:34	17:11
3	08:04	07:48	07:11	07:20	06:35	06:08	06:10	06:35	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36	21:05	21:15	20:54	20:11	19:18	17:33	17:10
4	08:04	07:47	07:09	07:18	06:33	06:07	06:11	06:36	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	21:05	21:14	20:53	20:09	19:17	17:31	17:10
5	08:04	07:46	07:08	07:16	06:32	06:07	06:12	06:37	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	21:06	21:14	20:52	20:07	19:15	17:30	17:10
6	08:04	07:45	07:06	07:15	06:31	06:07	06:12	06:38	07:09	07:39	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	21:07	21:14	20:51	20:06	19:13	17:29	17:10
7	08:04	07:44	07:04	07:13	06:30	06:07	06:13	06:39	07:10	07:41	07:16	07:49
	17:26	18:02	18:36	20:08	20:40	21:07	21:14	20:50	20:04	19:12	17:28	17:10
8	08:04	07:42	08:03	07:12	06:29	06:06	06:13	06:40	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	21:08	21:13	20:48	20:02	19:10	17:27	17:10
9	08:03	07:41	08:01	07:10	06:28	06:06	06:14	06:41	07:12	07:43	07:18	07:51
	17:28	18:05	19:38	20:10	20:42	21:09	21:13	20:47	20:01	19:08	17:26	17:10
10	08:03	07:40	08:00	07:08	06:26	06:06	06:15	06:42	07:13	07:44	07:19	07:52
	17:29	18:06	19:39	20:11	20:43	21:09	21:13	20:46	19:57	19:07	17:25	17:10
11	08:03	07:39	07:58	07:07	06:25	06:06	06:15	06:43	07:14	07:45	07:20	07:53
	17:30	18:07	19:40	20:12	20:44	21:10	21:12	20:45	19:56	19:05	17:24	17:10
12	08:03	07:38	07:56	07:05	06:24	06:06	06:16	06:44	07:15	07:46	07:22	07:54
	17:31	18:08	19:41	20:13	20:45	21:10	21:12	20:43	19:54	19:04	17:23	17:10
13	08:02	07:36	07:55	07:04	06:23	06:06	06:17	06:45	07:16	07:47	07:23	07:54
	17:32	18:10	19:42	20:14	20:46	21:11	21:11	20:42	19:52	19:02	17:22	17:10
14	08:02	07:35	07:53	07:02	06:22	06:05	06:18	06:46	07:17	07:48	07:24	07:55
	17:33	18:11	19:43	20:15	20:47	21:11	21:11	20:41	19:50	19:00	17:21	17:10
15	08:02	07:34	07:51	07:00	06:21	06:05	06:18	06:47	07:18	07:49	07:25	07:56
	17:34	18:12	19:44	20:16	20:48	21:12	21:10	20:39	19:49	18:59	17:20	17:11
16	08:01	07:33	07:50	06:59	06:20	06:05	06:19	06:48	07:19	07:50	07:26	07:57
	17:35	18:13	19:45	20:18	20:49	21:12	21:10	20:38	19:47	18:57	17:19	17:11
17	08:01	07:31	07:48	06:57	06:19	06:05	06:20	06:49	07:20	07:51	07:28	07:57
	17:36	18:14	19:47	20:19	20:50	21:13	21:09	20:37	19:45	18:56	17:19	17:11
18	08:00	07:30	07:46	06:56	06:18	06:06	06:21	06:50	07:21	07:52	07:29	07:58
	17:38	18:16	19:48	20:20	20:51	21:13	21:09	20:35	19:44	18:54	17:18	17:12
19	08:00	07:28	07:45	06:54	06:17	06:06	06:22	06:51	07:22	07:54	07:30	07:59
	17:39	18:17	19:49	20:21	20:52	21:13	21:08	20:34	19:42	18:53	17:17	17:12
20	07:59	07:27	07:43	06:53	06:17	06:06	06:22	06:52	07:23	07:55	07:31	07:59
	17:40	18:18	19:50	20:22	20:53	21:14	21:07	20:32	19:40	18:51	17:16	17:12
21	07:59	07:26	07:41	06:51	06:16	06:06	06:23	06:53	07:24	07:56	07:32	08:00
	17:41	18:19	19:51	20:23	20:54	21:14	21:06	20:31	19:39	18:50	17:16	17:13
22	07:58	07:24	07:40	06:50	06:15	06:06	06:24	06:54	07:25	07:57	07:33	08:00
	17:42	18:20	19:52	20:24	20:55	21:14	21:06	20:29	19:37	18:48	17:15	17:13
23	07:57	07:23	07:38	06:48	06:14	06:06	06:25	06:55	07:26	07:58	07:35	08:01
	17:43	18:22	19:53	20:25	20:56	21:14	21:05	20:28	19:35	18:47	17:14	17:14
24	07:57	07:21	07:36	06:47	06:13	06:07	06:26	06:56	07:27	07:59	07:36	08:01
	17:45	18:23	19:54	20:26	20:56	21:14	21:04	20:26	19:33	18:46	17:14	17:14
25	07:56	07:20	07:35	06:45	06:13	06:07	06:27	06:57	07:28	08:00	07:37	08:02
	17:46	18:24	19:55	20:27	20:57	21:15	21:03	20:25	19:32	18:44	17:13	17:15
26	07:55	07:18	07:33	06:44	06:12	06:07	06:28	06:58	07:29	08:01	07:38	08:02
	17:47	18:25	19:56	20:28	20:58	21:15	21:02	20:23	19:30	18:43	17:13	17:16
27	07:54	07:17	07:31	06:43	06:11	06:08	06:29	06:59	07:30	08:03	07:39	08:02
	17:48	18:26	19:57	20:29	20:59	21:15	21:01	20:22	19:28	18:41	17:12	17:16
28	07:53	07:15	07:30	06:41	06:11	06:08	06:30	07:00	07:31	08:04	07:40	08:03
	17:50	18:27	19:58	20:30	21:00	21:15	21:00	20:20	19:27	18:40	17:12	17:17
29	07:53		07:28	06:40	06:10	06:09	06:31	07:01	07:32	08:05	07:41	08:03
	17:51		19:59	20:31	21:01	21:15	21:00	20:19	19:25	18:39	17:12	17:18
30	07:52		07:26	06:39	06:10	06:09	06:32	07:02	07:33	08:06	07:42	08:03
	17:52		20:01	20:32	21:02	21:15	20:59	20:17	19:23	18:38	17:11	17:18
31	07:51		07:25		06:09		06:33	07:03		08:07		08:03
	17:53		20:01		21:02		20:58	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)

Project:

Northwest Ohio

Description:

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3100 DeMers Avenue
US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR265 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:04	07:50	07:14	07:23	06:37	06:09	06:09	06:33	07:04	07:34	07:09	07:43
	17:20	17:55	18:29	20:02	20:33	21:03	21:15	20:56	20:14	19:22	17:35	17:11
2	08:04	07:49	07:12	07:21	06:36	06:08	06:10	06:34	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:35	21:04	21:15	20:55	20:12	19:20	17:34	17:11
3	08:04	07:48	07:11	07:20	06:35	06:08	06:10	06:35	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36	21:05	21:15	20:54	20:11	19:18	17:33	17:10
4	08:04	07:47	07:09	07:18	06:33	06:07	06:11	06:36	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	21:05	21:14	20:53	20:09	19:17	17:31	17:10
5	08:04	07:46	07:08	07:16	06:32	06:07	06:12	06:37	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	21:06	21:14	20:52	20:07	19:15	17:30	17:10
6	08:04	07:45	07:06	07:15	06:31	06:07	06:12	06:38	07:09	07:39	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	21:07	21:14	20:51	20:06	19:13	17:29	17:10
7	08:04	07:44	07:04	07:13	06:30	06:06	06:13	06:39	07:10	07:41	07:16	07:49
	17:26	18:02	18:36	20:08	20:40	21:07	21:14	20:50	20:04	19:12	17:28	17:10
8	08:04	07:42	08:03	07:12	06:29	06:06	06:13	06:40	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	21:08	21:13	20:48	20:02	19:10	17:27	17:10
9	08:03	07:41	08:01	07:10	06:28	06:06	06:14	06:41	07:12	07:43	07:18	07:51
	17:28	18:05	19:38	20:10	20:42	21:09	21:13	20:47	20:01	19:08	17:26	17:10
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	17:33	18:11	19:43	20:15	20:47	21:11	21:11	20:41	19:50	19:00	17:21	17:10
15	08:02	07:34	07:51	07:00	06:21	06:05	06:18	06:47	07:18	07:49	07:25	07:56
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16	08:01	07:33	07:50	06:59	06:20	06:05	06:19	06:48	07:19	07:50	07:26	07:57
	17:35	18:13	19:45	20:18	20:49	21:12	21:10	20:38	19:47	18:57	17:19	17:11
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18	08:00	07:30	07:46	06:56	06:18	06:06	06:21	06:50	07:21	07:52	07:29	07:58
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19	08:00	07:28	07:45	06:54	06:17	06:06	06:22	06:51	07:22	07:54	07:30	07:59
	17:39	18:17	19:49	20:21	20:52	21:13	21:08	20:34	19:42	18:53	17:17	17:12
20	07:59	07:27	07:43	06:53	06:17	06:06	06:22	06:52	07:23	07:55	07:31	07:59
	17:40	18:18	19:50	20:22	20:53	21:14	21:07	20:32	19:40	18:51	17:16	17:12
21	07:59	07:26	07:41	06:51	06:16	06:06	06:23	06:53	07:24	07:56	07:32	08:00
	17:41	18:19	19:51	20:23	20:54	21:14	21:06	20:31	19:39	18:50	17:16	17:13
22	07:58	07:24	07:40	06:50	06:15	06:06	06:24	06:54	07:25	07:57	07:33	08:00
	17:42	18:20	19:52	20:24	20:55	21:14	21:06	20:29	19:37	18:48	17:15	17:13
23	07:57	07:23	07:38	06:48	06:14	06:06	06:25	06:55	07:26	07:58	07:35	08:01
	17:43	18:22	19:53	20:25	20:56	21:14	21:05	20:28	19:35	18:47	17:14	17:14
24	07:57	07:21	07:36	06:47	06:13	06:07	06:26	06:56	07:27	07:59	07:36	08:01
	17:45	18:23	19:54	20:26	20:56	21:14	21:04	20:26	19:33	18:46	17:14	17:14
25	07:56	07:20	07:35	06:45	06:13	06:07	06:27	06:57	07:28	08:00	07:37	08:02
	17:46	18:24	19:55	20:27	20:57	21:15	21:03	20:25	19:32	18:44	17:13	17:15
26	07:55	07:18	07:33	06:44	06:12	06:07	06:28	06:58	07:29	08:01	07:38	08:02
	17:47	18:25	19:56	20:28	20:58	21:15	21:02	20:23	19:30	18:43	17:13	17:16
27	07:54	07:17	07:31	06:43	06:11	06:08	06:29	06:59	07:30	08:03	07:39	08:02
	17:48	18:26	19:57	20:29	20:59	21:15	21:01	20:22	19:28	18:41	17:12	17:16
28	07:53	07:15	07:30	06:41	06:11	06:08	06:30	07:00	07:31	08:04	07:40	08:03
	17:50	18:27	19:58	20:30	21:00	21:15	21:00	20:20	19:27	18:40	17:12	17:17
29	07:53		07:28	06:40	06:10	06:09	06:31	07:01	07:32	08:05	07:41	08:03
	17:51		19:59	20:31	21:01	21:15	21:00	20:19	19:25	18:39	17:12	17:18
30	07:52		07:26	06:39	06:10	06:09	06:32	07:02	07:33	08:06	07:42	08:03
	17:52		20:01	20:32	21:02	21:15	20:59	20:17	19:23	18:38	17:11	17:18
31	07:51		07:25		06:09		06:33	07:03		08:07		08:03
	17:53		20:01		21:02		20:58	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)

Project:

Northwest Ohio

Description:

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US-GRAND FORKS, ND 58201
+1 701 775 3000
wind@eapc.net
Calculated:
5/20/2013 10:51 PM/2.9.207

SHADOW - Calendar

Calculation: NwOH - GE Final Layout - valid 130520Shadow receptor: SR266 - Non-Participating

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.46	0.51	0.55	0.60	0.68	0.74	0.75	0.74	0.68	0.62	0.42	0.38

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
434	482	705	559	385	472	793	1,057	1,141	1,028	807	595	8,459

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:04	07:50	07:14	07:23	06:37	06:09	06:09	06:33	07:04	07:34	07:08	07:43
	17:20	17:55	18:29	20:02	20:33	21:03	21:15	20:56	20:14	19:22	17:35	17:11
2	08:04	07:49	07:12	07:21	06:36	06:08	06:10	06:34	07:05	07:35	07:10	07:44
	17:21	17:56	18:30	20:03	20:34	21:04	21:15	20:55	20:12	19:20	17:34	17:11
3	08:04	07:48	07:11	07:20	06:35	06:08	06:10	06:35	07:06	07:36	07:11	07:45
	17:22	17:57	18:31	20:04	20:36	21:05	21:14	20:54	20:11	19:18	17:33	17:10
4	08:04	07:47	07:09	07:18	06:33	06:07	06:11	06:36	07:07	07:37	07:12	07:46
	17:23	17:58	18:32	20:05	20:37	21:05	21:14	20:53	20:09	19:17	17:31	17:10
5	08:04	07:46	07:08	07:16	06:32	06:07	06:12	06:37	07:08	07:38	07:13	07:47
	17:24	18:00	18:33	20:06	20:38	21:06	21:14	20:52	20:07	19:15	17:30	17:10
6	08:04	07:45	07:06	07:15	06:31	06:07	06:12	06:38	07:09	07:39	07:14	07:48
	17:25	18:01	18:34	20:07	20:39	21:07	21:14	20:51	20:06	19:13	17:29	17:10
7	08:04	07:44	07:04	07:13	06:30	06:06	06:13	06:39	07:10	07:41	07:16	07:49
	17:26	18:02	18:35	20:08	20:40	21:07	21:14	20:50	20:04	19:12	17:28	17:10
8	08:04	07:42	08:03	07:12	06:29	06:06	06:13	06:40	07:11	07:42	07:17	07:50
	17:27	18:03	19:37	20:09	20:41	21:08	21:13	20:48	20:02	19:10	17:27	17:10
9	08:03	07:41	08:01	07:10	06:28	06:06	06:14	06:41	07:12	07:43	07:18	07:51
	17:28	18:05	19:38	20:10	20:42	21:09	21:13	20:47	20:01	19:08	17:26	17:10
10	08:03	07:40	08:00	07:08	06:26	06:06	06:15	06:42	07:13	07:44	07:19	07:52
	17:29	18:06	19:39	20:11	20:43	21:09	21:13	20:46	19:57	19:07	17:25	17:10
11	08:03	07:39	07:58	07:07	06:25	06:06	06:15	06:43	07:14	07:45	07:20	07:53
	17:30	18:07	19:40	20:12	20:44	21:10	21:12	20:45	19:56	19:05	17:24	17:10
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13	08:02	07:36	07:55	07:04	06:23	06:05	06:17	06:45	07:16	07:47	07:23	07:54
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14	08:02	07:35	07:53	07:02	06:22	06:05	06:18	06:46	07:17	07:48	07:24	07:55
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15	08:02	07:34	07:51	07:00	06:21	06:05	06:18	06:47	07:18	07:49	07:25	07:56
	17:34	18:12	19:44	20:16	20:48	21:12	21:10	20:39	19:49	18:59	17:20	17:11
16	08:01	07:33	07:50	06:59	06:20	06:05	06:19	06:48	07:19	07:50	07:26	07:57
	17:35	18:13	19:45	20:18	20:49	21:12	21:10	20:38	19:47	18:57	17:19	17:11
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	17:38	18:16	19:48	20:20	20:51	21:13	21:09	20:35	19:44	18:54	17:18	17:12
19	08:00	07:28	07:45	06:54	06:17	06:06	06:22	06:51	07:22	07:54	07:30	07:59
	17:39	18:17	19:49	20:21	20:52	21:13	21:08	20:34	19:42	18:53	17:17	17:12
20	07:59	07:27	07:43	06:53	06:17	06:06	06:22	06:52	07:23	07:55	07:31	07:59
	17:40	18:18	19:50	20:22	20:53	21:14	21:07	20:32	19:40	18:51	17:16	17:12
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31	07:51		07:25		06:09		06:32	07:03		08:07		08:03
	17:53		20:01		21:02		20:58	20:15		18:36		17:19
Potential sun hours	298	297	370	398	448	452	459	428	375	345	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)

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in

Case No(s). 13-0197-EL-BGN

Summary: Application of Northwest Ohio Wind Energy - Appendix J Shadow Flicker
Assessment Continued (Part 29) electronically filed by Teresa Orahod on behalf of Sally
Bloomfield